SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

APPENDIX D
ENVIRONMENTAL AND CULTURAL RESOURCES

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

SUB-APPENDIX D.1 ENVIRONMENTAL AND CULTURAL TECHNICAL APPENDIX

JULY 2026

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1.0 Introduction

The U.S. Army Corps of Engineers, Tulsa District, (USACE) prepared this final environmental impact statement (FEIS) for the San Francisco Waterfront Coastal Flood Study (SFWCFS) feasibility study. It is a requirement of USACE planning policy and the National Environmental Policy Act (NEPA) of 1969 to make a report available for public review that describes analysis, risks, assumptions, and decisions made by the Study team during the planning process. NEPA requires Federal agencies, including USACE, to consider the potential environmental impacts of their proposed actions and any reasonable alternative plan before undertaking a major Federal action, as defined by 42 U.S.C §§ 4321-4347, as amended, and the Fiscal Responsibility Act 2023 (P.L. 118-5). This EIS was prepared in compliance with NEPA, the Council on Environmental Quality's (CEQ) NEPA Regulations, and USACE's Procedures for Implementing NEPA (Title 33 Code of Federal Regulations [CFR] Part 230 [33 CFR Part 230]). This EIS was prepared prior to recission of the CEQ's NEPA regulations and USACE's Civil Works guidance for implementing NEPA. As such, the procedures and guidelines in developing this document followed those preceding regulations.

To evaluate potential environmental impacts, USACE prepared an integrated feasibility report and environmental impact statement (IFR-EIS). An EIS is a supporting document that is the most thorough and comprehensive level of NEPA documentation used to assist in making decisions. Based on recent guidance to the Study team, the IFR-EIS was condensed for public readability, thus, the EIS could not be fully incorporated into the main report. Instead, the technical details were reserved for this appendix to divulge the full range of environmental conditions and potential impacts to the natural and human environment as a result of proposed actions. As such, the summaries provided in the main report are supported by the detailed information provided throughout this technical environmental and cultural resources sub-appendix.

This technical sub-appendix provides detailed descriptions of the existing conditions and analyses of the environmental consequences for the natural and human environment of the study area. The information detailed herein was used to develop the summaries provided in the IFR-EIS. This sub-appendix is structured in the following manner:

Section 1.0: Provides an introduction to the technical sub-appendix.

Section 2.0: Describes the array of alternatives considered for the SFWCFS Project.

Section 3.0: Details the affected environment for natural and human resources in the study area.

Section 4.0: Analyzes and describes the environmental consequences of alternative plans for the SFWCFS study, including a brief explanation of alternatives being analyzed. It is organized similarly to Section 3.

Section 5.0: Provides an overview of compliance status with various environmental laws.

Section 6.0: Lists references cited.

Natural and physical resource sections, such as changing meteorological and hydrologic conditions, geology, hydrology and hydraulics, aquatic and upland resources, etc. are provided in this main technical sub-appendix. Additionally, cultural resources, utilities, recreation and access, aesthetics, and public health and safety are also included. The sub-sections of regional air quality, noise and vibration, socioeconomics and community, transportation, and land use are provided in separate annexes to this technical sub-appendix. The annex is referenced in the appropriate sections of this report. Each annex is structured similarly to this sub-appendix to describe the affected environment and the environmental consequences for each resource.

1.1 Study Overview

Low-lying assets and economic activity along the San Francisco Waterfront are at risk of flooding from coastal and combined floods, extreme high tides, coastal storms, and RSLC. Without Federal action, it is expected that future RSLC will increase the frequency and depth of tidal flooding along the shoreline, thereby increasing economic damages and coastal and combined flood risk to one of the nation's most iconic waterfronts.

This study is being conducted under the authority of Section 110 of the Rivers and Harbors Act of 1950 and Section 142 of Water Resources Development Act (WRDA) 1976, as amended by Section 705 of WRDA 1986, and Section 203 of WRDA 2020. The purpose of the study is to investigate and identify ways to reduce coastal flooding risk along 7.5 miles of the San Francisco Waterfront by evaluating alternatives to meet current and future coastal and combined flood risk management needs.

The non-Federal sponsor (NFS) for the study is the Port of San Francisco (Port). The Port oversees the administration of the public trust for the State of California under the Burton Act, ensuring that public trust uses such as maritime, public access, historic resources, visitor-serving uses, and water-related and dependent uses are preserved and maintained along the waterfront.

1.1.1 Study Area

The study area extends approximately 7.5 miles from Aquatic Park in the northeast to just past Heron's Head Park in the south. The study area is divided into four reaches and fifteen sub-reaches for conducting and evaluating coastal process and economic analyses (**Figure D.1-1**). These reaches were selected based on hydrologic separability, identified geographic references, specific wave action within each reach, and major differences in physical structure inventory within the reach.



Figure D.1-1: Study Area

1.1.2 Study Scope

The study scope includes an assessment of existing and future without project conditions under a range of RSLC scenarios for a 100-year period of analysis (2040 to 2140). The study evaluated alternatives that meet current and future coastal flood risk management needs. The Study Team is using a 100-year period of analysis because of the long-lived infrastructure, the sensitivity to RSLC, the level of disruption that may be required for adaptation in a highly urbanized locale, and the need for flexibility, adaptability, and scalability in the alternatives to address uncertain timing of increased flood risk due to RSLC, extreme high tides, and coastal storms.

1.1.3 Revisions from the Draft EIS to Final EIS

In preparing the final EIS, USACE evaluated and considered all public and agency comments received on the draft IFR-EIS, as well as refinements the PDT considered after draft report release. This resulted in changes to the configuration of the TSP; however, it did not result in any changes in the conclusions of the draft EIS regarding the significance of impacts. USACE incorporated the following changes in this final EIS, consistent with modifications made to the proposed action, and other clarifications requested by comments on the draft EIS:

- Based on PDT evaluation and input, USACE revised the TSP to include four of the seven independent measures for consideration into the TNBP which increased the footprint of NNBFs and incorporated targeted defense in small sub-reaches.
- Revisions to the descriptions of the environmental consequences with the refinements made to the TSP (i.e., impacts of those four independent measures are no longer separate, rather incorporated into the analysis for the TNBP).
- Revisions to the descriptions of the affected environment and environmental consequences, included updated analyses, based on public and agency comments.
- Replacement of the tables in the draft IFR-EIS with written descriptions of the affected environment (Section 2) and environmental consequences (Section 4) as suggested during public and agency reviews.
- Added information about the public involvement and agency consultation processes following publication of the draft IFR-EIS.
- Added the following sub-appendices and annexes:
    - Sub-Appendix D.4 – Clean Water Act Compliance
        - Annex D.4.1 – 404(b)(1) Evaluation
        - Annex D.4.2 – Waterboard Letter Confirmation

- Sub-Appendix D.5, Coastal Zone Management Act Compliance
  - Annex D.5.1 – Consistency Determination
  - Annex D.5.2 – Bay Conservation and Development Commission Commitment Letter
- Sub-Appendix D.6, Endangered Species Act and Magnuson-Stevens Fishery Management and Conservation Act Compliance
  - Annex D.6.1 – U.S. Fish and Wildlife Service (USFWS) Biological Assessment
  - Annex D.6.2 – National Marine Fisheries Service Biological Assessment and Essential Fish Habitat (EFH) Assessment
  - Annex D.6.3 – USFWS Concurrence Letter
  - Annex D.6.4 – NMFS Biological Opinion and EFH Concurrence
- Sub-Appendix D.7, Fish and Wildlife Coordination Act Compliance
- Sub-Appendix D.8, Marine Mammal Protection Act Compliance, HQ Memorandum

- Incorporated minor technical corrections and clarifications throughout the final IFR-EIS and appendices to improve document readability and to respond to comments received.

2.0 Alternatives Considered

Plan formulation in response to the study authority was conducted in two broad phases. An initial planning iteration considered distinctly different conceptual approaches to manage the coastal flood risk in the region. The USACE San Francisco District Project Delivery Team (PDT) conducted an initial screening of the conceptual approaches including a deployable water management structure at the Golden Gate Bridge, an offshore wave attenuator, several scales of offshore barriers, perimeter plans along the Bay coastline and two forms of retreat.

The USACE Tulsa District completed the second and most significant phase of plan formulation where the perimeter and retreat plans were further developed, and measures were identified at the reach level and are known as the focused array of alternatives. The PDT formulated an array of alternatives that would reduce the risk of flooding along the waterfront by considering the three USACE RSLC curve scenarios (low, intermediate, and high), alignment of the line of defense relative to the existing shoreline, and adaptability of the scale of alignment of the measures to address higher sea levels if certain risk thresholds are reached following initial construction. The array of alternatives are distinctly different alternatives and formulated using three strategies – accommodate, defend, or combination of accommodate and defend/hybrid – to address the problems. The defend strategy is designed to minimize risk at the current shoreline or set back slightly from the shoreline, while accommodate would include measures that

allow flood waters to enter the area and people and assets at risk would be moved out of the way of water. The hybrid plans include a combination of the two. The alternatives each include structural, non-structural, and Natural and Nature-Based Features (NNBFs). The adaptability of each measure was considered to establish the first increment of scale and timing of construction to ensure performance over the period of analysis.

NNBFs were included where appropriate and possible, to address the study problems by maximizing natural processes to deliver project benefits in lieu of or to enhance performance of more traditional “gray” infrastructure. An extensive array of NNBF was formulated for each of the alternatives. In the draft IFR-EIS, NNBFs were also evaluated separately as “Independent Measures for Consideration” (Appendix I) with the understanding they could be added to most of the plans in the focused array.

The Focused Array of Alternatives included:

- Alternative A: No Action
- Alternative B: Nonstructural
- Alternative C: Defend, Scaled for Lower Risk
- Alternative D: Defend, Scaled for Low-Moderate Risk
- Alternative E: Defend Existing Shoreline, Scaled for Higher Risk
- Alternative F: Manage the Water, Scaled for Higher Risk
- Alternative G: Partial Retreat, Scaled for Higher Risk

Each alternative in the focused array was assessed for costs and benefits, impacts to the natural or human environment, and took into consideration the ability to mitigate impacts and to reach compliant with the various environmental laws. Consistent with study guidance, the alternative plans were evaluated under three USACE RSLC scenarios. Since coastal flood events have little variation in water surface elevation from small to extreme events, flood risk is primarily driven by RSLC in combination with coastal storms and extreme high tides. The variation of scale and type of actions across alternatives was a strategic approach to assess the difference in performance under uncertain timing of RSLC.

Alternatives D, E, F, and G were all designed to be adaptive, with subsequent actions assumed to be needed in the future, with the actual timing of implementation being dependent on RSLC monitoring and thresholds criterion. These Subsequent aAtions increased the finished elevation of the structural measure, thereby providing a higher level of risk management, but also, in some cases, changed the alignment. The Subsequent Actions alignments similarly followed the strategies as the First Actions by defending at the shoreline, accommodating, or a combination of the two.

For the purposes of this study, broad assumptions were made regarding adaptation of the finger piers in Reaches 1, 2, and 3. For the purposes of preliminary cost estimates and analysis, the alternatives assume keeping finger piers at their current elevation and either dry floodproofing or a perimeter wall to reduce flood risk to pier sheds, occupants,

and contents. The Non-Federal Sponsor will continue to study potential pier adaptation options and configurations to support future decision-making.

After the focused array was evaluated, the final array was identified and included development of a total net benefits plan (TNBP) and the identification of a National Economic Development (NED) Plan. The TNBP was developed by varying plan features and alignments by reach to achieve benefits across four benefit categories including national and regional economics, environmental quality, and other social effects and includes risk reduction strategies that do not maximize net NED benefits, but that support adaptability under uncertain timing of RSLC. The NED Plan only looked at which reaches maximized economic benefits and the focused array alternative that maximized economic benefits was selected for that reach. In addition to the final array in the draft IFR-EIS, a list of "independent measures" were developed that represented a series of measures that were included (or were similar to a measure included) in one or more focused array alternative but were not separated as an independent alternative wholly. Rather, one or more of the independent measures would be additive to the alternative selected for implementation and absorbed as part of the recommended plan.

The final array of alternatives, or the range of alternatives that are being seriously considered by the decision maker and that were analyzed in the draft EIS included:

- **No Action (NED Low Curve)**: no Federal action is taken.
- **Alternative B (NED Intermediate Curve)**: Proposes nonstructural measures such as relocation, raise in place, floodproofing, and zoning in areas identified with frequent flooding.
- **Alternative F**: Uses a combination of structural, nonstructural, and NNBFs to defend at the existing shoreline, except for some managed retreat inland along the southern waterfront and tide gates at the mouths of Islais and Mission creeks. Additional retreat and adaptations are proposed as the rate of RSLC increases.
- **Alternative G (NED High Curve)**: Uses a combination of structural, nonstructural, and NNBFs to defend against the high rate of RSLC. This alternative concedes the largest area for managed retreat and incorporates more nonstructural and NNBF measures.
- **Total Net Benefits Plan:** Hybridized plan that relies on defend measures, scaled to perform under a lower initial risk and to adapt to risk of a higher rate of RSLC as a potential end point. First actions are proposed to delay expenditures and add height or adapt measures as risk increases over later years. This alternative hybridizes nonstructural, structural, and NNBF from multiple action alternative.
- **Independent Measures for Consideration:** Potential considerations for TSP refinement to further reduce coastal flood and seismic risks, reduce costs and impacts, and gain community benefits. Addresses geographically specific areas with structural and NNBF.

The following list of "independent measures" represents a series of measures included in the NEPA analysis separately. Each measure was included (or was similar to a measure included) in one or more alternatives, but the given alternative as a whole was not proposed for inclusion in the Tentatively Selected Plan (TSP). These measures include:

- **Living Seawalls:** textured concrete bolted onto the existing seawall in portions of reaches 1, 2, and 3 to reduce wave hazards while supporting nearshore ecology wherever current maritime uses and pier configurations allow.
- **2A) Robust Coastal Defense of Ferry Building and Agriculture Building**: realigns the coastal flood defense structure adjacent to the bayside edge of the Ferry Building and Agriculture Building (i.e., existing wharf would be moved further into the bay).
- **2B) Coarse Beach at Rincon Park connecting to Pier 14:** Coarse beach would be integrated into the design of the flood defense where space constraints require bay fill. This measure is similar to the measure for this location included in Alternative F (1st action).
- **3A) Bay Bridge to South Beach Harbor Raised Shoreline with Rebuilt Wharves from Bay Bridge to the mouth of Mission Creek:** raise the current shoreline and redesign of the northbound lanes of the Embarcadero roadway (in collaboration with SFMTA and the Embarcadero Enhancement Project), and the approach is intended to be designed to avoid reconstruction of the light rail track. This is comparable to Alternative G (1st action) for this site.
- **3B) McCovey Cove North Curb Extension:** raises the shoreline in line with the current shoreline edge on the north side of McCovey Cove (along the ballpark). This is comparable to Alternative G (1st action) for this site.
- **3C) Planted Naturalized or Embankment Shoreline on Mission Bay south of Pier 50:** integrates NNBF into the flood defense structure design to reduce wave hazards, support nearshore ecology, and provide public water access. This is comparable to Alternative F (1st action) for this site.
- **4A) Inland Coastal Flood Defense at Southwest Islais Creek:** Gradual area of retreat where the line of defense falls more landward and would convert some industrial and other public lands to open space allowing for more long-term flood defenses. This is comparable to Alternative G (2nd action) between 3rd Street Bridge and the inland extent of the channel.

From the final array, the TSP or agency's preferred alternative, was selected. The TNBP was identified as the TSP in the draft IFR-EIS and has now become the Recommended Plan in the final IFR-EIS.

Additional details on the plan formulation process, alignments and measures developed for the action alternatives can be found in *Appendix A: Plan Formulation*.

As stated in Section 1.1.3, the independent measures evaluated in the draft IFR/EIS have now been fully incorporated into the Recommended Plan. Thus, the following sections have updated the analyses to reflect the inclusions of these independent

measures into the Recommended Plan rather than evaluating them separately as presented in the draft IFR/EIS.

3.0 Affected Environment

This section describes the existing condition of resources in the study area as of the date of the Notice of Intent (NOI) published July 27, 2023.

The structure of this section includes two important components including:

- **Regulatory Framework:** This section describes the applicable federal, state, and local laws, regulations, and policies that apply to the topic being discussed. Details of Federal and state regulations which require permits or other approvals or are relevant to several categories are briefly mentioned in this section and discussed in greater detail in Annex D-1-8: Regulatory Framework. Some resources will not have a regulatory framework but are described for a more complete understanding of the study area.
- **Existing Condition:** This section describes the local and regional conditions that provide the baseline condition and sufficient context for evaluating effects of the alternatives.

3.1 General Overview of the Study Area

The affected environment for all natural resources includes the San Francisco Bay area and San Francisco Bay watershed located in San Francisco County. The timing and ability to know what changes would occur from existing conditions to the 50- and 100-year project condition (2040 and 2090) with RSLC are difficult to predict, thus, it was assumed environmental conditions are likely to worsen overtime (i.e., result in habitat loss or degradation). This section focuses on describing existing conditions expected within the first 50 years of the study period.

Under the existing conditions and No Action Alternative, the measures proposed to protect against RSLC would not be constructed. Rather, smaller-scale measures would be implemented that are likely to be inefficient at providing adequate protection from flooding to existing features along the San Francisco waterfront.

3.2 Air Quality

Air Quality affected environment is addressed in Annex D.1.1.

3.3 Changing meteorological conditions

Climate refers to the long-term weather conditions that describe a region, whereas weather relates to short-term changes in the atmosphere (NOAA 2020).

3.3.1 Regulatory Framework

3.3.1.1 Federal

- No Federal regulations or laws pertain to changing meteorological conditions.

3.3.1.2 State

- California Environmental Quality Act (CEQA)
- Bay Conservation and Development Commission (BCDC) – state commission dedicated to protection, enhancement, and responsible use of San Francisco Bay; requires climate assessment for any actions that may impact the Bay
- Assembly Bill 1279 outlines the State's GHG reduction goals for achieving a 40 percent reduction below 1990 emissions levels by 2030 and an 85 percent reduction in anthropogenic emissions below 1990 emissions levels, as well as net-zero GHG emissions, no later than 2045.

3.3.1.3 Local

- Climate Action Plan – sets goal to achieve net-zero GHG emissions.
- Bay Area Air Quality Management District (BAAQMD) – develops the local elements of the State Implementation Plan for San Francisco Bay Area Air Basin

3.3.2 Existing Condition

San Francisco is straddled by sharp topography and marine environments that create a unique variety of microclimates. The San Francisco Bay area climate is classified as Mediterranean and is characterized by relatively dry, cool summers and mild winters (Null 1995). In the summertime, San Francisco experiences cool marine air and persistent coastal stratus and fog, with average temperatures between 60- and 70-degrees Fahrenheit (Null 1995). The cool marine air is influenced by the upwelling of cold water along the California coast, driven by oceanographic conditions that cause a net transport of surface water away from the shore that are consequently replaced by cold, upwelled water (Null 1995, Ahrens 1991). Winter temperatures are temperate with highs between 55- and 60-degrees Fahrenheit and lows between 45- to 50-degrees Fahrenheit (Null 1995).

Air temperature data from the National Center for Environmental Information demonstrate stable temperature over the last century with a slight positive trend in daily lows and highs (<0.02°F) (**Figure D.1-2**). The Bay area is also defined by dense sea fogs, most frequent in the summer months, that occur due to the interaction of colder nearshore sea temperatures and warmer offshore waters. In effect, the dominant, warmer west winds cause condensation in the coastal regions, creating sea fog. On

average, water temperatures within the bay range from 51 degrees Fahrenheit in the winter to 66 degrees Fahrenheit in late summer (Null 1995).

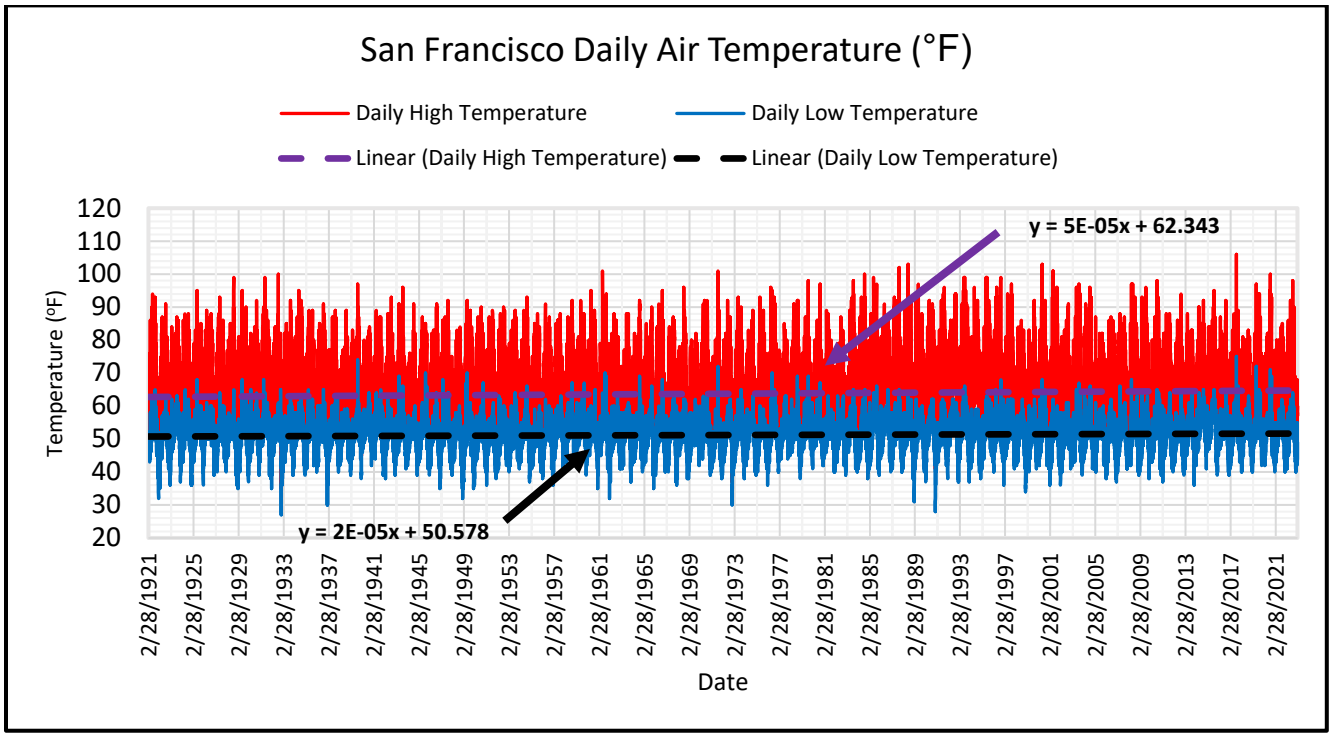


Figure D.1-2: Daily Ambient Air Temperature with Daily Hhighs (purple hashed) and Lows (black hashed) Highlighted (NCEI Station USW00023272, Downtown San Francisco)

Rainfall in San Francisco is seasonal, with over 80 percent occurring between November and March (Null 1995). Winter rains typically occur because of fronts primarily from the west-northwest and occasionally from the Gulf of Alaska. Spring and fall rain are infrequent, with most storms producing light precipitation during these periods (Null 1995). In general, hydrometeorological patterns in California are often associated with phenomena known as atmospheric river events. Atmospheric rivers are narrow bands of low-level systems with high precipitable water content that extend from the tropics into the mid-latitudes (Climate 2015). In general, California's hydrometeorological data indicate robust patterns of atmospheric river events promote heavy rains and flooding. Conversely, drought conditions prevail when atmospheric rivers are persistently low or weak (Climate 2015). Annual precipitation has been cyclical in the Bay area, varying from approximately 5 inches to 37 inches over the last century, but on average the region receives 20 to 23 inches of rain annually (**Figure D.1-3**).

Droughts are also common in the San Francisco Bay Area, which can be tracked in the U.S. Drought Monitor. The U.S. Drought Monitor categorizes drought by intensity, ranging from D0 (abnormally dry) to D4 (exceptional drought), corresponding to the

Palmer Drought Severity Index (PDSI). The PDSI is a standardized index ranging from -10 (dry) to +10 (wet) used to quantify long-term drought (NCAR 2023). In the U.S. Drought Monitor, D0 corresponds to a PDSI of -1.0 to -1.9 and is characterized by short-term dryness that slows planting, crop growth, and may have some lingering water deficits, while a D4 indicates a PDSI of -5.0 or less with exceptional and widespread loss of crops or pastures, and water shortages in reservoirs and streams (Fuchs 2023). Over the last two decades, drought intensity has become more prevalent in the San Francisco Bay area with D3 (PDSI = -4.0 to -4.9) and D4 conditions spanning multiple years (**Figure D.1-4**).

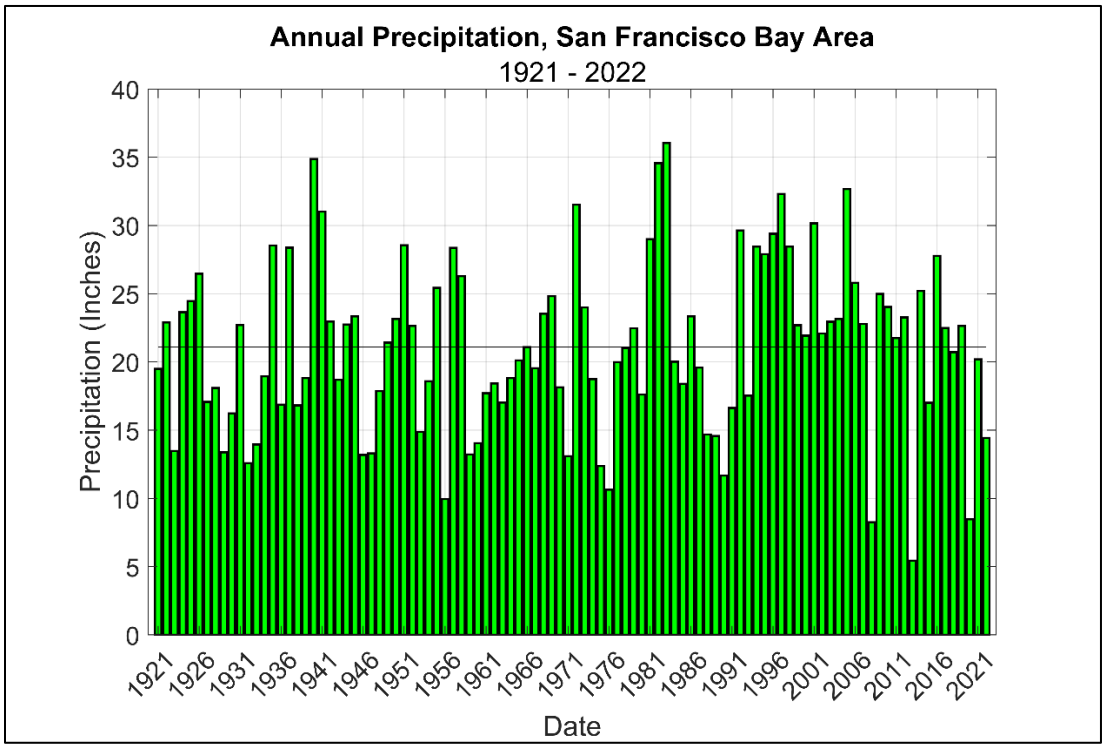


Figure D.1-3: Annual Precipitation (inches) in the San Francisco Bay Area from 1921 to 2021 (NCEI Station USW00023272, Downtown San Francisco)

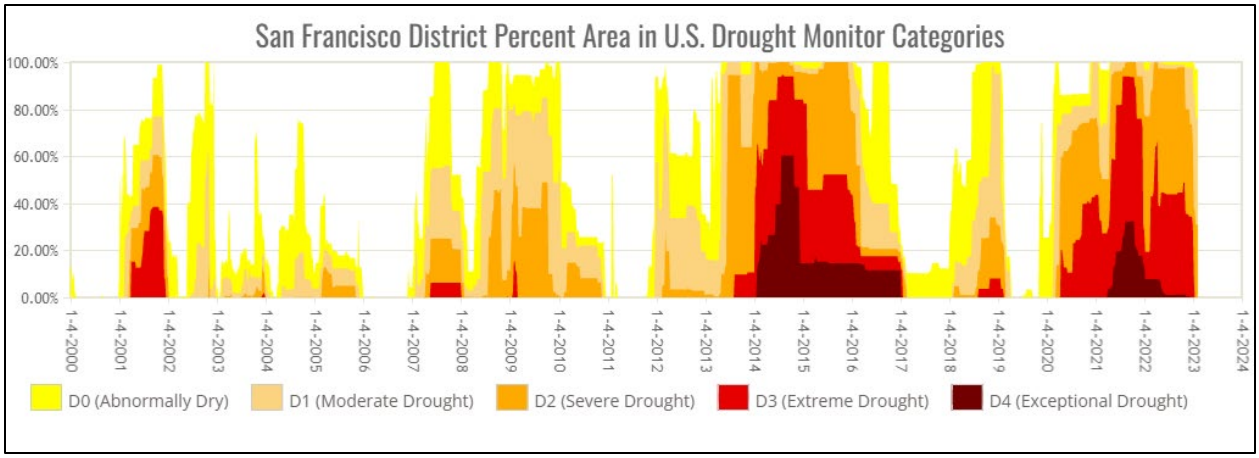
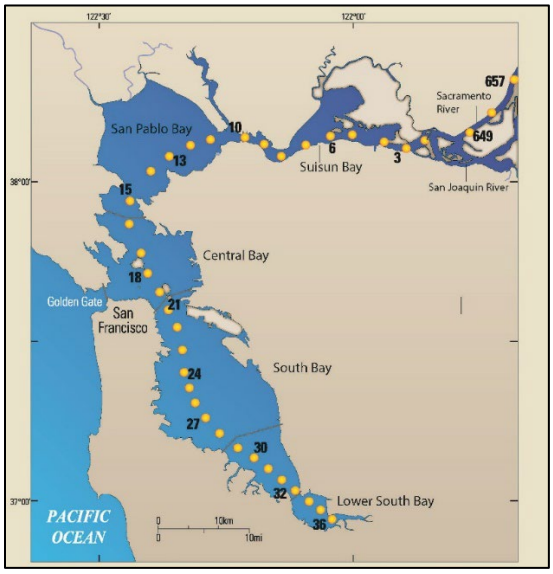


Figure D.1-4: San Francisco District Percent Area in U.S. Drought Monitor Categories from 2000 to 2023 (Fuchs 2023)

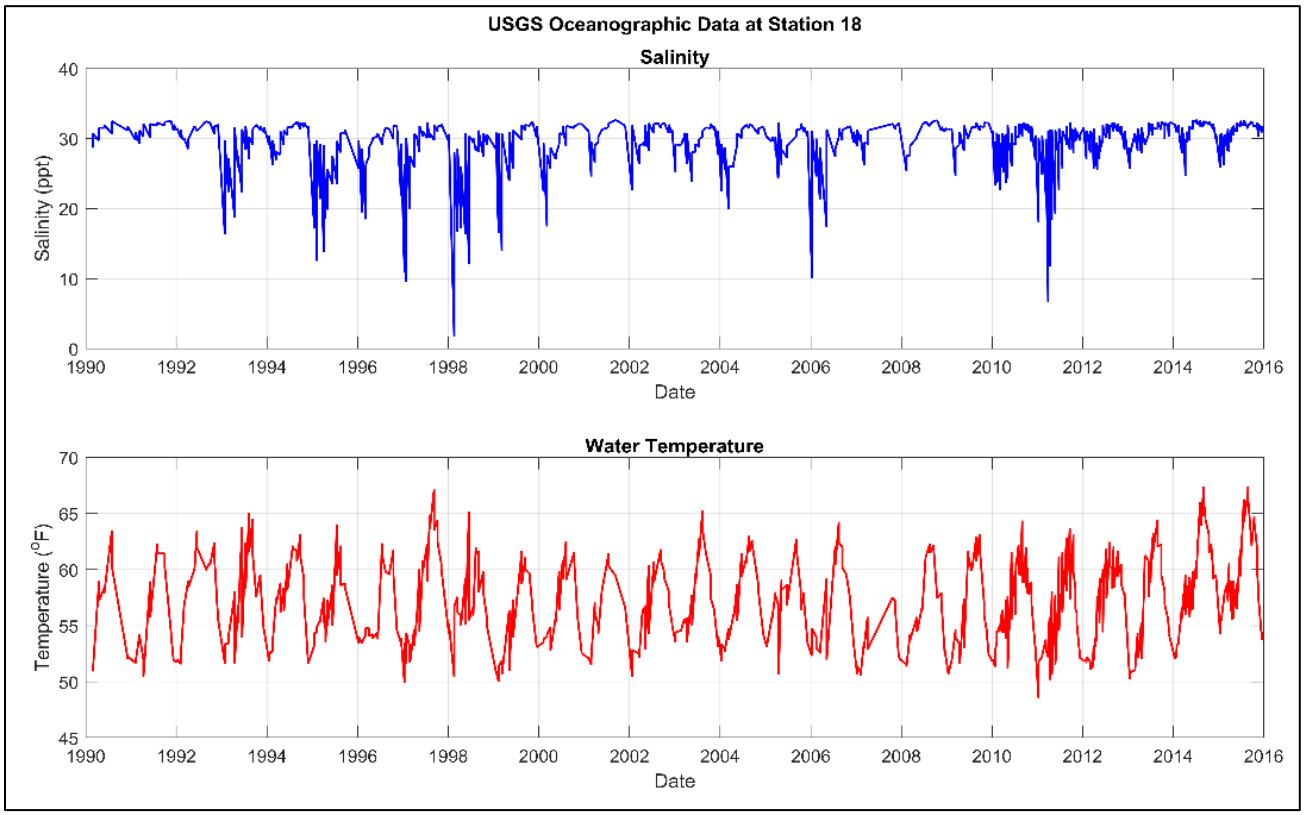
The San Francisco Bay is a large estuary with varying salinity, influenced by seasonality, local bathymetry, proximity to the Pacific Ocean, precipitation, and river discharge. Near downtown San Francisco, or Central Bay, the salinity profile is highly dependent on freshwater inflows from the northern tributaries, the Sacramento and San Joaquin Rivers, and the interaction with the Pacific Ocean (**Figure D.1-5**). Winds and spring-neap tidal variations act as secondary drivers to the salt field (Hericks et al. 2017). Furthermore, during seasons of low precipitation and riverine discharge, controlled release efforts from the Central Valley Project and State Water Project work to stabilize salinity by manually releasing freshwater into the bay (Hericks et al. 2017).



(Cloern and Schraga 2016)

Figure D.1-5: Map of U.S. Geological Survey Water Sampling Sites in San Francisco Bay

In 2016, the U.S. Geological Survey released water quality data including water temperature and salinity measurements sampled from discrete locations across the San Francisco Bay over the course of nearly 47 years (1969 – 2016). Data from station 18 (**Figure D.1-5**) were used to illustrate water temperature and salinity over approximately 30 years near San Francisco (**Figure D.1-6**). Water temperatures have been recorded in the range of roughly 48.5 to 67.5 degrees Fahrenheit (**Figure D.1-6**). Salinity at this location is most often in the range of 25 – 33 parts per thousand (ppt), though significant riverine discharge events have dropped the salinity to less than 10 ppt occasionally (**Figure D.1-6**).



(Cloern and Schraga 2016)

Figure D.1-6: Temporal Water Quality Parameters of Salinity and Temperature from Station 18 in San Francisco Bay

RSLC is a primary impact of changing hydrometeorological conditions (Knowles 2010) and is a present and future risk to the U.S. (Hall et al. 2019). This combined with land subsidence, and other coastal flood factors such as storm surge, waves, rising water tables, river flows, and rainfall are likely to result in a dramatic net increase in the exposure and vulnerability of coastal populations (USGCRP 2017; Sweet et al. 2022). It is generally accepted that global climate warming will increase rates of RSLC; however, the range in projected rates is wide due mainly to uncertainty in the amount of meltwater from land-based ice in Greenland and Antarctica (Knowles 2010).

The National Oceanic and Atmospheric Administration's (NOAA) Office for Coastal Management provides a web mapping tool to visualize community-level impacts from coastal flooding and RSLC. The present day mean higher high water (MHHW) conditions were compared to 3 ft and 7 ft of RSLC for the study area (**Figure D.1-7**) using the NOAA RSLC viewer (https://coast.noaa.gov/slr/).



Figure D.1-7: NOAA RSLC Inundation Viewer of the Study Area for MHHW Conditions for Present Day (a), 3 ft of RSLC (b), and 7 ft RSLC (c).

Comparatively, the USACE has three RSLC scenarios (low, intermediate, and high) that are predicated on data from the National Research Council and Intergovernmental Panel on Climate Change (IPCC). The USACE RSLC scenarios with the 1% Annual Exceedance Probability (AEP) was mapped to contrast the NOAA RSLC Viewer (**Figure D.1-8** through **Figure D.1-10**).

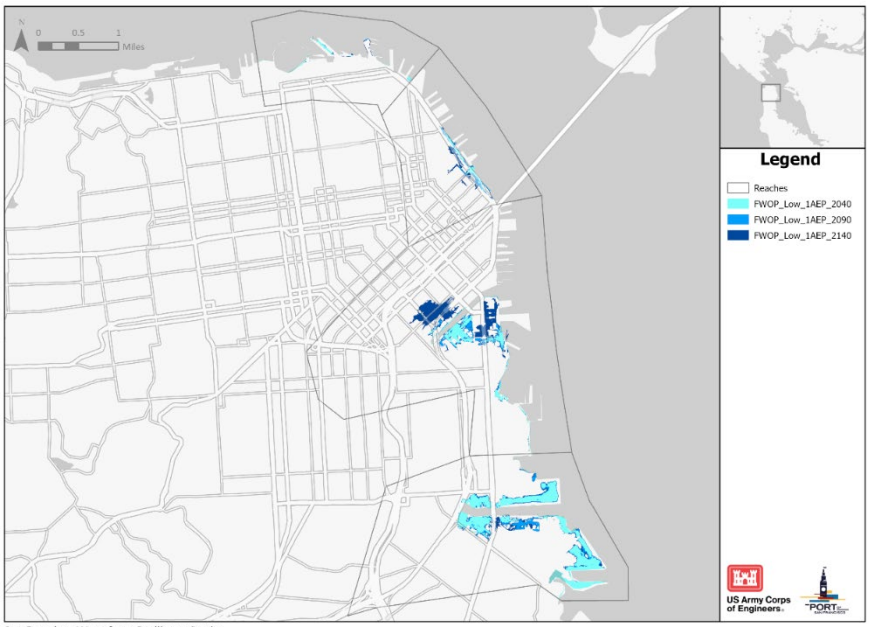


Figure D.1-8: USACE Low RSLC and 1 Percent AEP for 2040 (light blue), 2090 (blue), and 2140 (dark blue)

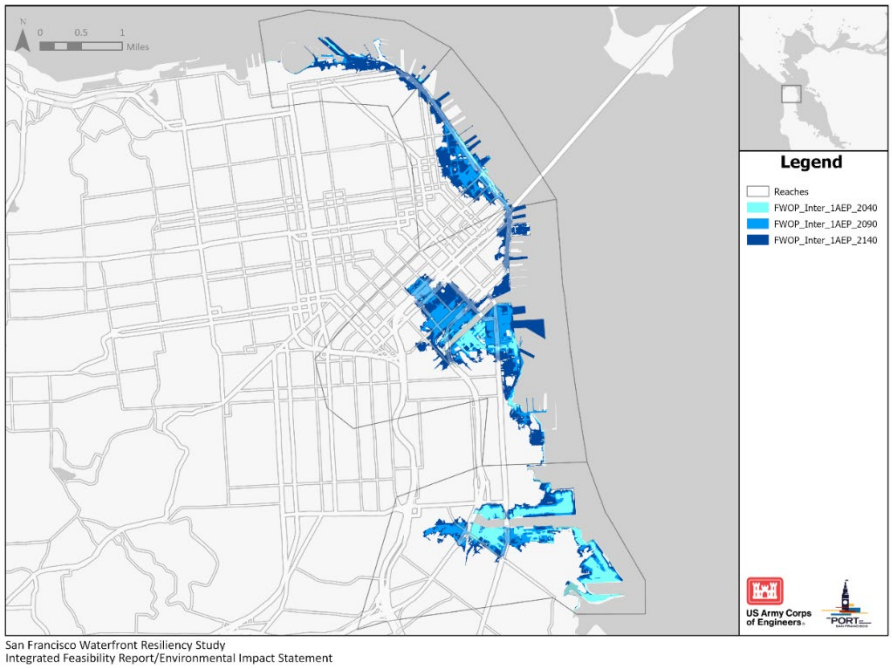


Figure D.1-9: USACE Intermediate RSLC and 1 percent AEP for 2040 (light blue), 2090 (blue), and 2140 (dark blue)

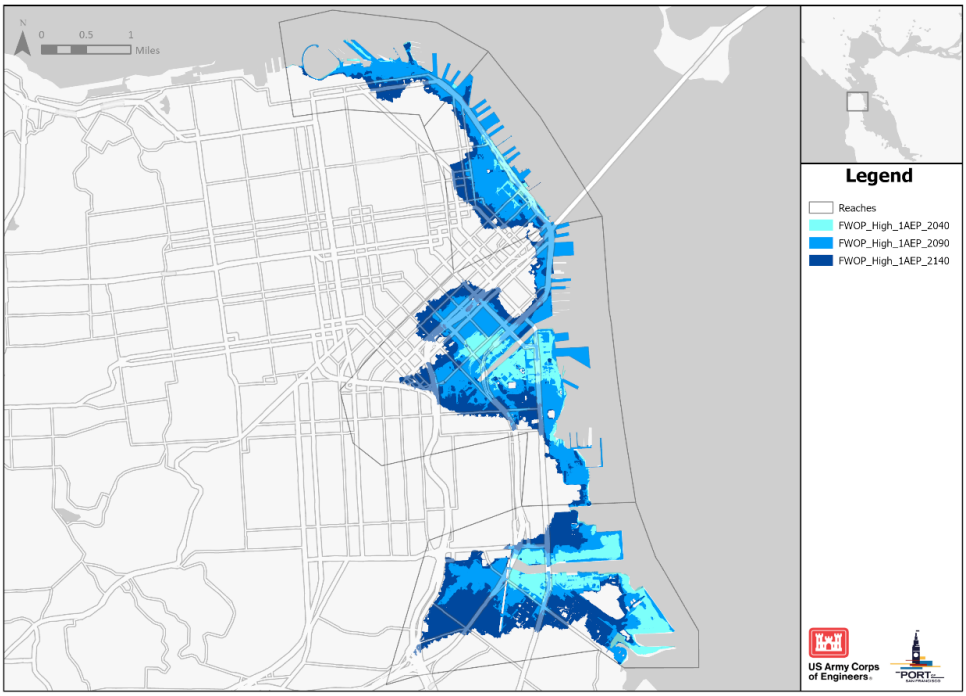


Figure D.1-10: USACE High RSLC and 1 percent AEP for 2040 (light blue), 2090 (blue), and 2140 (dark blue)

3.4 Geology and Geomorphology

Geology is the study of the structure, evolution, and dynamics of Earth and its natural mineral and energy properties (USGS 2022a), while geomorphology is the study of the physical features of the Earth's surface and their relation to the geological structure (Stetler 2014). San Francisco is part of the California Coast Ranges geomorphic provinces and is characterized by a series of northwest-trending ridges and valleys that run nearly parallel to the San Andres fault zone (Norris and Webb 1990). The San Francisco Bay lies within a depression created by an expansion between the San Andres and Hayward fault systems. Much of the province is composed of marine sedimentary deposits and volcanic rocks (Norris and Webb 1990). Within this province, the Northern Coast Ranges, where project activities would occur, the geologic structure contains the Alcatraz terrane. The Alcatraz terrane is an amalgamation of semi-coherent blocks that consists of shale, greenstone, basalt, chert, sandstone, graywacke, and serpentine. Much of these units originated from ancient seafloor sediments that were displaced and deformed through tectonic forces (CCSF 2017).

3.4.1 Regulatory Framework

3.4.1.1 Federal

- No Federal regulations or laws pertain to geology and geomorphology.

3.4.1.2 State

- California Building Code – provides minimum standards for building design in the state
- Seismic Hazards Mapping Act of 1990 – requires review of any proposed land use management, construction, etc. to encourage safety elements that reduce seismic hazards

3.4.1.3 Local

- Port of San Francisco Building Code – provides minimum standards for building design and construction on Port property
- San Francisco General Plan – provides standards to reduce structural and nonstructural hazards to life safety and minimize property damage resulting from future disasters, including considering geologic hazards

3.4.2 Existing Condition

3.4.2.1 Sediments

The sediments within San Francisco Bay originate from erosion of surrounding hills or from later marine and riverine deposits. Generally, the upper several feet of the sediment profile in San Francisco Bay consists of more recently deposited marine and riverine sediments. The thickness of various underlying historic sediment formations varies throughout the San Francisco Bay/Delta Estuary and it can be several hundred feet thick. Large areas of San Francisco Bay contain Bay Mud, a marine clay-silt deposit, that lie beneath softer, more recently deposited muds (USACE 2015). Because bay mud was not placed with modern engineering compaction techniques, it has less resistance to liquefaction (see below) and is more vulnerable to becoming unconsolidated during a seismic event (Hicock et al. 2008). Bay mud can be divided into younger and older, varying in engineering properties, dependent on thickness and consolidation (CCSF 2017).

San Francisco Bay surficial sediments have been deposited since industrialization began in California, and, thus, may have been exposed to anthropogenic sources of pollutants. Recent sand deposits may also be exposed to anthropogenic sources of pollutants but typically do not accumulate significant pollutant concentrations.

3.4.2.2 Seismicity

Several active faults traverse the San Francisco Bay watershed, including the Hayward fault zone, and the San Andres, San Gregorio, Concord-Green Valley, and Calaveras faults, which are the most likely sources of future earthquakes (e.g., CCCARTO 2022, CCSF 2017, Fialko 2006, Field & Milner 2008). The are no fault zones directly within the study area.

The U.S. Geological Survey (2015) predicted the San Francisco region had, on average, a 100 percent likelihood of experiencing a 5.0 magnitude or greater earthquake every year. The probability of experiencing a 7.0 magnitude earthquake decreases to 51 percent every 50 years. The Hayward-Rodgers Creek and Calaveras faults are the most likely to contribute to a large magnitude earthquake in the San Francisco region (USGS 2015).

The Federal Emergency Management Agency's (FEMA) Seismic Design Category ratings define the potential effects of shaking in the study area as follows:

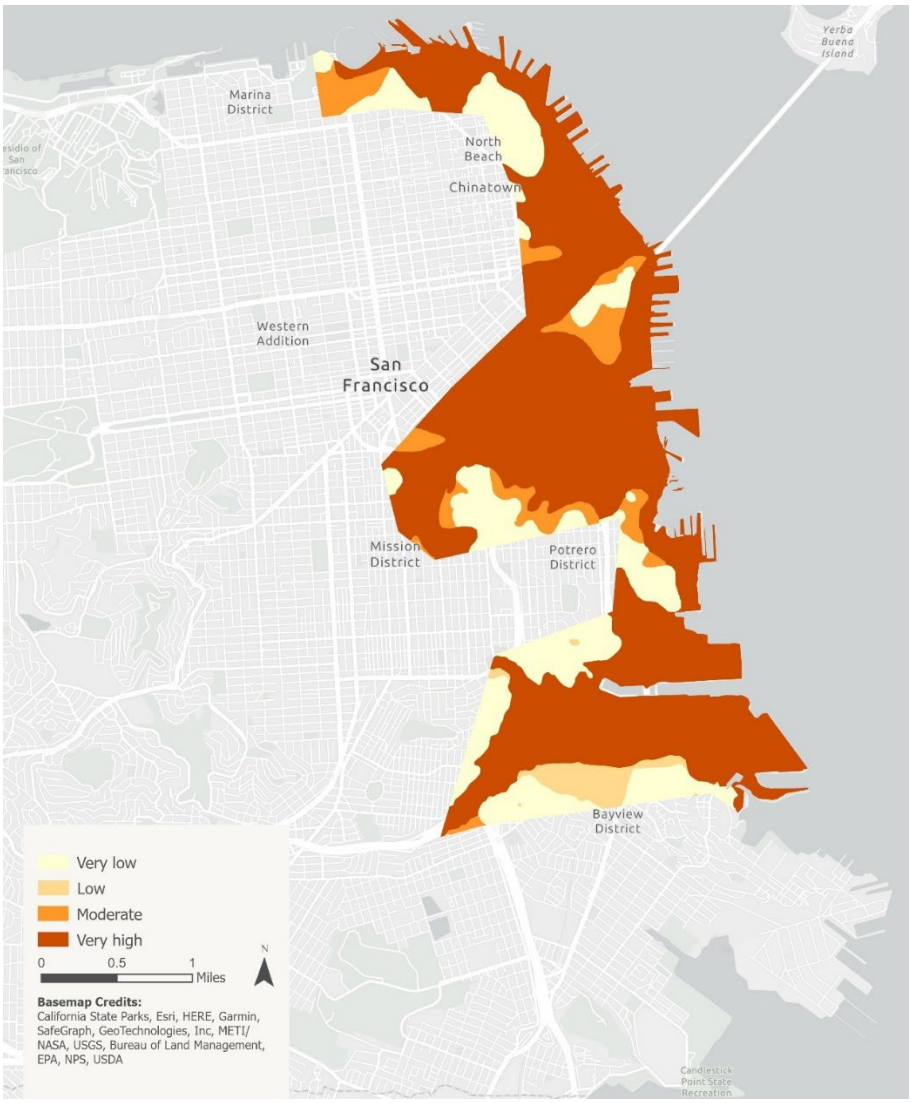
- D1, D2: very strong shaking – damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures.
- E: strongest shaking – damage considerable in specially designed structures; frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. Shaking intense enough to completely destroy buildings.

Shaking intensity generally declines moving eastward from the study area, with the highest shaking potential centered on the Hayward and Green Valley fault zones (FEMA 2020).

3.4.2.3 Seismically induced Liquefaction

Liquefaction is a process in which saturated, loosely packed, coarse-grained soils transform from a solid to a near-liquid state as a result of seismic ground shaking (USGS 2022b). Liquefaction can cause slope instability, lateral spreading, loss of foundation bearing capacity, and ground settlement. An area can be susceptible to liquefaction (i.e., saturated sandy-to-silty Quaternary material is present) or it may raise to the level of a hazard (i.e., soil material is present, and it is likely a seismic event could displace sediment triggering liquefaction). **Source: USGC** 2006, accessed via MTC/ABAG Hazard Viewer Map (MTC/ABAG 2021)

Figure D.1-11 presents a high-level overview of liquefaction susceptibility for the study area.



Source: USGC 2006, accessed via MTC/ABAG Hazard Viewer Map (MTC/ABAG 2021)

Figure D.1-11: Earthquake Liquefaction Susceptibility

3.4.2.4 Upland Geologic Hazards

Upland areas may be susceptible to lateral spreading, subsidence, settlement, and erosion which may be caused or exacerbated by seismic activity. Comprehensive maps for these hazards have not been developed for the study area. Site susceptibility to these hazards is dependent upon their specific location, which has not been determined at this time.

3.4.2.5 Tsunamis and Seiches

Seismic activity has the potential to result in tsunamis or seiches, presenting a hydrologic hazard. Low-lying coastal areas, such as tidal flats, marsh lands, and former

bay margins that have been artificially filled, but are still at or near sea level, are generally the most susceptible to tsunami inundation. The shoreline in the study area is within tsunamic inundation areas as delineated on the State's tsunami inundation maps (CEMA 2020).

A seiche is caused by oscillation of the surface of an enclosed water body, such as San Francisco Bay, resulting from an earthquake or large wind event. Seiches can result in long-period waves that cause run-up (i.e., uprush on the shoreline or structures above the still water level or overtopping of adjacent landmasses). The primary tsunami threat along the California coast is from distant earthquakes along subduction zones elsewhere in the Pacific basin.

3.5 Soils and Minerals

Soils are dynamic and diverse natural systems comprised of five components – minerals, soil organic matter, living organisms, gas, and water. Minerals are divided into three size categories – clay, silt, and sand (Needelman 2013) and can be composed of a number of different materials with a variety of origins. Soil formation is dominated by one of five factors – climate, vegetation, topography, parent material, or time – which contributes to different mineral assemblages within the soil (Heckman and Rasmussen 2018).

3.5.1 Regulatory Framework

3.5.1.1 Federal

- No Federal regulations or laws pertain to soils and minerals.

3.5.1.2 State

- No state regulations or laws pertain to soils and minerals.

3.5.1.3 Local

- No local regulations or laws pertain to soils and minerals.

3.5.2 Existing Condition

3.5.2.1 Soils

The San Francisco Bay area is comprised of a combination of residual (i.e., have formed in place) and depositional (i.e., transported from somewhere else) soils that are predominately clay, sand, loam, and peat-like organic matter (Hayes 2005). Much of the residual soil is fine in texture and formed from sedimentary rocks which over-time weathered to clay minerals and clay-like soils rich in nutrients. Many of the depositional soils occur along the wetlands where fine, clay-sized sediments were transported via marine currents or streams, and large-particle sand that were deposited by streams or

carried by wind. Loamy soils are an optimal blend of sand, silt, and clay and are typically found in alluvial or depositional valley and bay fronts around the bay. Soils along the California coast contain approximately four percent organic material, while this lowers with inland soils to about one to two percent (Hayes 2005).

3.5.2.2 Mineral Resources

California hosts a diversity of mineral resources that can be categorized into metals, industrial minerals, and construction aggregate. Metals include gold, silver, iron, and copper. Industrial minerals include boron compounds, rare-earth elements, clay, limestone, gypsum, salt, and dimension stone. Construction aggregate is comprised of sand, gravel, and crushed stone (CGS 2019). San Francisco County historically produced mineral commodities such as boron, borate, and soapstone; however, the most recent record was 1969 (CGS 2022).

3.6 Hydrology and Hydraulics

Hydrology and hydraulics help with understanding and quantifying the flow magnitude, frequency, duration, timing, and variability of water flow and behavior (GeoEngineers 2023).

3.6.1 Regulatory Framework

3.6.1.1 Federal

- Clean Water Act (CWA) – regulates point-source pollutant discharges into waters of the United States through effluent limits and establishing water quality standards on a water-body specific basis.
- E.O. 11988, Flood Plain Management – directs Federal agencies to avoid, to the best extent practicable, long- and short-term adverse effects associated with the occupancy or modification of the base flood plain (1 percent annual event), and to avoid direct and indirect support of development in the base flood plain where practicable

3.6.1.2 State

- Bay Area Stormwater Management Agencies Association – focuses on regional challenges and opportunities to improve the quality of stormwater flows in creeks, the Delta, San Francisco Bay, and the Pacific Ocean
- Bay Conservation and Development Commission (BCDC)

3.6.1.3 Local

- San Francisco Public Utilities Commission

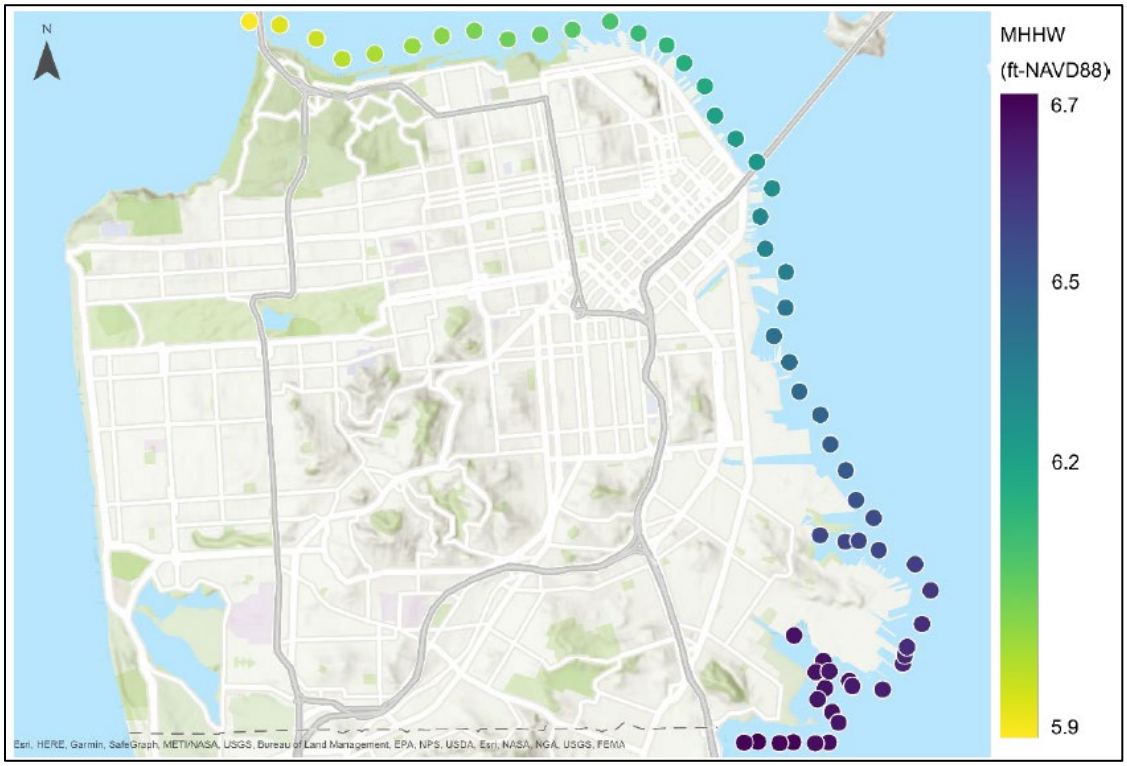
3.6.2 Existing Condition

3.6.2.1 Surface Water

3.6.2.1.1 Tides and Currents

San Francisco Bay is characterized by broad narrow shoals and narrow channels that result in a complex tidal system with a complex bathymetry that contribute to large spatial variability in flow properties. The interactions among tidal processes, bathymetric complexities, and shoreline orientation amplify tidal ranges, with tides increasing with the spatial distance from the Golden Gate inlet (Conomos 1979). The elevation of tidal ranges along the study area varies by approximately 0.5 ft between Aquatic Park and Heron's Head (**Source: May** et al. 2023

Figure D.1-12).



Source: May et al. 2023

Figure D.1-12: Variation in MHHW in the study area

The bay in the study area is a partially to well mixed estuary with substantial longitudinal density gradients (Walters et al. 1985) dominated by seasonally varying river inflow (Conomos et al. 1985). Tidal currents are generated by mixed semi-diurnal and diurnal tides with the bay experiencing two tidal cycles daily with two high and two low tides of unequal height. Additionally, the bay experiences pronounced spring-neap tidal

variability (Rajasekar 2016). The NOAA tidal gauge near the Presidio (Station ID: 9414290) report a mean tidal range of 4.09 ft and diurnal range of 5.84 ft (NOAA 2023b). Freshwater inflows are highest during the winter and generate strong estuarine circulation. Tidal currents mix the water column, and combined with the river inflow and basin geometry, determine circulation patterns in the bay (Conomos et al. 1985). Winds are strongest during summer and winter storms and exert stress on the bay's water surface thereby creating large waves that contribute markedly to the transport of water mass throughout the estuary (Conomos et al. 1985). Water level variations in the bay are driven primarily by five tidal and oceanic cycles including the mixed semidiurnal tidal cycle, two week spring-neap cycle, seasonal spring/summer (low levels) and fall/winter (higher levels) cycles, El Nino and La Nina, and the Pacific Decadal Oscillation (atmospheric shift on decadal time scale).

3.6.2.1.2 Waves

The wave climate in San Francisco Bay is predominantly driven by wind and ocean swells from the Pacific Ocean. The steep topography, hills, and valleys throughout the San Francisco Bay Area drive complex wind patterns and because of the large size of the Bay, those winds can sufficiently generate wind-driven waves ranging from 3 to 5 ft high in vulnerable (i.e., exposed) areas of the shoreline. The most impactful waves to the study area shoreline are those driven by easterly (i.e., offshore; Ferry building and southward), north and northeasterly (northern waterfront), and southeasterly winds (southern waterfront; May et al. 2023). The strongest winds occur during the spring, lowest are typically experienced in the fall, while the winter produces the most variable wind directions. In general, wind-driven waves can impact shorelines across the study area (May et al. 2023).

Ocean-driven swell is another predominant driver of waves in the San Francisco Bay Area, which create longer-period waves that develop in the Pacific Ocean that can span thousands of miles. The occurrence of these waves is heightened in the fall when storms over the Pacific Ocean become stronger and more frequent that result in ocean swells penetrating through the Golden Gate. As the ocean swell propagates through the Golden Gate Channel, the swell waves quickly dissipate energy and decrease in height as they enter the San Francisco Bay, by as much as 69% in the northern waterfront. The ocean swell waves can elevate offshore Bay water levels in the study area, but do not directly travel to the shoreline, rather contribute to the wind-driven wave climate (May et al. 2023). Ocean-driven swells can develop into damaging waves along the study area.

3.6.2.2 Flooding

Climate change is likely to increase extreme flooding events (Seneviratne et al. 2012), particularly in low-lying coastal areas (Wong et al. 2014). Rapid urbanization, as within the study area, further increases flood risk with growing concentrations of people and assets in the city (Revi et al. 2014). Coastal flooding events occur when extreme water levels develop following storm surges, tides, seasonal cycles, interannual anomalies, or

a combination of these, driven by large-scale climate variability and RSLC (Kasmalkar et al. 2020). Additional details about flooding can be found in Sub-Appendix B.1.

3.6.2.3 Stormwater

In San Francisco, stormwater runoff is generated predominantly from rain events that flow over land or impervious surfaces (e.g., paved streets, parking lots). Stormwater runoff can capture pollutants, chemicals, oils, and sediment that if deposited in the San Francisco Bay and other surface waters (e.g., rivers, streams, lakes) can have negative effects on water quality. Most of San Francisco is served by a combined storm sewer system, where stormwater, along with residential and commercial sewage, is directed to treatment plants prior to being released to the San Francisco Bay or Pacific Ocean (SFPUC 2021b).

3.7 Water Quality

Water quality describes the condition of water, including chemical, physical, and biological characteristics typically with respect to suitability for a purpose, such as drinking or swimming. Water quality is measured by several factors including salinity, turbidity, bacteria, dissolved oxygen, contaminants, etc. (NOAA 2023a).

3.7.1 Regulatory Framework

3.7.1.1 Federal

- Clean Water Act (CWA) – regulates point-source pollutant discharges into waters of the United States through effluent limits and establishing water quality standards on a water-body specific basis.
- National Pollutant Discharge Elimination System (NPDES) – permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the U.S.
- Rivers and Harbors Act of 1899 – regulates development and use of nation's navigable waterways
- Oil Pollution Act of 1990 – governs oil spills into the nation's waterways
- Ports and Waterways Safety Act of 1972 – provides authority for the U.S. Coast Guard's program to increase vessel safety and protect the marine environment in ports, harbors, waterfront areas, and navigable waters
- Estuary Protection Act of 1968 – focuses on improving waters, habitats, and living resources of estuaries of local significance
- Coastal Zone Management Act of 1972 – preserves, protects, develops, restores, or enhances the resources of the Nation's coastal zone

3.7.1.2 State

- California Water Code
- California Health and Safety Code
- California State Water Resources Control Board

3.7.1.3 Local

- San Francisco Bay Regional Water Quality Control Board (Water Board) – maintains a basin plan that contains Section 303 water quality standards and prepares CWA Section 401 water quality certifications

3.7.2 Existing Condition

The study area encompasses shoreline along the Central and South San Francisco Bay. Water quality in the San Francisco Bay Region of the study area is saline and predominated by ocean influences; however, substantial runoff from freshwater during heavy rains are also prevalent. The freshwater inundation can temporarily reduce salinity in the study area (Bay Institute 2003). Physical barriers, such as the Golden Gate Bridge, influence sedimentation and water quality characteristics by altering the behavior of currents which affect circulation, flushing, and water exchange.

Suspended sediments are a key component of the estuarine system, which tend to have higher levels of turbidity or suspended sediment loads due to discharges from rivers, drainages, and their shallow nature. Suspended sediment concentrations are variable in San Francisco Bay and strongly correlate to season and water depth (Buchanan and Ganju 2006; Buchanan and Ganju 2005; McKee et al. 2006), ranging from 1,000 milligrams per liter (mg/L) near the bottom to 10 mg/L near the surface (Buchanan and Ganju 2006). The study area is located nearshore and is relatively shallow water that is strongly influenced by discharges, vessel traffic, and wind- and wave-generated sediment disruption.

Contaminants are prominent in the bay and are transported by a variety of sources including, but not limited to, urban uses, industrial outfall, municipal wastewater outfalls, municipal stormwater, upstream farming, upstream historic and current mining discharges, and legacy pollutants. Approximately 40 percent of California drains into San Francisco Bay including point and non-point source pollutants that distribute up to 40,000 metric tons of at least 65 different pollutants (BCDC 2020). The study area is listed as an impaired water body by the San Francisco Water Board. Under Section 303(d) of the CWA, impaired waters are defined as those that do no meet water quality standards, even after point and non-point sources of pollution have had pollution control technologies implemented. The pollutants recorded in the Central San Francisco Bay, including the study area, are chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, hydrogen sulfide, lead, mercury, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), selenium, silver, furans, and dioxins. Pollutant concentrations vary seasonally and annually, dependent on the source and degradation

characteristics. Some contaminants such as ammonia, copper, and legacy pesticides have decreased due to cleanup efforts and natural attenuation (SFEI 2010; Bay Institute 2003).

The Regional Monitoring Program for Water Quality, within the San Francisco Estuary Institute, has collected water quality data annually since 1993 in San Francisco Bay. The monitoring effort measures parameters including nutrients (e.g., ammonia, dissolved organic carbon, silicates, nitrate, nitrite, phosphate), temperature, salinity, conductivity, turbidity (suspended solids), pH, hardness, dissolved oxygen (DO), trace elements (e.g., aluminum, arsenic, copper, lead, mercury), trace organics (e.g., PAHs, PCBs, pesticides), and toxicity. Pollutants in the bay that are recorded at detectable levels include trace metals, pesticides, PCBs, PAHs, algal blooms and low DO, and sediment contamination.

The San Francisco Bay is typically well oxygenated with DO concentrations ranging from 9 to 10 mg/L during high freshwater inflow, 7 to 9 mg/L during moderate flow, and 6 to 9 mg/L during low flow (typically summer months).

3.8 Groundwater

Groundwater exists as water underground in saturated zones beneath the land surface (USGS 2023). Groundwater moves and stores in natural aquifers and is one of the U.S.'s most important natural resources. It provides approximately 37% of the water for public supply and drinking water for more than 90% of rural populations (USGS 2023).

3.8.1 Regulatory Framework

3.8.1.1 Federal

- CWA
- Safe Drinking Water Act – regulates the nation's public drinking water supply
- NPDES

3.8.1.2 State

- Sustainable Groundwater Management Act – requires groundwater-dependent regions to halt overdraft and develop plans to bring basins into balanced levels of pumping and recharge through local planning efforts. Directs local agencies to work together to create a plan to balance the amount of water pumped in and out of the basin.

3.8.1.3 Local

- SFPUC

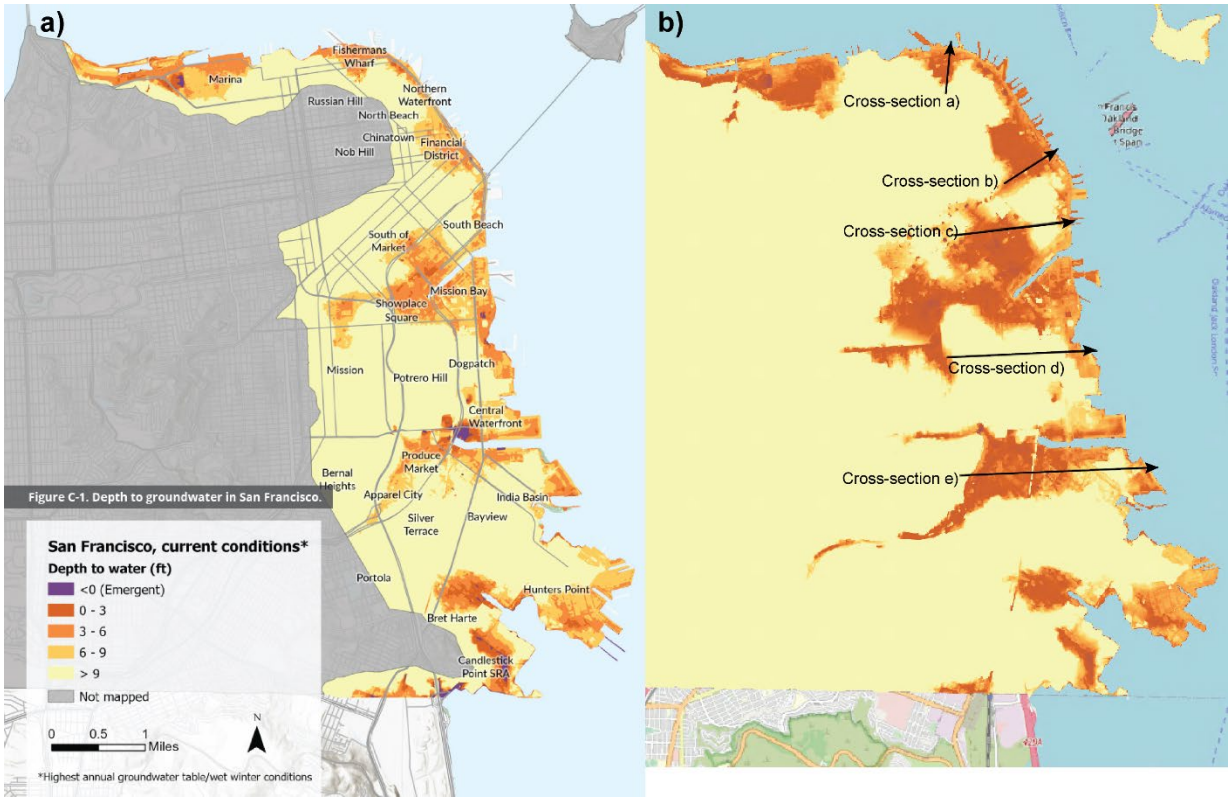
3.8.2 Existing Condition

The study area overlies seven small groundwater basins. Local groundwater supply comes from the Westside Basin, a series of aquifers extending from Golden Gate Park southward to San Bruno. Groundwater is pumped from the Westside Groundwater Basin from depths of approximately 400 feet below the surface, blended with surface water supplies from San Francisco, treated, and distributed to the city for drinking water (SFPUC 2021a). Most of the groundwater supplies in the study area are confined between two substantial layers of clay that act as aquitards. Aquitards have low permeability which allow groundwater to be confined and under high pressure.

Groundwater closest to the surface is shallow groundwater or the “water table” and is not constrained by an overlying aquitard and is thus unconfined. Unconfined aquifers are at atmospheric pressure, so water levels rise and fall in response to surface recharge, tidal changes, and underflow. Deeper unconfined aquifers, like Westside Basin, are used for public water supply and shared by various municipalities.

Shallow groundwater in the study area is poor quality and is not used for supplying drinking water. Young Bay Mud acts as an aquitard, separating shallow groundwater from deeper aquifers used for municipal water supply and generally acts as a barrier to the vertical migration of contaminants. Shallow groundwater levels are influenced by seasonal variations in precipitation, tidal levels, local irrigation, groundwater pumping, and other factors, and vary across the study area.

Existing groundwater conditions were evaluated using empirical mapping and numerical modelling techniques in previous studies (May et al. 2019, Plane et al. 2019, Befus et al. 2020). Both techniques indicated the presence of emergent and shallow groundwater within the study area; however, the majority is more than 9 feet below the surface **Figure D.1-13**.). Additional details and maps can be found in Annex B.1.5.

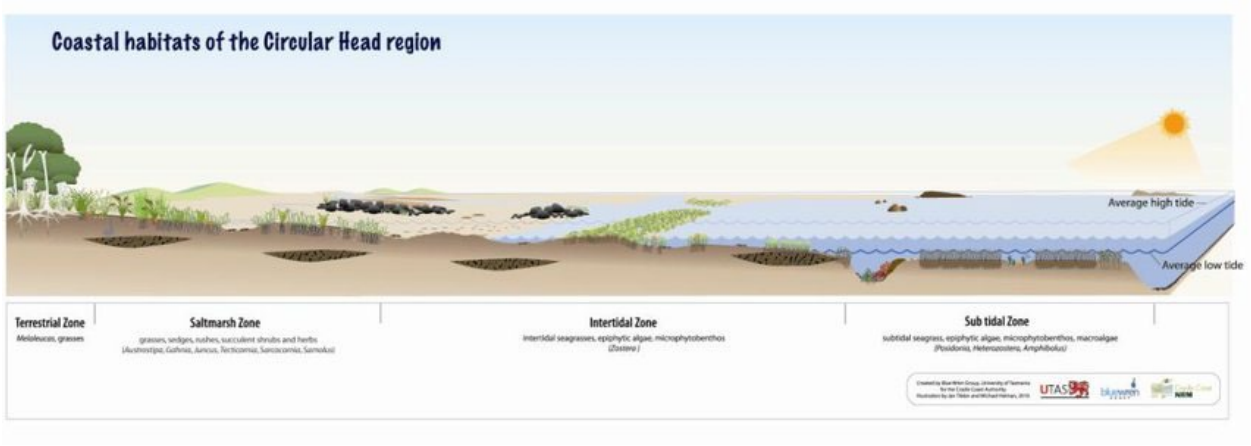


Source: May et al. 2022, Befus et al. 2020

Figure D.1-13: Existing Depth to Groundwater for the Study Area

3.9 Aquatic Resources

Aquatic resources refers to a range of habitats and natural water resources that are of potential use to humans including, but not limited to, wetlands, streams, lakes, rivers, springs, seeps, reservoirs, ponds, and groundwater (Britannica 2023). Coastal habitats can be complex systems comprised of marsh zones, intertidal, and subtidal areas (**Figure D.1-14**).



Source: Prahalad and Pearson 2013

Figure D.1-14: Cross Section View of Coastal Complex

3.9.1 Regulatory Framework

3.9.1.1 Federal

- Estuary Protection Act of 1968 – focuses on improving waters, habitats, and living resources of estuaries of local significance
- Fish and Wildlife Coordination Act – requires Federal agencies to first consult with USFWS and in some instances NMFS, as well as state fish and wildlife agencies regarding potential impacts on fish and wildlife resources, and measures to mitigate these impacts.
- Executive Order (EO) 13112 on Invasive Species – directs Federal agencies to prevent the introduction and control the spread of invasive species. Invasive species are defined by the EO as “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.”
- EO 11990, Protection of Wetlands – directs Federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agencies’ responsibilities

3.9.1.2 State

- San Francisco Bay Regional Water Quality Control Board – implements the requirements of CWA

- San Francisco Bay Conservation and Development Commission (BCDC) – regulates fill, extraction of materials, and substantial changes in land use, water, and structures within the bay, and within 100 feet of the bay shoreline
- Marine Life Management Act (MLMA) – requires the development of fishery management plans for all of the State's major recreational and commercial fisheries

3.9.1.3 Local

3.9.2 Existing Condition

3.9.2.1 Intertidal Habitats

Intertidal habitats are the regions of the bay that lie between low and high tides (NOAA 2022b). The Central Bay basin includes natural and artificial intertidal habitats such as sandy beaches, natural and artificial rock (quarried rip-rap), concrete bulkheads, concrete, composite, and wood pier pilings, and mud flats. These habitats provide highly diverse locations for marine flora and fauna to forage, rest, reproduce, and refuge. The Central Bay basin's proximity to the Pacific Ocean has resulted in an intertidal zone inhabited by many coastal and estuarine species.

Rip-rap that has been placed for shoreline protection in the Central Bay basin along the study area provide numerous havens in which assorted marine species survive and flourish. Typical invertebrate and algae species inhabiting these zones include sea lettuce (*Ulva* spp.), rockweek (*Fucus gardener*), the red algae species (*Polyneura latisima* and *Gigartina* spp.), and the non-native brown algae species (*Sargossum muticum*; AMS 2009).

The study area includes limited areas of sandy beaches (e.g., Aquatic Park) and mudflats (e.g., Heron's Head), which are mainly composed of sandy substrates and other soft-bottom material (SFPUC 2014). These habitats support benthic fauna including amphipods, polychaetes, and flies of the intertidal zone, providing food for shorebirds. Other common invertebrates within the intertidal environment included balanoid barnacles (Balanidae) in the high and middle intertidal zones; limpets (Patellidae, Fissurellidae), saltwater mussels (*Mytilus* spp.), and native Olympia oysters (*Ostrea lurida*) in the lower middle and low intertidal zones. Shorebirds that frequent intertidal habitats during migration or overwinter within the terrestrial study area include sanderling (*Calidris alba*), willet (*Tringa semipalmata*), marbled godwit (*Limosa fedoa*), and whimbrel (*Numenius phaeopus;* GFNMS and FMSA 2006). Spotted sandpiper (*Actitis macularius*) and black oystercatcher (*Haematopus bachmani*) may forage along the rocky shoreline during low tide within the intertidal zones of the study area.

3.9.2.2 Subtidal Habitats

Subtidal habitats are submerged areas beneath the San Francisco Bay water surface and include mud, shell, sand, rocks, artificial structures, shellfish beds, eelgrass beds, macroalgal beds, and the water column above the bay bottom (Cosentino-Manning et

al. 2010). Soft substrate comprises the majority of the bay's bottom (approximately 90%) and ranges between soft mud with high silt and clay content and areas of coarser sand. These latter tend to occur in locations subjected to high tidal or current flow. Soft mud locations are typically located in areas of reduced energy that enable deposition of sediments that have been suspended in the water column, such as in protected slips, under wharfs, and behind breakwaters and groins. Exposure to wave and current action, temperature, salinity, and light penetration determine the composition and distribution of organisms within soft sediments. Muddy-sand sediments consists of a diverse polychaete community represented by several subsurface deposit-feeding capitellid (segmented worms) species, a tube-dwelling filter-feeding species (*Euchone limnicola*), a carnivorous species (*Exogone lourie*), and the maldanid polychaete (*Sabaco elongates*).

Minimal hard substrate occurs naturally in the bay. Rock habitat includes boulders, bedrock (rock not normally moved by currents), shellfish beds, and some algal beds (Cosentino-Manning et al. 2010). Submerged hard bottom substrate is typically covered with a mixture of turf organisms dominated by hydroids, bryozoans, tunicates, encrusting sponges, encrusting diatoms, and anemones. In the intertidal and subtidal zones, barnacles (*Balanus glandula, Amphibalanus amphitrite, A. improvises*), Bay mussel (*Mytilus trossulus/galloprovincialis*) and Olympia oyster are commonly present on hard substrate, as well as the invasive Asian mussel (*Musculista senhousia*). Barnacles can also be found on subtidal pier pilings, exposed rock outcropping, and debris. Pacific rock crab (*Cancer antennarius*) and the red rock crab (*C. productus*) inhabit rocky, intertidal and subtidal areas in the Pacific Ocean, and likely use the Bay as an extension of their coastal habitats (Hieb 1999). Shellfish beds are hardbottom locations where shellfish species occupies more than 50% of an area of more than a few square meters. Five species of shellfish occur in the Bay including native Olympia oysters, California mussels, hybridized Bay mussels, and non-native ribbed horsemussel (*Geukensia demissa*) and green bagmussel (*Musculista senhousia*).

Artificial structures include a variety of man-made objects designed to protect shorelines and shoreline structures, for transportation, recreation, and restoration (oyster shell and artificial reefs; Cosentino-Manning et al. 2010). Red and brown algae are found attached to submerged intertidal hard substrate, including pier pilings.

Submerged aquatic vegetation (SAV) refers to all underwater flowering plants. In San Francisco Bay SAV includes sago pondweed (*Stuckenia pectinata*), eelgrass (*Zostera marina*), surfgrasses (*Phyllospadix torreyi* and *P. scouleri*), and widgeongrass (*Ruppia maritima*). Eelgrass is the most extensive SAV in San Francisco Bay (Cosentino-Manning et al. 2010), albeit very few beds are documented or known to occur within the study area (Merkel and Associates 2014). Small, isolate beds are known to occur along the southern extent of the study area, such as Heron's Head Park. All SAV in the Central Bay basin is considered critical essential fish habitat (EFH) for spawning Pacific herring, which attach their egg masses to eelgrass, seaweed, and hard substrates.

Subtidal habitats provide diverse structure and function as an important habitat in the bay for various wildlife including fish (herring and salmon), vegetation (eelgrass, seaweed), shellfish, invertebrates, marine mammals, and birds (diving ducks, shorebirds) that forage, rest, refuge, and reproduce in the subtidal areas (Cosentino-

Manning et al. 2010). The harbor and main channel areas are characterized by a mix of benthic communities from surrounding areas, including deep and shallow-water and slough marine communities. The most common large mobile benthic invertebrate organisms in the Bay include blackspotted shrimp (*Crangon nigromaculata*), the bay shrimp (*C. franciscorum*), Dungeness crab (*Metacarcinus magister*), and the slender rock crab (*Cancer gracilis*). All of these mobile invertebrates provide an important food source for carnivorous fishes, marine mammals, and birds in San Francisco Bay's food web.

3.9.2.3 Open water (Pelagic) Habitat

The open water (pelagic) environment of the San Francisco Bay is near the Pacific Ocean and is very similar to the open water coastal environment. Pelagic habitat is the predominant marine habitat in the Bay and includes the area between the water surface and the seafloor, which can be further subdivided into shallow water/shoal and deep-water/channel areas. The water column is predominantly inhabited by planktonic organisms that float or swim in the water, fish, marine birds, and marine mammals.

Marine birds regularly inhabiting or using the open waters of the study area include cormorants [double-crested and Brandt's cormorants (*Phalacrocorax auratus* and *P. penicillatus*)], pigeon guillemot (*Cepphus columba*), gulls [herring gull (*Larus argentatus*), mew gull (*L. canus*), Western gull, California gull (*L. californicus),* ring-billed gull (*L. delawarensis*)], greebes [eared greb (*Podiceps nigricolis*), western and Clarke's grebe (*Aechmophorus occidentalis* and *A. clarki*), common loon (*Gavia immer*), California brown pelican (*Pelecanus occidentalis californicus*), and terns [Caspian tern (*Hydroprogne caspia*), least tern (*Sternula antillarum*)]. Common diving benthivores (animals that feeds on benthic prey) are canvasback (*Aythya valisineria*), greater scaup (*A. marila*), lesser scaup (*A. affins*), and surf scooter (*Melanitta perspicillata*).

Few marine mammal species occur in the San Francisco Bay within the study area. Pacific harbor seals (*Phoca vitulina richardsi*) are the only resident in the Bay year-round with the highest numbers sighted during the pupping (March to May) and molting (June to July) seasons (SFBAWT 2022). Harbor seals congregate on "haul-out" terrestrial sites annually, which are typically located in areas with easy access to the water, proximity to food, and experiences minimal disturbances. Haul-out sites can be used annually or seasonally, with some being important for providing shelter during pupping and molting (SFBAWT 2022).

California sea lions (*Zalophus californianus*) use the Bay for foraging but breed elsewhere. Pier 39 in the study area is a common haul-out site for California sea lions where they are often observed loafing. The greatest number of sea lions are observed in the Bay during the winter herring run (December to February). Sea lions are opportunistic feeders and will prey mostly on schooling species, but have also been known to consume leopard sharks, shrimp, and crabs (SFBAWT 2022).

Harbor porpoises (*Phocoena phocoena*) are sighted year-round in harbors, bays, and estuaries of the San Francisco Bay. The porpoise is elusive and typically solitary, or may travel in small pods of two to five individuals (MMC 2022). Individuals traditionally feed on schooling fish (herring, capelin, hake) and will occasionally eat squid or

octopus. They were believed to have disappeared from the San Francisco Bay in the 1940s during World War II and because of environmental contaminants from industrialization; however, returned in the 1990s following restoration attributed to the Clean Air and Water Act (MMC 2022).

Most cetacean sightings occur in the Central Bay basin, outside of the study area. Marine mammal presence is predominantly dependent on distribution and presence of prey species and foraging habitat (SFBAWT 2022).

3.9.2.4 Wetlands

Formal delineation of water of the U.S., including wetlands, occurred in 2015 along the Port of San Francisco waterfront between the open water basin north of Pier 40 and Heron's Head Park at Pier 98. The delineation excluded Mission Creek, the Pier 70 Mixed-Use District Project area between Mariposa and 23rd streets, Pier 94 Wetlands, and Heron's Head Park. Federal potentially jurisdictional wetlands were documented within Warm Water Cove, and on the north and south banks of Islais Creek (Coast 2015). To be considered federally jurisdictional, wetlands generally must exhibit a defined bed and bank and an ordinary high-water mark or be subject to the ebb and flow of tides. Existing wetlands occur at Pier 94 and Heron's Head Park.

3.9.2.5 Other Waters

The study area is adjacent to navigable waters of the U.S., which are regulated by the Federal Clean Water Act (CWA) and are defined under the CWA, title 33 Code of Federal Regulations (CFR) 329.4 as "waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce". Waters of the U.S. are defined in 33 CFR 328.3 as waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including waters subject to the ebb and flow of tides; territorial seas; interstate waters; impoundments of water; tributaries of water that are relatively permanent, standing, or continuously flowing; intrastate lakes and ponds that are relatively permanent, standing or continuously flowing bodies of water with continuous surface connection to the waters; wetlands adjacent to waters of the U.S. or that have a continuous surface connect to relatively permanent, standing, or continuously flowing bodies of water.

Waters of the State of California are defined in the California Water Code section 1305(e) as "any surface water or groundwater, including saline waters, within the boundaries of the State" and include all federally jurisdictional waters. Waters of the State are broadly construed to include public and private waters in natural and artificial channels.

3.9.2.6 Fisheries

Fisherman's Wharf is the central hub of Northern California's commercial and recreational fishing fleets, while Pier 45 is the West Coast's largest concentration of commercial fish processors and distributors (POSF 2022). The San Francisco Bay,

adjacent to the study area, once supported several commercial fisheries including salmon, sardines, herring, halibut, sturgeon, oysters, crabs, and shrimp; however, presently only the Pacific herring (*Clupea pallasii*) fishery has survived (Mann n.d.). Annual herring landings have ranged up to 11,000 metric tons (mt) since 1980 (Thayer et al. 2020). Herring is found offshore in California during the spring and summer foraging in the open ocean and then forms spawning aggregations starting in the fall. San Francisco Bay hosts the largest spawning aggregation, along with Tomales Bay, for Pacific herring with the greatest concentrations between October and April (CFW 2022). Many of the once productive commercial fisheries collapsed due to overharvesting and a myriad of environmentally damaging practices such as water consumption and diversion, modification of the sediment supply, introduction of nonnative species, and sewage input, as well as climate shifts and environmental policy that did not effectively protect the resources (Cloern and Jassby 2012).

The bay supports a variety of important recreational fisheries including groundfish, salmon, sharks, sportfish, shellfish, and kelp. Although recreational fisheries are popular in San Francisco Bay, many of the fish are under a consumption advisory from the California Office of Environmental Health Hazard including sharks, white sturgeon, surfperches, striped bass (do not eat), and California halibut and white croaker (limit consumption to one serving per week; (OEHHA 2018).

3.9.2.7 Macroinvertebrates

Olympia oysters are native oysters to most of western North America and was a key component of the San Francisco Bay marine ecosystem prior to overharvesting and increased siltation from hydraulic mining in the mid-nineteenth century (NOAA 2008). The oysters were thought to be extinct in San Francisco Bay but have been observed slowly recovering since 2000. However, the current extent of Olympia oysters is estimated to be 1% of historic levels (Wasson et al. 2015). The National Marine Fisheries Service (NMFS) and California Department of Fish and Wildlife (CDFW) have prioritized restoring and reestablishing the Olympia oyster in San Francisco Bay because of its importance as a keystone species.

Olympia oysters are predominantly estuarine, with the greatest abundances in Central California found at the 0-feet tide mark, mean lower low water, but can be found up to approximately 33 feet (Baker 1995; Wasson et al. 2015). In order to settle, the oysters require a hard substrate such as intertidal or shallow subtidal rocks (Wasson et al. 2015). Olympia oysters form sparse to dense beds and are known to provide high biodiversity habitat because they create physical habitat structure for juvenile fish, crustaceans, worms, and foraging fish and birds (NOAA 2008). They stabilize sediment, reduce turbidity, improve light penetrations, and in some instances help modulate plankton blooms, thereby improving the physical conditions that encourage the establishment of SAV, such as eelgrass beds.

Naturally occurring populations of native oysters can be found throughout the San Francisco Bay on natural and artificial hard substrate. Oysters have successfully established on human-made habitats such as marina floats and in tidally restricted

ponds, lagoons, and saline lakes (Cosentino-Manning et al. 2010). Olympia oysters are expected in rocky intertidal, subtidal habitats in the marine regions of the study area.

Other macroinvertebrates that may occur in the study area include a variety of amphipods, copepods, fish, gastropods, isopods, crustaceans (e.g., Ostracoda), annelids, polychaetes, etc. (Hartman et al. 2019). Macroinvertebrate communities can differ significantly seasonally, regionally, and locally, thus conditions of populations would be expected to change throughout the year (Howe et al. 2014).

3.10 Upland Resources

3.10.1 Regulatory Framework

3.10.1.1 Federal

- CZMA
- Endangered Species Act (ESA) – designates plants and terrestrial animals as threatened or endangered, protects, and prohibits take

3.10.1.2 State

- California Native Plant Protection Act (NPPA) – designates plants as rare or endangered, protects, and prohibits take

3.10.2 Existing Condition

A vegetation community is a recognizable collection of plant species that interact with each other and the elements of their environment and are distinct from adjacent vegetation communities (Holland 1986). The San Francisco waterfront is primarily developed with limited areas of landscape plantings (e.g., parks), California annual grassland, ruderal vegetation, coastal scrub, and tidal marshes.

3.10.2.1 Developed/Barren

The study area is largely composed of developed urban land that includes buildings, paved streets, sidewalks, parking lots, docks, and piers. These areas provide limited habitat opportunities for wildlife and do not include natural vegetation communities. Paved roads, parking lots, buildings and empty lots can generally act as habitat for striped skunk (*Mephitis mephitis*), racoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and killdeer (*Charadrius vociferus*) that may use these areas for foraging, shelter, nesting, and as corridors to move between barren/developed property to undeveloped areas (e.g., parks). Abandoned buildings can also support bats such as the Mexican free-tailed bat (*Tadarida brasiliensis*) and pallid bat (*Antrozous pallidus*). Bats can also adapt to living in urban areas near water and roost in structures that provide adequate thermal regulation. Vacant buildings can serve as roosting sites for local bats or as nesting sites for common urban birds such as barn owl (*Tyto alba*), cliff swallow (*Petrochelidon pyrrhonota*), rock pigeon (*Columba livia*), and house sparrow.

High rises and bridges are often breeding grounds for peregrine falcons (*Falco peregrinus*). Marine mammals are observed using piers and docks as resting sites. For example, California sea lions (*Zalophus californianus*) are well-known for resting on the K-docks at the Pier 39 Marina in San Francisco.

3.10.2.2 Landscape

Landscape plantings can provide cover, foraging, and nesting habitat in an urban environment for a variety of bird species, reptiles, and small mammals, particularly those tolerant of human disturbance and presence. Birds commonly found in such habitat include native birds such as house finch (*Haemorhous mexicanus*), California scrub jay (*Aphelocoma californica*), mourning dove (*Zenaida macroura*), Brewer's blackbird (*Euphagus cyanocephalus*), and Anna's hummingbird (*Calypte anna*), as well as non-native species like house sparrow (*Passer domesticus*) and European starling (*Sturnus vulgaris*). Other common wildlife to landscape areas include striped skunk, raccoon, Virginia opossum, and non-natives such as Norway rat (*Rattus norvegicus*), black rat (*Rattus rattus*), and feral cat (*Felis catus*).

Landscape vegetation is present in the study area adjacent to buildings and within public parks including, but not limited to, Levi's Plaza, Mission Creek Garden, Mission Bay Commons Park, Warm Water Cove Park, Islais Creek Park, and India Basin Shoreline Park. Mature ornamental landscape trees and shrubs in the study area can provide cover, foraging, and nesting habitat for a variety of bird species, as well as reptiles and small mammals, especially those that are tolerant of disturbance and human presence.

3.10.2.3 California Annual Grassland

The California annual grassland community, also known as non-native grassland, is typically composed of a dense cover of introduced annual grasses and ruderal (woody) forbs (broad-leaved plants) adapted to colonizing and persisting in disturbed upland habitats. Non-native grasses typically include wild and slender oats (*Avena barbata*), barley (*Hordeum vulgare*), soft chess (*Bromus hordeaceus*), foxtail barley (*Hordeum murinum* ssp. *Leporinum*), red brone (*Bromus madritensis* ssp. *Rubens*), Medusahead (*Elymus caput-medusae*), and an array of associated annual and perennial forbs. California annual grassland is present at Heron's Head Park and Pier 94 where it is interspersed with scattered shrubs such as coyote brush (*Baccharis pilularis*).

California annual grassland community can provide cover, foraging, and nesting habitat for a variety of bird species, as well as reptiles and small mammals. Reptiles inhabiting this community may include western fence lizard (*Sceloporus occidentalis*), California alligator lizard (*Elgaria multicarinata multicarinata*) and Pacific gopher snake (*Pituophis catenifer catenifer*). Bird species may include western meadowlark (*Sturnella neglecta*), white-crowned sparrow (*Zonotrichia leucophrys*), cliff swallow, western bluebird (*Sialia Mexicana*), and northern mockingbird (*Mimus polyglottos*). Mammals common to annual grasslands include California ground squirrel (*Otospermophilus beecheyi*), black-tailed jack rabbit (*Lepus californicus*), and Botta's pocket gopher (*Thomomys bottae*).

3.10.2.4 Coastal Scrub

Coastal scrub is present only at the easternmost portion of the study area, within India Basin Open Space. Coastal scrub commonly includes buckwheat (*Eriogonum* spp.), sage (*Salvia* spp.), bush monkeyflower (*Mimulus aurantiacus*) and poison oak (*Toxicodendron diversilobum*). Typical wildlife found in scrub habitat include mammals such as Botta's pocket gopher, house mouse (*Mus musculus*), California vole (*Microtus californicus*), raccoon, and striped skunk. Reptiles common to these areas include California kingsnake (*Lampropeltis californiae*), Pacific gopher snake, and western fence lizard. These species attract larger predators and scavengers, particularly to scrub edges and nearby grassland clearings. Birds inhabit and forage for insects in coastal scrub including wrentit (*Chamaea fasciata*), California scrub jay, spotted towhee (*Pipilo maculatus*), white-crowned sparrow, and northern mockingbird.

3.10.2.5 Coastal Saltmarsh

Coastal saltmarsh is a wetland type flood and drained by saltwater between high and low tides and is composed of a variety of terrestrial and aquatic species (NOAA 2022c). Coastal saltmarshes can be fully tidal, or brackish if they occur near the mouth of a freshwater source. Vegetation associated with this habitat include pickleweed (*Salicornia pacifica*), marsh jaumea (*Jaumea carnosa*), alkali heath (*Frankenia salina*), cordgrass (*Spartina* sp.), salt grass (*Distichlis spicata*), alkali bulrush (*Bolboschoenus maritimus*), and cattail (*Typha* sp.). Coastal saltmarsh is present in the Southern Waterfront subarea, including at the Pier 94 Wetlands and Heron's Head Park. The saltmarsh at Heron's Head is interspersed with areas of unvegetated salt panne (water retaining depressions). Salt panne's are often seasonally inundated, and because of this, can inhibit the establishment of vegetation, leavening a barren area.

Coastal saltmarshes in the Central and South Bay are remnants of their former extent. Where salt marshes are still present, they support high densities and high diversity of wildlife. Additionally, they provide habitat for the Ridgway's rail (*Rallus obsoletus*) and salt marsh harvest mouse (*Reithrodontomys raviventris*), both of which are federally and state-endangered and state fully protected species. However, the salt marshes within the study are small, narrow, and scattered, providing marginal habitat for these species.

3.10.2.6 Wildlife Corridors

Wildlife corridors are vital passage routes for birds, fish, and mammals that travel during their life cycle (USFWS 2022). Wildlife movement corridors are considered important ecological resources by CDFW and the U.S. Fish and Wildlife Service (USFWS). The movement corridors provide favorable locations for wildlife to travel amongst different habitats such as foraging sites, breeding sites, cover areas, and preferred seasonal range locations. They can also function as dispersal corridors allowing animals to move between various locations within their range. Topography, natural factors, and urbanization can fragment large open-space areas and impede wildlife movement between areas of suitable habitat. This fragmentation can create isolated "islands" of vegetation that may not provide sufficient accommodations to sustain populations and

can adversely affect genetic and species diversity. Integrated wildlife corridors into urban and developed areas mitigates the effects of this fragmentation by allowing animals to move between remaining habitats, which in turn allows depleted populations to replenish and promotes genetic exchange between populations.

The study area is too urbanized to provide a terrestrial wildlife corridor between two core habitat areas. However, the San Francisco Peninsula is an important migratory stopover for birds along the Pacific Flyway, one of the four major avian migratory routes in North America. During fall and spring migrations, birds of prey, songbirds, shorebirds, and waterbirds stop to forage and rest in suitable habitat along this route such as Golden Gate Park, the Presidio, Mount Sutro, Lake Merced, and coastal and bayside beaches. Migrating birds that forage in intertidal and marine environments may use San Francisco Bay during migration.

Central Bay serves as a migration corridor for anadromous fish between the Pacific Ocean and spawning habitat, in a few of the tributaries to San Francisco Bay. The study area does not fall within the wildlife corridor for these anadromous fish which are typically confined to deeper channels during migration.

3.11 Special status species

Special-status species are plant and wildlife species considered sufficiently rare, such that they require special consideration and/or protection and should be, or currently are, listed as rare, threatened, or endangered by the Federal and/or state governments. Such species are legally protected under the Federal and/or state ESA or other regulations listed below, or are species considered sufficiently rare by the regulatory and scientific community to qualify for protection.

3.11.1 Regulatory Framework

3.11.1.1 Federal

- Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) – governs management and conservation of commercial and recreational fisheries in U.S. Federal waters (three to 200 nautical miles [nm] from shore)
- ESA – establishes protections for fish, wildlife, and plants listed as threatened or endangered
- Marine Mammal Protection Act (MMPA) – establishes protections for marine mammals
- Migratory Bird Treaty Act – prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species
- Bald and Golden Eagle Protection Act – prohibits any take of bald or golden eagle, alive or dead, or any part (including feathers), nests, or eggs

- Federal Regulation of Wetlands and other waters – Federal government regulates waters, including wetlands, in the CWA

3.11.1.2 State

- California Endangered Species Act (CESA) – conserves and protects plant and animal species and their environments
- California Native Plant Protection Act (NPPA) – designates plants as rare or endangered, protects, and prohibits take
- California Fish and Game Code (CFGC) – protects and regulates state listed species
- State Regulation of Wetlands and other waters – regulations activities in wetlands reside primarily with the State Water Resources Control Board

3.11.1.3 Local

- San Francisco General Plan – policies that protect biological resources
- San Francisco Public Works Code – protects street trees, significant trees, and landmark trees under San Francisco Public Works jurisdiction
- San Francisco Planning Code Section 139 – standards that guide the use and types of glass and façade treatments, wind generators and grates, and lighting treatments that can be used during construction projects to create bird-safe buildings and reduce bird-related hazards
- San Francisco Bay Plan – specifies goals, objectives, and policies for existing and proposed waterfront land use and other areas under the jurisdiction of BCDC

3.11.2 Existing Condition

3.11.2.1 Federally-Listed Threatened and Endangered Species

The ESA was enacted to provide a program for the preservation of endangered and threatened species and to provide protection for the ecosystems upon which these species depend for their survival. The U.S. Fish and Wildlife Service (USFWS) is the primary agency responsible for implementing the ESA and oversees protection of non-marine species (i.e., birds, terrestrial species, freshwater species), while the National Marine Fisheries Service (NMFS) protects marine species. An endangered species is one in danger of extinction throughout all or a significant portion of its range. A threatened species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range, while proposed species are those that have been formally submitted to Congress for official listing. The USFWS's Information for Planning and Consultation (IPaC) database lists the threatened and endangered

species and trust resources that may occur within the study area boundary (Appendix D-5). NMFS provided a letter documenting species anticipated in the study area (Appendix D-6). Based on the IPaC report and NMFS letter, there are 23 USFWS listed species (threatened, endangered, or candidate), five additional NMFS listed species, and two designated critical habitats (CH) found to potentially occur within the study area (**Table D.1-1**).

Table D.1-1: Federal Threatened, Endangered, or Candidate Species Identified by USFWS and NMFS that aay occur in the Study Area

Sea turtle jurisdiction is shared jointly by USFWS (inland waters and nesting beaches) and NMFS (offshore marine environment). A superscript "CH" indicated critical habitat for the species. Information sourced from USFWS and NMFS species pages and Calflora (www.calflora.org)

Common Name *Scientific Name*	**Federal Status**	**Jurisdiction**	**Habitat Requirements**	**Potential to occur in the study area**
MAMMALS				
Salt marsh harvest mouse *Reithrodontomys raviventris*	Endangered	USFWS	Generally restricted to saline or subsaline marshes, particularly dense stands of pickleweed, adjacent to upland, salt-tolerant vegetation	Minor to moderate – suitable habitat at Heron's Head and Pier 94 wetlands
BIRDS				
California Ridgeway's Rail *Rallus obsoletus obsoletus*	Endangered	USFWS	Resident of San Francisco Bay area; lives in dense vegetation in saltwater marshes, freshwater marshes, and mangrove swamps	Moderate – likely to occur in Heron's Head Park; have been previously observed
California least tern *Sterna antillarum browni*	Endangered	USFWS	Breeds along the immediate coast of California on unfrequented sandy beaches or abandoned salt flats close to estuaries and coastal embayment's; feeding occurs nearshore in open water;	Moderate – likely to occur, but not likely to be nesting
Marbled murrelet *Brachyrampuhus marmoratus*	Threatened	USFWS	Spends most time on the ocean, resting and foraging in near-shore marine waters; nest in old-growth forests with large trees, multiple canopy layers and moderate to high canopy closure	Moderate – may occur feeding

Common Name ***Scientific Name***	**Federal Status**	**Jurisdiction**	**Habitat Requirements**	**Potential to occur in the study area**
Western snowy plover *Charadrius nivosus nivosus*	Threatened	USFWS	Winters along the California coast resting and foraging on sand spits and dune-backed beaches, in urban areas they are found in bluff-backed beaches; nests along shores, peninsulas, offshore islands, bays, estuaries, and rivers of the U.S. Pacific Coast	Unlikely; lacks suitable habitat
REPTILES				
Alameda whipsnake *Masticophis lateralis euryxanthus*	Threatened	USFWS	Prefer coastal sage scrub and northern coastal scrub, but can also inhabit grasslands, oak savanna, oak-bay, and open woodlands; rock outcrops and talus; use small burrows, rock, and soil crevices, brush, and debris for refuge	Unlikely; outside known range; no suitable habitat
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	Endangered	USFWS	Prefer densely vegetated ponds near open hillsides; hunt in shallow water 2 inches deep or less; aquatic habitats with shallow water edges are essential habitat; require adjacent upland habitat for basking, and burrows or thick grass mats for shelter and hibernacula	Unlikely; lacks suitable habitat
Green sea turtle *Chelonia mydas*	Threatened	USFWS	Shallow habitats such as lagoons, bays inlets, shoals, estuaries, and other areas with abundant marine algae and seagrass; high-energy beaches with deep sand for nesting, usually coarse to fine grain sizes, with little organic content	Unlikely; lacks suitable nesting and foraging habitat

Common Name *Scientific Name*	Federal Status	Jurisdiction	Habitat Requirements	Potential to occur in the study area
Northwestern pond turtle *Actinemys marmorata*	Proposed	USFWS	Semi-aquatic requiring upland terrestrial habitat and aquatic habitats within proximity (approximately less than 500m). Habitat generalists, occurring in a broad range of permanent and ephemeral aquatic waterbodies including ponds, marshes, wetlands, estuaries, rivers, lakes, etc. Despite their ability to be generalists, suitable aquatic habitat is relatively rare across their range.	Unlikely; lacks suitable habitat
AMPHIBIANS				
California red-legged frog *Rana draytonii*	Threatened	USFWS	Requires aquatic breeding habitat – low-gradient freshwater bodies (ponds, marshes, lagoons) that hold water for at least 20 weeks; non-breeding aquatic habitat – provides shelter, forage, refuge, and dispersal for juveniles and adults (springs, plunge pools); upland habitat – located within 300 feet of aquatic/riparian habitat, comprised of grasslands, woodlands, and/or vegetation that provides shelter, forage, and refuge; and dispersal habitat – accessible upland or riparian haitats between occupied locations allowing for movement between sites;	Unlikely; lacks suitable habitat
FISH				
Delta smelt *Hypomesus transpacificus*	Threatened	USFWS	Endemic to California; only occurs in the Sacramento-San Joaquin estuary; spawns in freshwater in the spring, migrates to low salinity area in the summer for rearing, matures in the fall in low salinity water, migrates upstream to freshwater in winter	Unlikely; outside of known range

Common Name ***Scientific Name***	**Federal Status**	**Jurisdiction**	**Habitat Requirements**	**Potential to occur in the study area**
Tidewater goby *Eucyclogobius newberryi*	Endangered	USFWS	Brackish water lagoons, estuaries, and marshes along the California coast; shallow, still water	Unlikely; outside of known range
Longfin smelt, San Francisco Bay Delta Distinct Population Segment *Spirinchus thaleichthys*	Endangered	USFWS	Spend early life growing and feeding in freshwater or low saline streams, bays, and estuaries; transition to saline estuaries and bays and open ocean as young adults and adults, then return to freshwater to spawn	Moderate; suitable habitat exists in the study area. Juveniles or adults could be expected to transition through the bay fall to early winter
Sacremento River Chinook salmon [CH], winter-run Evolutionary Significant Unit (ESU) *Oncorhynchus tshawytscha*	Endangered	NMFS	Spend early life growing and feeding in freshwater streams, estuaries, and wetlands; transition to open ocean and estuaries, then return to freshwater to spawn	Likely; migrate through San Francisco Bay from December through July with peak occurrence in March
Central Valley Chinook salmon, spring-run ESU *O. tshawytscha*	Threatened	NMFS	Spend early life growing and feeding in freshwater streams, estuaries, and wetlands; transition to open ocean and estuaries, then return to freshwater to spawn	Likely; migrate through San Francisco Bay in summer months before returning to spawn mid-August through early October
Central California Coast Steelhead trout, Distinct Population Segment (DPS) *Oncorhynchus mykiss*	Threatened	NMFS	Occupy gravel-bottom, fast-flowing, well-oxygenated freshwater streams and rivers for spawning and when hatched, migrate to the ocean and return to freshwater to spawn; use aquatic vegetation, boulders, and wood as refuge; spend most of the year in estuaries or open ocean	Likely; temporary as transition through open water adjacent to study area during migration

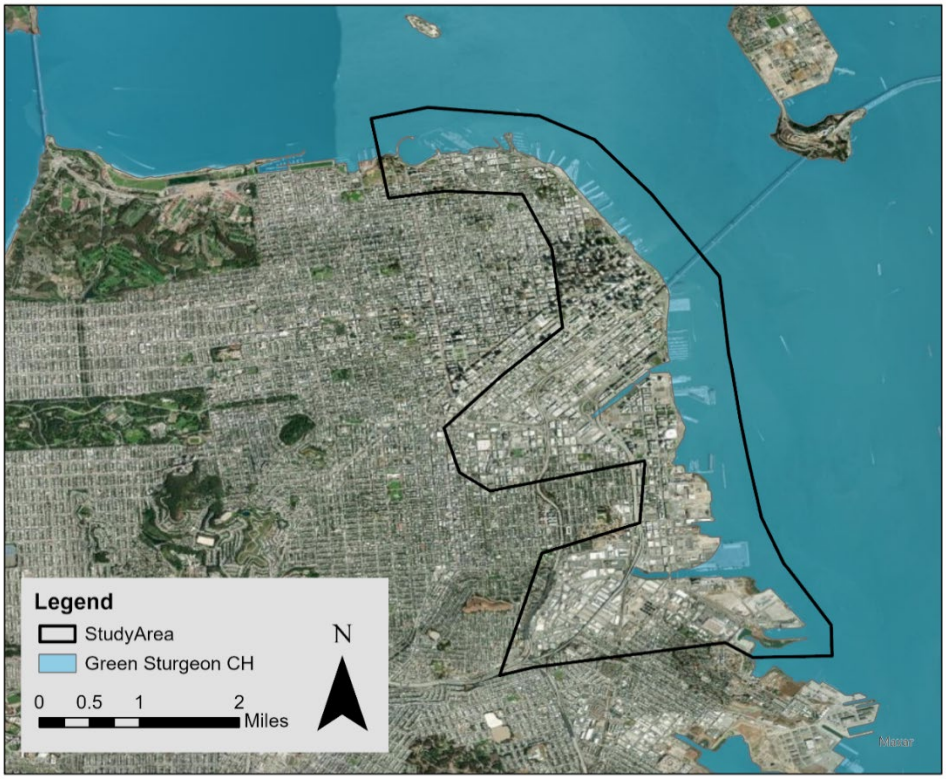
Common Name ***Scientific Name***	**Federal Status**	**Jurisdiction**	**Habitat Requirements**	**Potential to occur in the study area**
California Central Valley Steelhead trout DPS *O. mykiss*	Threatened	NMFS	Occupy gravel-bottom, fast-flowing, well-oxygenated freshwater streams and rivers for spawning and when hatched, migrate to the ocean and return to freshwater to spawn; use aquatic vegetation, boulders, and wood as refuge; spend most of the year in estuaries or open ocean	Likely; temporary as transition through open water adjacent to study area during migration
North American Green sturgeon, southern DPS [CH] *Acipenser medirostris*	Threatened	NMFS	Spawn and rear as juveniles in freshwater streams and rivers, migrate to saltwater to feed, and return to freshwater for spawning; require fast-flowing, well oxygenated streams for spawning	Likely; juveniles reside in San Francisco Bay and adults migrate to their spawning grounds through the bay
INSECTS				
Monarch butterfly *Danaus plexippus*	Proposed	USFWS	Require milkweed and flowering plants for foraging during breeding and migration. Lay eggs on milkweed plants	Unlikely; limited suitable habitat
FLOWERING PLANTS				
California seablite *Suaeda californica*	Endangered	USFWS	Margins of coastal salt marshes on Morro Bay in upper intertidal zones	Likely; suitable habitat at Heron's Head, endemic to California coastal zones
Franciscan manzanita *Arctostaphylos franciscana*	Endangered	USFWS	Bluffs and hills surrounding San Francisco Bay, northern coastal scrub	Unlikely; outside of known range
Marin dwarf-flax *Hesperolinon congestum*	Threatened	USFWS	Endemic to California; serpentine soils in Marin, San Francisco, and San Mateo counties	Unlikely; outside of known range

Common Name ***Scientific Name***	**Federal Status**	**Jurisdiction**	**Habitat Requirements**	**Potential to occur in the study area**
Marsh sandwort *Arenaria paludicola*	Endangered	USFWS	Freshwater-marshes, swamps, and areas that are wet year-round	Unlikely; lacks suitable habitat
Presidio clarkia *Clarkia franciscana*	Endangered	USFWS	Serpentine bluffs and serpentine grasslands	Unlikely; outside of known range
Presidio manzanita *Arctostaphylos hookeri var. ravenii*	Endangered	USFWS	Serpentine outcrop of the San Francisco Presidio in maritime chaparral-coastal prairie plant communities	Unlikely; outside of known range
Robust spineflower *Chorizanthe robusta var. robusta*	Endangered	USFWS	Endemic to California; grows in dunes, coastal areas, and meadows	Moderate – suitable habitat at Heron's Head
San Francisco lessignia *Lessingia germanorum*	Endangered	USFWS	Restricted to vegetation gaps on remnant sand dunes and related sandy soils	Unlikely; outside of known range
Showy Indian clover *Trifolium amoenum*	Endangered	USFWS	Endemic to California; occurs typically in wetlands or grassland areas	Unlikely; outside of known range
Sonoma sunshine *Blennosperma bakeri*	Endangered	USFWS	Occurs in Sonoma County in vernal pools and wet grasslands	Unlikely; outside of known range
White-rayed pentachaeta *Pentachaeta bellidiflora*	Endangered	USFWS	Found only in San Mateo County in grasslands with serpentine soil	Unlikely; outside of known range and lacks suitable habitat

3.11.2.1.1 Critical Habitat

Critical habitat is defined by NMFS as “specific areas…occupied by a species…that contain physical or biological features essential to conservation of the species and that may require special management considerations or protection”. Once critical habitat has been designated, a Federal agency is required to consult with NMFS to “ensure actions they fund, authorize, or undertake are not likely to destroy or adversely modify” the critical habitat. Two critical habitat occur within the study area – green sturgeon and chinook salmon.

Green sturgeon critical habitat spans approximately 320 miles (mi) of freshwater river habitat, 897 square miles (mi^2) of estuarine habitat, 11,421 mi^2 of marine habitat, 487 mi of the Sacramento-San Joaquin Delta, and 135 mi^2 of the Yolo and Sutter bypasses in the Sacramento River (50 CFR 226). All of San Francisco Bay adjacent to the study area is considered critical habitat for green sturgeon (**Figure D.1-15**).

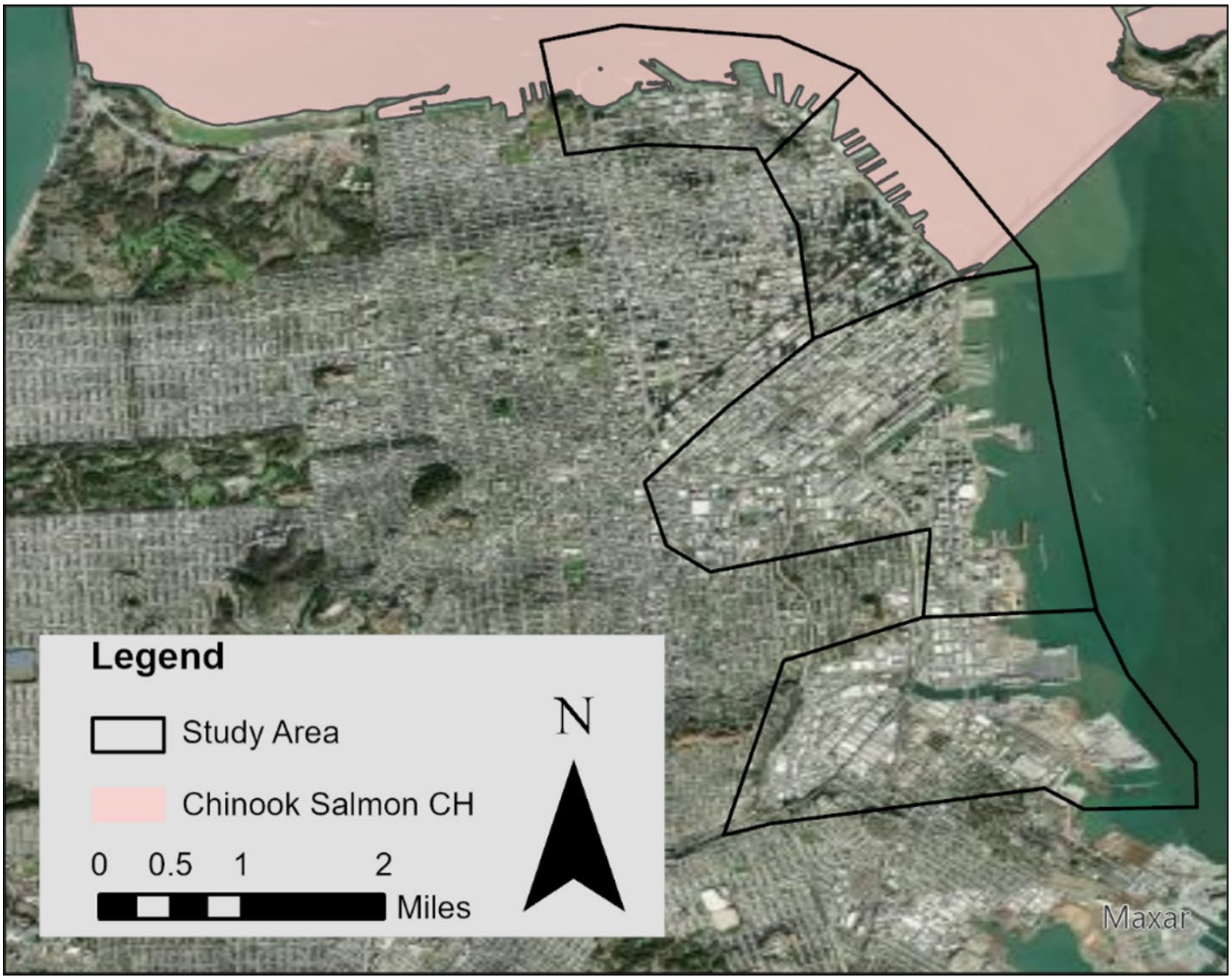


Source: NMFS 2021

Figure D.1-15: Green Sturgeon Critical Habitat Within the Study Area

There are several chinook salmon critical habitats throughout California; however, only one intersects the study area – the Sacramento River winter-run chinook salmon. The critical habitat includes the Sacramento River from Keswick Dam, Shasta County (river

mile 302) to Chipps Island (River Mile 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay from San Pablo Bay to the Golden Gate Bridge (50 CFR 226). Chinook salmon critical habitat includes waters in the northern two reaches of the study area (**Figure D.1-16**).



Source: NMFS 2021

Figure D.1-16: Chinook Salmon Sacramento River Winter-Run Critical Habitat within the Study Area

3.11.2.2 State-listed Threatened and Endangered Species

In California, animal or plant species of conservation concern may be listed as threatened or endangered under the authority of the California Endangered Species Act of 1984 (CESA; Cal. Code Regs. tit. 14, §§ 783.0-787.9). State-listed species may also be protected federally under the ESA, or strictly listed as state protected. California has

54 animals listed as endangered, 43 animals as threatened, 137 plants as endangered, and 21 plants as threatened (CNDDB 2023a; CNDDB 2023b).

After reviewing a description of each species provided by the California Natural Diversity Database (CNDDB) and consulting with resource agencies, the PDT concluded that the focused study area is outside the known range or does not provide suitable habitat for 92 of the animals and 156 of the plants. The CNDDB online BIOS Quicktool was used to evaluate the state-protected threatened and endangered species likely present in the study area. Data are reported on a quad basis; thus species were pulled for the San Francisco North and Hunters Point Quad to incorporate the entire study area, and beyond.

The study area does provide suitable habitat for seven CESA protected animal and plant species (**Table D.1-2**). Of these, three of the animal and plant species, respectively, also are federally listed.

Table D.1-2: California State-Listed Threatened and Endangered Species Likely to Occur in the Study Area

Common Name Scientific Name	State status	Federal status	Habitat requirements
BIRDS			
California Ridgeway's rail *Rallus obsoletus obsoletus*	Endangered	Endangered	Resident of San Francisco Bay area; lives in dense vegetation in saltwater marshes, freshwater marshes, and mangrove swamps
Bank swallow *Riparia riparia*	Threatened	None	Breed in open lowland areas near bodies of water; avoid forests, woodlands, or areas that lack appropriate nesting
California black rail *Laterallus jamaicensis coturniculus*	Threatened	None	Lives in tidal and freshwater marshes in California
FISH			
Longfin smelt *Spirinchus thaleichthys*	Threatened	Endangered	Spend early life growing and feeding in freshwater or low saline streams, bays, and estuaries; transition to saline estuaries and bays and open ocean as young adults and adults, then return to freshwater to spawn
Chinook salmon - Central Valley spring-run *Oncorhynchus tshawytscha*	Threatened	Threatened	Spend early life growing and feeding in freshwater streams, estuaries, and wetlands; transition to open ocean and estuaries, then return to freshwater to spawn
PLANTS			

Common Name Scientific Name	State status	Federal status	Habitat requirements
Marsh sandwort *Arenaria paludicola*	Endangered	Endangered	Freshwater-marshes, swamps, and areas that are wet year-round
Marin dwarf flax *Hesperolinon congestum*	Threatened	Threatened	Endemic to San Francisco county; occurs in serpentine soils, in dry native bunch grasses

3.11.2.3 Migratory Birds

San Francisco Bay is a migration highway for over 250 species of birds, many of which are small songbirds (e.g., warblers, thrushes, tanagers, sparrows) and some threatened species (GGAS 2023). A variety of birds use this area to forage in the many microclimates while others use the Bay area as a resting stop-over. The San Francisco Bay is the largest estuary on the Pacific Coast, thus, is an ideal refuge for shorebirds, raptors, and songbirds. Some of the prominent species include, but are not limited to (Karlenzig 2013):

- Songbirds: varied thrush (*Ixoreus naevius*), red-winged blackbird (*Agelaius phoeniceus*), golden-crowned sparrow (*Zonotrichia atricapilla*), and black-throated gray warbler (*Setophaga nigrescens*);
- Hawks: ferruginous hawk (*Buteo regalis*), Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*);
- Waterfowl: lesser scaup (*Aythya affinis*), greater scaup (*A. marila*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*);
- Shorebirds: whimbrel (*Numenius phaeopus*), long-billed curlew (*Numenius americanus*), marbled godwit (*Limosa fedoa*), willet (*Tringa semipalmata*), black-bellied plover (*Pluvialis squatarola*), American avocet (*Recurvirostra americana*), and black-necked stilt (*Himantopus mexicanus*).

3.11.2.4 Bald and Golden Eagles

The Bald and Golden Eagle Protection Act was enacted in 1940 and prohibits the take and/or disturbance of bald or golden eagles without a permit issued by the Secretary of the Interior (16 U.S.C. 668-668d; 50 CFR 22.6). Bald eagles (*Haliaeetus leucocephalus*) are the national symbol that was in danger of extinction throughout most of its range in North America. In 2007, bald eagle populations had recovered to such as state that they were delisted from the ESA (USFWS 2023a). Bald eagles are solely native to North America and may be found throughout most of California at lakes, reservoirs, rivers, and some rangelands and coastal wetlands. Most breeding occurs in northern California, but scattered nesting also occurs in the central and southern Sierra Nevada mountains and foothills, inland southern California, and Santa Catalina Island (CDFW 2023a).

Golden eagles are global species, with the western U.S. comprising 80% of the species' range in the contiguous U.S. (USFWS 2023b). Most golden eagles in California are resident, though some can be migratory, and inhabit forests, canyons, shrub lands, grasslands, and oak woodlands. Nests are constructed on platforms on steep cliffs or in large trees (CDFW 2023b).

Populations of bald and golden eagles are found in the less urbanized areas of San Francisco Bay and coastal range. While individual eagles may migrate through the area, the project area does not support nesting habitat for eagles as it generally lacks large mature trees. If nesting were to occur, the nest would need to be placed on man-made structures which would present its own set of challenges to survival, although not unheard of in other parts of the county. The chance of this occurring is relatively low since more suitable nesting habitat is available throughout the Bay or in more vegetated areas of the City.

3.11.2.5 Marine Mammals

The Marine Mammal Protection Act was passed in 1972 in response to concerns about significant declines in marine mammal species caused by human activities. As such, the MMPA established a national policy to prevent marine mammal species and population stocks from declining beyond that in which they cease to be significant functioning elements of ecosystems. Three Federal entities share responsibility for implementing MMPA, NOAA Fisheries, USFWS, and the Marine Mammal Commission (MMC). NOAA is responsible for protecting whales, dolphins, porpoises, seals, and sea lions; USFWS protects walrus, manatees, sea otters, and polar bears; and MMC provides oversight of domestic and international policies and actions of Federal agencies addressing anthropogenic impacts on marine mammals and their ecosystems.

There are two pinniped and four species of cetaceans likely to occur in or near the study area, which include harbor seals (*Phoca vitulina richardii*), California sea lion (*Zalophus californianus*), harbor porpoise (*Phocoena phocoena*), common bottlenose dolphin (*Tursiops truncatus*), California gray whale (*Eschrichtius robustus),* and humpback whale (*Megoptera noveangliae*), respectively.

3.11.2.5.1 Harbor Seals

Harbor seals are widely distributed in the North Pacific, with two subspecies, western and eastern. The eastern subspecies inhabits coastal and estuarine areas from Mexico to Alaska on the western coast of the U.S. Harbor seals have fairly strong site fidelity and do not make extensive pelagic migrations but can travel a few hundred kilometers to find food or suitable breeding areas (Herder 1986; Harvey and Goley 2011). California supports 400 to 600 harbor seal haul out sites widely distributed along the mainland and offshore islands, intertidal sandbars, rocky shores, and beaches (Hanan 1996; Lowery et al. 2008). Three stocks are recognized along the west coast, California, outer coasts of Oregon and Washington, and inland waters of Washington. The harbor seal population estimate for California includes nearly 31,000 individuals (Caretta et al. 2019). Historically, harbor seals were commercially harvested prior to state and Federal protection, but now face threats of mortality or injury from commercial gillnetting,

shootings, ship/vessel strikes, entrainment in power plants, recreational fisheries, human-induced abandonment of pups or harassment, marine debris entanglement, stabbing/gaff wounds, and research-related deaths (Carretta et al 2014; Caretta et al. 2019). California harbor seals are not considered endangered or threatened under the ESA or CESA nor designated as depleted under the MMPA. Harbor seals are likely to be present in the study area swimming, loafing, or feeding.

3.11.2.5.2 California Sea Lions

California sea lions have five genetically distinct populations in the Pacific, the U.S. stock is the Pacific Temperate, while the other four reside in or near Mexico (Schramm et al. 2009). The U.S. population includes rookeries within U.S. waters and the Coronados Islands just south of the U.S. and Mexico border. Along the U.S. west coast, population has been estimated at nearly 258,000 animals (Lowry et al. 2017; DeLong et al. 2017; Laake et al. 2018). Over four decades (1975 – 2014), the California sea lion populations have increased, nearly reaching their expected carrying capacity (Laake et al. 2018; Caretta et al. 2019). Historically, California sea lions were exploited for food, oil, and hides, but that has since ceased (Stewart et al. 1993). Current threats to the species include mortality and injury from a variety of commercial and recreational fisheries along the U.S. west coast (Barlow et al. 1994; Caretta and Barlow 2011; Carretta et al. 2018a, 2018b; Julian and Beeson 1998; Jannot et al. 2011), shootings, power plant entrainment, marine debris entanglement, oil exposure, vessel strikes, and dog attacks (Caretta et al. 2018b). California sea lions are not listed as endangered or threatened under ESA or CESA or depleted under the MMPA (Caretta et al. 2019). This is the most likely marine mammal to be present in the study area as Pier 39 in the northern waterfront is an important haul out site.

3.11.2.5.3 Harbor Porpoise

Harbor porpoises are found in coastal and inland waters of the Pacific Ocean and exhibit fairly restricted movement along the western coast of the United States, with regionalized populations among California, Washington, British Columbia, and Alaska (Calambokidis and Barlow 1991; Rosel et al. 1995). Recently, genetic studies reported four separate stocks of harbor porpoise along the Central California coast (Chivers et al. 2002, 2007). The study area is likely to include individuals from the San Francisco-Russian River stock, which based on 2007-2011 aerial surveys, supports nearly 9,900 porpoises (Forney et al. 2013). Harbor porpoises can be sensitive to fishery related strandings or injuries; however, within the more recent NOAA Fisheries survey period, no fishery-related mortality or injury within the San Francisco-Russian River stock were reported (Caretta et al. 2019). Harbor porpoises are not listed as threatened or endangered under ESA, MMPA, or CESA. Harbor porpoises are likely to be observed in San Francisco Bay near the study area and may occasionally transit through the study area, though they are not expected to remain there for any extended period.

3.11.2.5.4 Common Bottlenose Dolphin

Bottlenose dolphins are globally distributed and, in many regions, including California, have separate coastal and offshore populations (Walker 1981; Ross and Cockcroft 1990; Van Waerebeek et al. 1990). The California coastal stock is genetically distinct from the offshore population (Perrin et al. 2011; Lowther-Thielking et al. 2015) and are found within 1 km of the shore (Hansen 1990; Carretta et al. 1998; Defran et al. 1999). Bottlenose dolphins can be highly migratory, as with the coastal California population, in which 80% of identified individuals have been observed as far south as Ensenada, Mexico (Defran et al. 1999; Feinholz 1996; Defran et al. 2015). The California coastal population is estimated to have remain stable over two decades (1987 – 2005; Dudzik et al. 2006), while more recent surveys (2009 – 2011) suggest an increase (Weller et al. 2016). This could reflect population growth or may be an artifact of dolphins moving north from Mexican waters (Carretta et al. 2019). Common bottlenose dolphins are highly susceptible to fishery-related mortalities given their exclusive use of coastal habitats. Bottlenose dolphins are not listed as threatened or endangered under ESA or CESA, nor as depleted under the MMPA (Carretta et al. 2019). Bottlenose dolphins are likely to occur regularly near the study area but may not be as common within the study area given its proximity to an urban shoreline.

3.11.2.5.5 California Gray Whale

Gray whales are commonly found in the North Pacific Ocean, with two genetically distinct populations – Eastern North Pacific and Western North Pacific (LeDuc et al. 2002; Lang et al. 2011a; Weller et al. 2013). Gray whales that may frequent San Francisco Bay would be from the Eastern North Pacific stock. A small number of these whales feed along the Pacific coast in California during summer months (Darling 1984; Gosho et al. 2011; Calambokidis et al. 2017). The Eastern North Pacific population frequenting California was most recently estimated at 26,960 individuals (Durban et al. 2017). The stock overall has increased through recent decades (Durban et al. 2017). One of the most common threats to gray whales include entanglement in commercial fishery equipment, in both the drift gillnets and pot and trap fisheries (Carretta et al. 2018a, 2018b). Ship strikes are another source of mortality and serious injury to gray whales (Carretta et al. 2018a). Gray whales may occur near the study area in the San Francisco Bay but may not be as common within the study area given its proximity to an urbanized shoreline.

3.11.2.5.6 Humpback Whale

North Pacific humback whales comprise a distinct subspecies compared to the North Atlantic humpback whales (Jackson et al. 2014). Currently, NMFS recognizes one humpback whale stock on the west coast with two separate feeding groups, a California and Oregon feeding group and a northern Washington and southern British Columbia feeding group (Calambokidis et al. 2008; Barlow et al. 2011; Wade et al. 2016). The California and Oregon stock abundance was most recently estimated at 2,374 whales (Calambokidis et al. 2017). This stock has shown a long-term increase for the last several decades, but as early as 2010 the population was likely leveling off

(Calambokidis et al. 2017). Humpback whales have incurred serious injuries, non-serious injuries, and mortality involving pot/trap fisheries, fishery interactions, vessel strikes, gillnet fisheries, and marine mooring interactions (Carretta et al. 2018a). Humpback whales may occur near the study area in the San Francisco Bay but are not likely to occur directly within the study area given its proximity to an urban shoreline.

3.11.2.6 Essential Fish Habitat

Essential Fish Habitat (EFH) includes "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NMFS 2021; GMFMC & NMFS 2016). Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes). Of the fish species considered by NMFS to potentially occur within the study area, EFH habitat for these species consists of all waters and substrate from mean higher high water (MHHW) to 3,500 water depth, seamounts, and areas designated as Habitats of Particular Concern (HAPC). HAPC are identified based on one or more of the following considerations:

- Importance of the ecological function provided by the habitat;
- Extent to which habitat is sensitive to human-induced environmental degradation;
- Extent to which development activities are or will be stressing the habitat; and
- Rarity of habitat (50 CFR 600.815(a)(8)).

There are four HAPCs within the study area, including the San Francisco Estuary (estuary HAPC), seagrass, rocky reef, and marine and estuarine SAV HAPC. Estuary HAPCs are defined as "MHHW, or the upriver extent of saltwater intrusion, upstream and landward to where ocean-derived salts measures less than 0.5 ppt during the period of average annual low flow". Seagrasses HAPC include "those waters, substrate, and other biogenic features associated with eelgrass species (*Zostera* spp.), widgeongrass (*Ruppia maritima*), or surfgrass (*Phyllospadix* spp.)." The rocky reef HAPC includes "those waters, substrates, and other biogenic features associated with hard substrate (bedrock, boulders, cobble, gravel, etc.) to MHHW" (NOAA 2022a). Marine and estuarine SAV includes kelps (floating and submerged) and eelgrass (NOAA 2014). The study area includes 0.29 acres of seagrass HAPC, and the entire in-water study area is considered salmon EFH and estuary HAPC (**Figure D.1-17**).

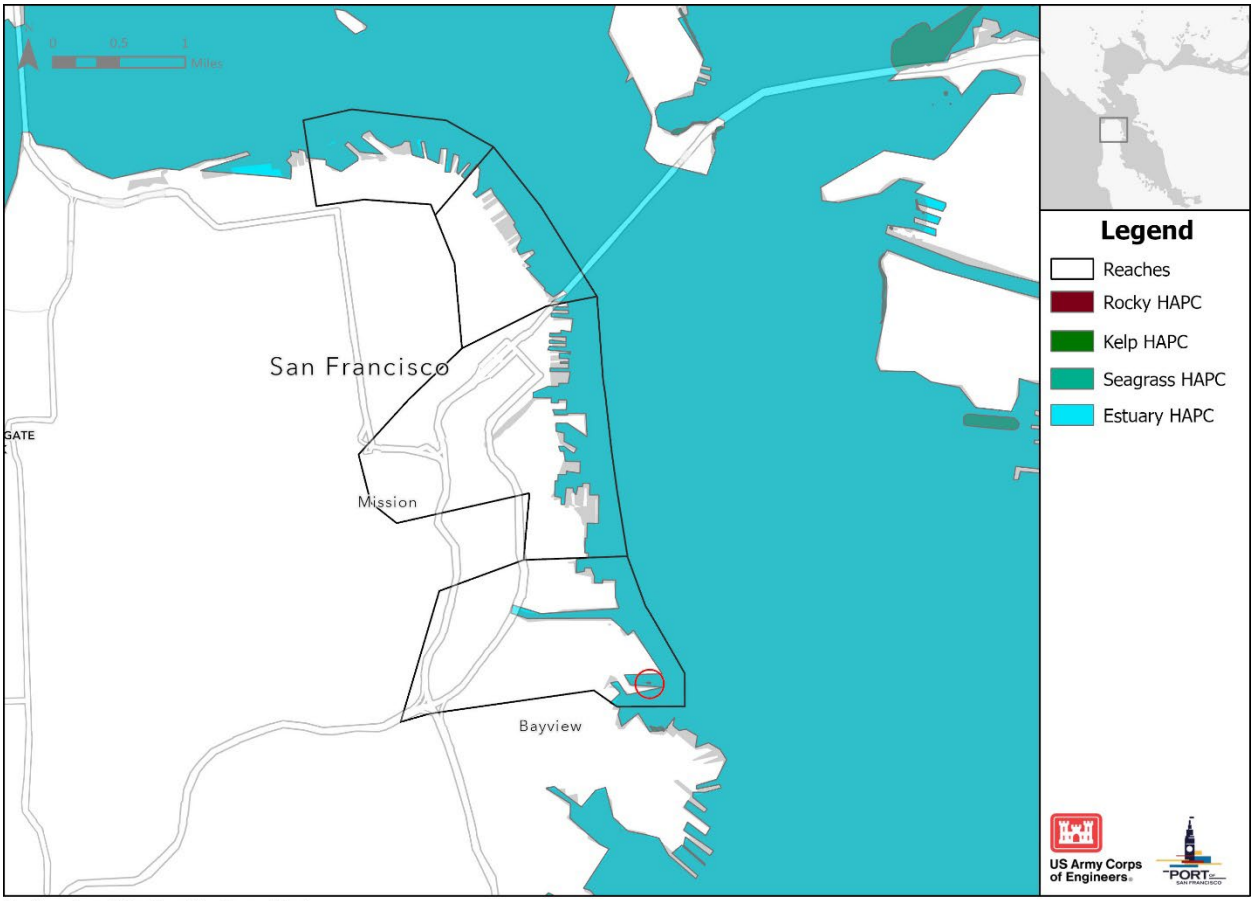


Figure D.1-17: HAPC within the Study Area. Source: Hanshew 2019.

The study area falls within EFH for 20 species of commercially important fish and sharks managed under three Federal fisheries management plans (FMP):

- Pacific Groundfish FMP
- Coastal Pelagic FMP
- Pacific Coast FMP

3.11.2.6.1 Coastal Pelagic EFH

The Coastal Pelagic FMP is designed to protect habitat for fish species associated with open coastal waters. Fish managed under this plan include planktivores (aquatic organism that feeds on planktonic food) and their predators. Those found in the study area include Northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), and jack mackerel (*Trachurus symmetricus*).

3.11.2.6.2 Pacific Groundfish EFH

The Pacific groundfish FMP is designed to protect habitat for more than 90 species of fish including rockfish, flatfish, roundfish, some sharks and skates, and other species associated with underwater substrate. Fifteen species are reported present in the study area including English sole (*Parophyrs vetulus*), sand sole (*P. lascaris*), curlfin sole (*Pleuronichthys decurrens*), Pacific sanddab (*Citharichthys sordidus*), starry flounder (*Platichthys stellatus*), lingcod (*Ophiodon elongatus*), brown rockfish (*Sebastes auriculatus*), Pacific whiting (*Merluccius productus*), kelp greenling (*Hexagrammos decagrammus*), leopard shark (*Triakis semifasciata*), spiny dogfish (*Squalus acanthias*), skates (*Raja* spp.), soupfin shark (*Galeorhinus galeus*), bocaccio (*Sebastes paucispinis*), and cabezon (*Scorpaenichthys marmoratus)*.

3.11.2.6.3 Pacific Salmon EFH

The Pacific Salmon FMP is designed to protect habitat for commercially important salmonid species. Sacramento Chinook salmon (*Oncorhynchus tshawytscha*) is the only one of these species that may be seasonally present in the study area, though coho salmon (*O. kisutch*) was historically common in San Francisco Bay.

Table D.1-3 identifies the fish species covered by the FMP's listed above as utilizing the study area, along with the life stage and relative occurrence.

Table D.1-3: Managed Fish Species in the Study Area Under the MSFMA

FMP	Common name	Scientific name	Life stage	Abundance
Coastal Pelagic	Northern anchovy	*Engraulis mordax*	J, A	A
	Jack mackerel	*Sardinops sagax*	E, L	P
	Pacific sardine	*Trachurus symmetricus*	J, A	P
Pacific Groundfish	English sole	*Parophyrs vetulus*	J, A	A
	Sand sole	*Psettichthys melanostictus*	L, J, A	P
	Curlfin sole	*Pleuronichthys decurrens*	J	R
	Pacific sanddab	*Citharichthys sordidus*	E, L, J, A	P
	Starry flounder	*Platichthys stellatus*	J, A	P
	Lingcod	*Ophiodon elongatus*	J, A	P
	Brown rockfish	*Sebastes auriculatus*	J	P
	Pacific whiting	*Merluccius productus*	E, L	P

FMP	Common name	Scientific name	Life stage	Abundance
	Kelp greenling	*Hexagrammos decagrammus*	J, A	P
	Leopard shark	*Triakis semifasciata*	J, A	P
	Spiny dogfish	*Squalus acanthias*	J, A	P
	Skates	*Raja* spp.	J, A	P
	Soupfin shark	*Galeorhinus galeus*	J, A	R
	Bocaccio	*Sebastes paucispinis*	J	R
	Cabezon	*Scorpaenichthys marmoratus*	J	P
Pacific Coast Salmon	Chinook salmon	*Oncorhynchus tshawytscha*	J, A	Seasonally P
	Coho salmon	*O. kisutch*	J, A	Historically P

Life stage is indicated with A = adult, J = juvenile, L = larvae, and E = egg. Abundance is recorded as A = abundant, P = present, and R = rare.

3.11.2.7 Rare and Unique Habitats

Eelgrass is a native marine plant found globally within soft-bottom bays and estuaries. It is typically found in healthy, shallow bays and estuaries where the depth of occurrence is a function of light penetration. In deeper water, light penetration is reduced below a level in which photosynthesis is able to meet the metabolic demands of the plant to sustain net growth. Eelgrass beds are dynamic, expanding and contracting seasonally and annually dependent on habitat quality. Importantly, eelgrass is considered an indicator community for the health of an estuary. It enhances water quality through sediment trapping and habitat stabilization, transforms nutrients, oxygenizes water, and serves as a primary producer, nursery habitat, and forage area for commercially and recreationally important fish, as well as migratory birds.

Eelgrass is sensitive to changes in water quality and turbidity and disturbances from shipping and boating that can disrupt seagrass beds directly through destruction of plants by propellers, anchors and anchor chains, dredging, and construction of facilities. Indirect impacts can occur through turbidity from dredging and boat wakes or shading from structures such as docks. Hardening of the shoreline can reflect waves that may increase wave action or limit or destroy eelgrass beds. Most of these threats are localized and have a limited spatial and temporal effect. However, eelgrass beds may be impacted by climate change through RSLC but may respond by establishing closer to the present-day shoreline and dying out at greater depths.

In San Francisco Bay eelgrass is afforded special management considerations by CDFW, USFWS, NMFS, U.S. Environmental Protection Agency (EPA), and BCDC. In the bay, eelgrass beds occur on soft bottom substrate in shallow areas and are most likely limited to the southern waterfront near Heron's Head.

3.12 Noise and Vibration

The Noise and Vibration affected environment is available in Annex D.1.2.

3.13 Cultural Resource

3.13.1 Regulatory Framework

3.13.1.1 Federal

- National Historic Preservation Act (NHPA) – requires Federal agencies to consider the effects of funded or approved actions that have the potential to affect any district, site, building, structure, or object that is listed in, or eligible for listing in, the National Register of Historic Places.
- National Register of Historic Places (NRHP) – authoritative guides for federal, state, and local governments, private groups, and citizens to identify the nation's cultural resources and to indicate what properties should be considered for protection from destruction or impairment.

3.13.1.2 State

- California Environmental Quality Act (CEQA) requires state and local agencies to identify and assess the impacts of their activities on historic resources. CEQA also established the California Register of Historical Resources (CRHR) and criteria for evaluating the significance of historic resources.
- California Health and Safety Code 7050.5 and Public Resources Code 5097.98 – establishes a process for the treatment and repatriation of human remains that are discovered during the course of investigations.

3.13.1.3 Local

- San Francisco General Plan – establishes policies for the preservation of notable landmarks, areas of historic, architectural, or aesthetic value, culturally significant landscapes, sites, buildings, structures, and objects.
- San Francisco Planning Code – establishes the City's desire to preserve landmarks and historic buildings. It also establishes the San Francisco Historic Preservation Commission to provide recommendations to the San

Francisco Board of Supervisors regarding historic resources and the review of projects subject to the NHPA and CEQA.

- San Francisco Legacy Business Registry – provides policies for recognizing longstanding, community-serving businesses that serve as valuable cultural assets.

3.13.2 Existing Condition

The identification of historic properties included developing relevant criteria through context information such as environmental, precontact, historic, ethnography and ethnohistory, traditional, archaeological, and historical built environment. Detailed information about this process can be found in Section 4.18.

The study area is at the northern margin of the San Francisco Peninsula, a landform that is composed primarily of uplifted marine sedimentary rock, with local accumulations of Holocene-age alluvial (transported by the movement of water) and aeolian deposits (transported by wind). During a period that roughly coincides with the Holocene epoch (around 12,000 years ago), the study area underwent a series of geomorphic changes induced by sea-level rise, intertidal oscillation, wind, and anthropogenic filling, with the potential to affect archaeological resource preservation and visibility.

The precontact cultural chronology of the San Francisco Bay Area has been summarized by numerous reviewers (Beardsley 1948; Bennyhoff and Hughes 1987; Fredrickson 1974; Heizer 1958; Byrd et al. 2010; Groza et al. 2011). These summaries have divided the precontact cultural sequence into multiple phases or periods, which are delineated by changes in regional patterns of land use, subsistence, and tool types over time. The geologic time segments include Terminal Pleistocene (13,500–11,600 calibrated years before present [cal BP]), Early Holocene (11,600–7700 cal BP), Middle Holocene (7700–3800 cal BP), and Late Holocene (3800 cal BP onward), with further divisions of the Late Holocene based on research presented by Groza et al. 2011.

The San Francisco Bay Area was traditionally inhabited by the Ohlone people, who spoke various dialects of Costanoan languages. These languages are part of the Utian language family, which is part of a larger language family, Penutian, with languages and dialects spoken by Native Americans across California, Oregon, and Washington (Callaghan 1967). The territory of the Ohlone people extended along the coast, from the Golden Gate in the north to just below Carmel in the south, as well as through several inland valleys (Levy 1978). As with most other California groups, the Ohlone were primarily hunter-gatherers. Spanish colonization and subsequent rule by Mexico and the U.S. translated into dramatic disruptions in the traditional subsistence patterns, customs, and practices of the Ohlone. In addition, European diseases caused a rapid decline in the Ohlone population (Milliken 1995). Although they have yet to receive formal recognition from the Federal government, the Ohlone persevered and are actively maintaining their ancestral heritage through political advocacy and education. Many Ohlone are active in maintaining their traditions and advocating for Native American issues.

The historical context covers the period from 1776 to the present and reviewed information about San Francisco's early development (1776-1850), and the development of the waterfront (1850-present). The earliest European settlement in the vicinity of San Francisco occurred in 1776. Mexico seized California in 1822 (Kyle 2002; Woodbridge 2006) and the U.S. claimed the state during the Mexican-American War in 1846 (Bean and Rawls 2002; Sandos 2004). San Francisco was named in 1846 and the discovery of gold in 1848 lead to rapid population growth and expansion. San Francisco became a well-established port by the 1860s and was the second largest port in the U.S. during World War II (DOI 2006). Substantial commercial and industrial development on the waterfront began in the 1850s (San Francisco Planning Department 2011) and continued through the 1960s (City of San Francisco 1983).

Based on a records search of the California Historical Resources Information System (CHRIS) -Northwest Information Center, a total of 14 previously recorded archaeological resources are located in or adjacent to the study area. All 14 are historic-aged archaeological resources, and consist of remnants of historical maritime, commercial, residential, transportation infrastructure, and shipwrecks. Review of the *Geoarchaeological Assessment and Prehistoric Site Sensitivity Model for the City and County of San Francisco, California* (Meyer and Brandy 2019) reveals that much of the study area has moderate to high sensitivity for both buried and submerged archaeological resources and low sensitivity for precontact archaeological resources exposed on the ground surface before Gold Rush development and filling. Additionally, property parcel data was obtained from the San Francisco Planning Department's Property Information Map to identify properties that are 45 years old or older.

A total of 2,846 parcels were identified in the study area. This includes resources listed in or eligible for listing in the NRHP as well as resources listed in or eligible for listing in the CRHR, as follows:

- 17 NRHP-listed properties, and nine NRHP-listed districts;
- Three NRHP-eligible structures (bridges), and five NRHP-eligible districts;
- Nine CRHR-eligible districts;
- 544 parcels with CEQA historical resources not yet evaluated for NRHP eligibility;
- 306 properties determined not eligible for the NRHP;
- 1,191 parcels that require further research to classify them among the preceding categories because they are of historic age (i.e., constructed in 1990 or earlier) and unevaluated;
- 214 parcels exempt because parcel data indicates that they are not recorded as historic age (i.e., constructed in 1990 or later);
- 528 parcels exempt because they are vacant; and

- Eight parcels that are unknown because their geospatial location could not be determined.

3.14 Socioeconomics and Community

The Socioeconomics and Community affected environment is addressed in Annex D.1.3.

3.15 Transportation

The Transportation affected environment is addressed in Annex D.1.4.

3.16 Utilities

3.16.1 Regulatory Framework

There are no Federal or state regulatory standards for utilites; however, many of the state laws reference, support or emphasize the importance of maintaining or increasing public utilities.

3.16.1.1 Local

- SFPUC

3.16.2 Existing Conditions

3.16.2.1 Potable Water

Potable, or low-pressure water (LPW) is vital to the community's development and daily functions. All types of businesses—office buildings, hotels, restaurants, and industry—depend on potable water to stay open. The SFPUC Water Enterprise operates San Francisco's water distribution system, which includes reservoirs and storage tanks, pump stations, fire hydrants, distribution pipelines, isolation valves, and automatic air valves. In the study area, critical LPW assets include the Bay Bridge Pump Station, water mains, low pressure fire hydrants, and automatic air valves (CH2M/Arcadis, 2020h).

From a coastal flooding perspective, the Bay Bridge Pump Station is most vulnerable to flood damage (and service disruption) while underground pipes are vulnerable to rising ground water. The Bay Bridge Pump Station, located in Reach 3, is the sole provider of potable water to Treasure Island and Yerba Buena Island. If the facility is damaged, around 3,200 residential customers could lose potable water service (U.S. Census, 2020).

3.16.2.2 Combined Sewer System

Through the San Francisco Public Utilities Commission, the City operates and maintains a predominantly combined sewer system with major infrastructure including three treatment plants, 27 pump stations, 1,000 miles of sewer mains, 17 miles of transport/storage (T/S) structures and 36 combined sewer discharge structures and over 85 green infrastructure facilities.

The combined sewer system collects both wastewater and stormwater for most of the City. The wastewater is collected, stored, conveyed to, and treated at one of three treatment plants, two of which are located in the study area. The Southeast Treatment Plant is the City's largest wastewater treatment facility (43 million gallons per day (MGD) average dry weather capacity in 2022, 250 MGD peak wet weather capacity) and is located within the study area. The North Point Wet Weather Treatment Plant is also located in the study area, is used only during wet weather, and has a peak wet weather treatment capacity of 150 MGD. Local gravity sewers convey combined wastewater flows to T/S boxes, which meters to the treatment plants. Once system capacity is exceeded during wet weather events, discharges through one of the combined sewer discharge structures occur with equivalent to primary treatment. Generally, only during the most prolonged intense rainstorms is the combined capacity of the treatment plants and T/S boxes exceeded. Instead of allowing the excess water to back up through the sewers into homes and streets, water is discharged into either the Bay or Ocean through combined sewer discharge (CSD) structures.

Wastewater service is critical in supporting residents, commerce, and industries. In addition to providing wastewater service to SFPUC customers, the combined sewer system is also an essential stormwater drainage system for the City; together, the collection system and outfalls provide drainage for public streets, sidewalks, parks, and public/private facilities during wet weather events.

Some of the City's most critical wastewater conveyance and treatment facilities are in the waterfront area. This includes several miles of local gravity sewer systems, T/S boxes, tunnels, a force main, combined sewer gravity mains, CSD structures, pump stations, and two treatment facilities. These assets are arranged by Reach as follows:

- Reach 1 critical wastewater assets consist of the North Shore Pump Station, the North Point Wet Weather Facility, the North Beach Tunnel, a part of the Jackson T/S Box and one CSD outfall structure.
- Reach 2 includes the Jackson T/S Box, the North Shore Force Main, a part of the Channel T/S Box and three CSD structures.
- Reach 3 includes the Channel T/S Box, the Channel Pump Station, the Channel Force Main, the smaller Mission Bay, Berry Street, Harriet Street and Mariposa Pump Station, the Mariposa T/S Box and several CSD structures.
- Reach 4 encompasses part of the Channel Force Main, the Bruce Flynn Pump Station, the Booster Pump Station, the Southeast Bay Outfall, the Islais

Creek T/S Box, the Southeast Treatment Plant and Bay Outfall, and several CSD structures.

3.16.2.3 Waste Management

Recology, or Recycle Central, is located on Pier 96 (Reach 4), and provides collection and sorting of recyclable materials including containers, mixed paper and carboard to commercial and residential customers in California. The facility, which opened in 2002, was designed and constructed in partnership with the City of San Francisco and is a key asset to the City's zero waste goal. Recology covers over 185,000 square feet and processes about 750 tons of material each day, employing over 180 people, many from the nearby Bayview Hunters point neighborhood.

3.16.2.4 Energy

The San Francisco Public Utilities Commission (SFPUC) and Pacific Gas and Electric Company (PG&E) provide energy to the study area and the City of San Francisco.

The SFPUC manages two retail electric service programs: Hetch Hetchy Power and CleanPowerSF. Together, these programs provide more than 70% of the electricity consumed in San Francisco today. For over 100 years, Hetch Hetchy Power has generated clean, 100% greenhouse gas-free electricity for San Francisco. It powers critical municipal services such as Muni and San Francisco General Hospital, affordable and public housing sites, and new developments like The Shipyard and Salesforce Transit Center.

Launched in 2016, CleanPowerSF is San Francisco's community choice aggregation program and serves more than 380,000 residential and commercial customers with clean, renewable electricity at competitive rates. CleanPowerSF's current resource portfolio includes solar, wind, hydroelectric, and geothermal power.

PG&E provides power through a combination of energy resources, including natural gas, nuclear, biomass and waste, geothermal, small and large hydroelectric, solar, and wind resources (PG&E 2019).

3.17 Recreation and Access

3.17.1 Regulatory Framework

There are no regulatory standards for recreation and access; however, many of the state and local laws reference, support or emphasize the importance of maintaining or increasing the opportunities for recreation and access, even though those laws are not specifically for regulating recreation or access.

3.17.2 Existing Condition

The San Francisco Bay is a major destination for recreationists, including water-based activities such as cruising, wakeboarding, sailing, windsurfing, and kiteboarding as well as fishing both from land and boat, and land-based tourism and recreation at public

parks and open spaces. In total, the City and County of San Francisco is home to approximately 5,890 acres of parkland and open space areas (San Francisco 2014).

The Port oversees public access, parks and open spaces, natural and cultural resources, and much of the City's last remaining critical industrial uses. The Exploratorium, Oracle Park, the Ferry Building, Chase Center, Heron's Head Park and EcoCenter, and Fisherman's Wharf are all within the study area.

The San Francisco Bay Trail (Bay Trail) runs along the entire study area. The Bay Trail is a planned 500-mile hiking and biking path that provides scenic recreation for hikers, joggers, bicyclists, skaters, and wheelchair users. It also offers a setting for wildlife viewing and environmental education and serves as a commute alternative for bicyclists (San Francisco Bay Trail 2020). The Embarcadero Promenade and the Blue-Greenway, both elements of the San Francisco Bay Trail, are significant recreation resources for the City. These are among the most heavily used trails for walking, jogging, and cycling in the City, providing miles of access along San Francisco Bay.

Aquatic Park contains a variety of open spaces, parks, and recreational activities for locals and visitors. It also houses the Maritime Museum, the oldest senior center in the U.S., and Aquatic Park Cove, a San Francisco Maritime National Historical Park that provides outdoor recreational opportunities. The San Francisco Maritime National Historical Park includes a fleet of historic ships, a visitor center, Maritime Museum, Maritime Research Center, and the Aquatic Park Historic District. In addition, a green open area overlooks Aquatic Park Cove and the beach. Views to north San Francisco, Alcatraz Island, the Golden Gate Bridge, and Sausalito in Marin County are also available (NPS 2016).

Fisherman's Wharf offers numerous water activities, including ferry and excursion boat tours, sport fishing trips, and kayak rentals.

The Ferry Building and surrounding area features a continuous pedestrian promenade, public market, public art, and landscaping. Neighbors and visitors can use the area's ferries, hovercraft, and excursion boats; visit the public market, conference facilities, and retail establishments; or enjoy other public-oriented activities (POSF 2023).

Embarcadero Plaza features local vendors as well as weekly farmers markets. The plaza is adjacent to multiple transit lines, including the San Francisco Bay Ferry, Bay Area Rapid Transit (BART), San Francisco Municipal Railway (Muni) buses, the Market Street Railway F-line and E-line, and cable cars.

Sue Bierman Park occupies 4.4 acres of land and includes a children's playground and lawns with trees and walking paths. The park is also popular with a non-native flock of parakeets that roost in the non-native trees in the park.

South Beach is a full-service marina with 700 slips with concrete docks, a 640-foot recreational and commercial guest dock, and the Pier 40 Maritime Center. Brannan Street Wharf is another public pier that offers a lawn area, waterside walkway with seating, shade structure, and a dock for small vessels displaying history exhibits of Pier 36. Recreationalists have access to South Beach Park, which features a playground, lawn, and picnic tables.

The Mission Bay Park system oversees park and recreational facilities in the Mission Creek, Mission Rock, and Mission Bay along the Port's southern waterfront. Several green open spaces and parks are located near Mission Creek. The 10-acre Mission Creek Park includes lawns and a tree-lined esplanade, walking and biking pathways, a small amphitheater for outdoor events, sports courts, a boat launch, and an off-leash dog play area (Mission Bay Parks 2017). Mission Bay Commons Park is a 2.2-acre open grass area that offers a walk/run sidewalk loop as well as benches. The Pier 52 boat launch is the only public motorized boat launch in San Francisco, providing public access to the Bay, and is used by Port maintenance crews for pier maintenance and emergency response activities.

Pier 70 is directly south of Mission Bay, in the Port's central waterfront. This pier area is included on the National Register of Historic Places because of more than 150 years of continuous ship building and repair operations, its role in the industrialization of the western U.S., the war efforts, and architectural and engineering feats. The Bay Trail is the only recreational feature onsite.

Pier 80, Islais Creek, Cargo Way, Pier 94/96, and Heron's Head contain the Maritime Eco-Industrial Center. The Maritime Eco-Industrial Center is as an area that co-locates maritime industrial uses to enable product exchange, optimizes the use of resources, incorporates green designs and green technologies, fosters resource recovery and reuse, provides economic opportunities that employ residents, minimizes environmental impacts, and incorporates public open space for enjoyment and habitat. The Blue Greenway, the main connecting vein of these sites, crosses Islais Creek. Other recreational resources within the Maritime Eco-Industrial Center include Warm Water Cove Park, Tulare Park, Islais Creek Park, Rosa Parks Skate Plaza, and Heron's Head Park.

Heron's Head Park is on the southernmost edge of the study area and is a 22-acre open space with habitat for plants and birds. Heron's Head Park is one of the few wetlands on the City's shoreline and home to more than 100 bird species annually. Thousands of birdwatchers, hikers, students, teachers, and others visit the open space habitat for recreational and educational purposes (POSF 2023). The park features walking paths, an environmental education center, benches, picnic tables, and a barbeque area.

3.18 Aesthetics

3.18.1 Regulatory Framework

3.18.1.1 Federal

- CZMA

3.18.1.2 State

- Scenic Highway Program – preserves and protect scenic highway corridors from change that would diminish the aesthetic value of lands adjacent to highways
- California Green Building Code – composes mandatory requirements for exterior light sources to reduce the amount of light and glare that extends beyond a property
- San Francisco Bay Plan
- San Francisco Waterfront Special Area Plan – sets forth specific policies for uses, fill, public access, and design for piers and shoreline areas between Hyde St Pier in Fisherman's Wharf to India Basin

3.18.1.3 Local

- San Francisco General Plan – provides general policies and objectives to guide land use decisions
- San Francisco Planning Code – guides and regulates future growth and development; protects the character and stability of residential, commercial, and industrial areas within the city; provides adequate light, air, privacy, safety, and convenience of access to property; prevent land overcrowding; and regulations building locations and use of buildings and adjacent lands
- Port of San Francisco Waterfront Plan – governs the use, design, and improvement of properties under its jurisdictions
- San Francisco Bay Trail Plan – guides selections of the bay trail route and implementation of the trail system

3.18.2 Existing Condition

Port maritime and water-dependent uses stretch along the entire waterfront, preserving San Francisco's working waterfront character and heritage. The Port waterfront is distinctly urban in character. The Port's linear stretch of property extends through a diverse cross-section of San Francisco districts and neighborhoods that define much of the urban character and scale. Distinguishing features of the waterfront include the pier facilities and maritime operations that connect to the larger San Francisco urban landscape. San Francisco's street grid provides a direct connection from the City's neighborhoods to the network of historic piers, maritime facilities, and open spaces that extend along and over the Bay. This juxtaposition creates what is generally considered a unique and visually pleasing waterfront experience.

The Embarcadero and Terry A. Francois Boulevard form a break in the city landscape that creates two distinct identities: City neighborhoods on the west side and the Port waterfront features on the east side. The Bay and piers create visual contrasts to the

city streets and upland neighborhoods that adjoin the Embarcadero and Terry A. Francois Boulevard. These contrasts help give the San Francisco waterfront its unique identity.

The Port waterfront has distinct land use and architectural characteristics. Fisherman's Wharf is characterized by many simply detailed one-story industrial buildings. The bulkhead buildings and piers along the Embarcadero, with the Ferry Building as the centerpiece, reflect the Port's historic civic significance. The South Beach and Rincon Hill neighborhoods and entertainment venues such as Oracle Park and Chase Center highlight the transformation of former industrial areas to new residential neighborhoods and City attractions. Mission Rock is an emerging new mixed-used neighborhood in Mission Bay with parks, commercial and residential uses. Pier 70 is an emerging mixed-use district in the Dogpatch neighborhood with parks, commercial and residential uses and is home to the Union Iron Works Historic District which showcases the architectural, maritime and labor history of the area. The Islais Creek area in the Bayview community is characterized by large industrial buildings and facilities.

The open spaces along the Port waterfront within the study area vary in character, largely related to the physical form of the waterfront's edge. From Fisherman's Wharf to just south of China Basin Channel, the waterfront is a built edge supported by the Embarcadero Seawall and pile-supported pier decks. The built seawall ends at the Mission Bay waterfront, transitioning to a solid landform that meets the water. The natural shoreline areas include those along Mission Creek, along the northeast shoreline of Pier 94, and at Heron's Head Park.

The Port waterfront includes public pedestrian and fishing piers at Pier 7, Pier 14, Pier 41, historic Pier 43, atop the South Beach Harbor breakwater, and at Agua Vista Park Pier. Each offers views across the Bay and back to the city along with opportunities for recreational fishing. Wharves are pile-supported spaces alongside the Embarcadero Promenade, or behind some of the restaurants and historic fishing industry buildings in Fisherman's Wharf, that often provide access to areas where one can view fishing boat activity, tugboats, ferries, and other vessels. It is visually defined by the commercial and tourist destinations that attract visitors to the study area. These locations combine to create a lively and visually appealing urban waterfront and include uses such as entertainment venues (Oracle Park and Chase Center), museums and cultural uses (Maritime Museum at Aquatic Park, The Exploratorium at Pier 15 and the World War II vessels typically harbored at Pier 45), and world-famous tourist attractions (Fisherman's Wharf, Pier 39, and Alcatraz Landing). The commercial and tourist destinations integrate with, and highlight, the dynamic maritime setting while providing public access to views of the Bay. Views of the waterfront from adjacent streets are dramatic because of the City's hilly topography, the compactness of adjacent districts, and the built character and maritime uses of the waterfront. The Port waterfront is a strong part of the City's visual identity due to its maritime features, public access areas, historic resources, and encompassing views from various vantage points. Because of the density of the city, the openness of the Bay, and the open spaces, large numbers of people are attracted to the waterfront and its panoramic views.

Light pollution includes all forms of unwanted light in the night sky, such as glare, light trespass, sky glow, and overlighting (excessive use of artificial light). Sources of light

and glare are abundant in the urban environment of the study area, including streetlights, parking lot lights, security lights, vehicular headlights, internal building lights, and reflective building surfaces and windows. On nights with sporting events or other events, Oracle Park and Chase Center are major sources of light along the waterfront because of field lighting, exterior stadium lighting, and emergency lighting.

3.19 Hazardous, Toxic, and Radioactive Waste

The Hazardous, Toxic, and Radioactive Waste affected environment is addressed in Annex D.1.6.

3.20 Land Use Planning

Annex D.1.7 discusses land use regulation, designations and zoning, and existing land uses found in the study area.

3.21 Public Health and Safety

3.21.1 Regulatory Framework

3.21.1.1 Federal

- No Federal regulations or laws pertain to public health and safety.

3.21.1.2 State

- No state regulations or laws pertain to public health and safety.

3.21.1.3 Local

- No local regulations or laws pertain to public health and safety.

3.21.2 Existing Condition

The San Francisco Fire Department (SFFD) and San Francisco Police Department (SFPD) provide fire protection and emergency services and public safety services, respectively, within the City and County of San Francisco and the study area. In addition, there are several other public services, including the University of California Mission Bay campus, schools, non-profit organizations and child centers, within the study area. The SFPD, SFFD, and other public service facilities within the study area are detailed in **Table D.1-4**.

Table D.1-4: Public Service Facilities Located in the Study Area

Subarea	Public Service Facility	Location	Description
Fisherman's wharf	Police Department Marine Berths and Unit Headquarters	Hyde St. Harbor	Marine unit that responds to emergencies on the water or along the shoreline. Unit also

			assists in rescue operations in collaboration with the U.S. Coast Guard.
South beach	Fire Boat Station 35	399 The Embarcadero	SFFD's fireboat headquarters. The station houses the department's three fireboats: the *Phoenix*, Guardian, and *Saint Francis*.
Mission bay	Public Safety Campus	3rd St at Mission Rock	The Public Safety Campus houses the new Fire Station 4, SFPD headquarters, and the Southern District Police Station.

Note: Aquatic Park, Pier 31-25, the northeast waterfront, Ferry building, South beach, Mission Creek, Mission Rock, Pier 70, Pier 80, Cargo Way, Pier 94-96, and Heron's head do not have critical facilities or public services within them.

The SFPD, located on the first floor of the Public Safety Campus, provides public safety services for the study area and the City and County of San Francisco. The SFPD is the 11th largest police department in the U.S. and serves a population of approximately 1.5 million, comprising daytime commuters, tourists, and visitors (City and County of San Francisco 2020c). The SFPD has 10 districts, each with its own station. Three police districts, Bayview, Southern, and Central, cover the study area. SFPD headquarters, the Southern Police District Station, and SFPD Marine Unit headquarters and berths are located within the study area.

The SFFD is responsible for fire protection and emergency medical services for the City and County of San Francisco, including the study area. In addition to the SFFD, several privately operated ambulance companies are authorized to provide advanced life support services. The SFFD consists of two divisions, divided into ten battalions and 45 active stations (City and County of San Francisco 2020b). Division 2 serves the northern and western regions of the city and San Francisco County, and Division 3 serves the eastern and southern regions (City and County of San Francisco 2020b). Fire Stations 4 and 35 are within the study area.

4.0 Environmental Consequences of the Alternative Plans

In this section reasonably foreseeable effects, to include direct, indirect, and beneficial, of the SFWCFS study Alternative Plans have been assessed based on the current level of design.

Like Section 3, this section is organized by resource topic with the impacts of each alternative described within each resource section. The following topics will be described within each resource section:

- ***Significance Criteria:*** This section provides the criteria used to define the level at which an impact would be considered significant. Significance criteria is based on factual or scientific information and data; context and intensity of

the action, as described above; and regulatory standards for Federal, state, and local agencies.

- ***Impacts:*** This section describes the impacts of the alternative and are considered and evaluated as to whether they are direct, indirect, or cumulative. Each resource starts with a summary discussion of the overall potential impacts and benefits to the resource relative to the construction, operations, and maintenance assumptions, followed by an Alternative-specific discussion of potential impacts and benefits, reflected by numerical magnitude ratings.
- ***Mitigation Need:*** This section describes measures taken to mitigate (i.e. avoid, minimize, or compensate for) adverse effects. For impacts that must be compensated, the amount of compensatory mitigation required, and type of mitigation proposed, is described. Mitigation applies to any adverse impact, even if the impact is not significant. However, mitigation is not required if the resource itself is not considered significant.
- ***Conclusion:*** This section briefly summarizes the impacts described and rates the impact intensity in relation to significance, as described above.

4.1 Methodology for Describing Environmental Consequences

Impacts are described as either *beneficial* or *adverse*. *Beneficial* impacts result in a positive change in the condition of the resource when compared to the No Action Alternative. *Adverse* impacts result in a negative change in the condition of the resource when compared to the No Action Alternative.

All potential impacts, both beneficial and adverse, are described by their characteristics:

- type (direct, indirect, cumulative),
- duration (short-term, long-term, permanent),
- geographic extent (localized or beyond project boundaries).

Note: The terms *consequences*, *impacts*, and *effects* are considered synonymous in this analysis.

4.1.1 Types of Potential Impact

NEPA requires agencies to analyze and disclose the “reasonably foreseeable environmental effects of the proposed agency action” as amended in the FRA of 2023 (42 U.S.C § 4332(2)(C)(i)). In the absence of definitions for impacts in USACE implementing regulations, the following definitions were applied to this analysis consistent with the Council on Environmental Quality’s regulations at 40 CFR § 1508.1(g). These categories are used to describe the nature, timing, and proximity of impacts on the affected resources:

- **Direct impact**: A known or potential impact caused by the proposed action or project that occurs at the time and place of the action.
- **Indirect impact**: A known or potential impact caused or induced by the proposed action or project that occurs later than the action or is removed in distance from it but is still reasonably expected to occur.
- **Cumulative impact**: A known or potential impact resulting form the incremental effect of the proposed action added to other past, present, or reasonably foreseeable future actions. The timeframe for the cumulative impact analysis is 5 to 10 years after project implementation.

4.1.2 Duration of Potential Impact

The duration of potential impacts is short-term, long-term, or permanent. This indicates the period during which the resource would be impacted. Duration considers the permanence of an impact and is defined as:

- **Short-term impact**: A known or potential impact of limited duration, relative to the proposed action and the environmental resource. For this analysis, short-term impacts may be instantaneous or last from minutes up to five years.
- **Long-term impact:** A known or potential impact of extended duration, relative to the proposed action and the environmental resource. For this analysis, long-term impacts are those lasting longer than five years.
- **Permanent impact:** A known or potential impact that is likely to remain unchanged indefinitely.

4.1.3 Geographic Extent of Potential Impacts

The geographic extent of potential impacts are:

- **Localized:** Impacts that are site-specific and generally limited to the area within the project boundaries.
- **Beyond proposed boundaries:** Impacts that are unconfined or unrestricted to the project boundaries. These impacts may extend in the immediate vicinity of the project area or throughout the region.

4.1.4 Significance

Finally, impacts are described in relation to their significance. In considering whether the effects of the alternatives being considered are significant, the potential affected environment and degree of the effects of the action are analyzed. Impacts on each resource can vary in degree or magnitude from a slightly noticeable change to a complete change in the environment.

The magnitude or intensity of the proposed action was qualitatively and quantitatively assessed by the degree to which each alternative would impact a particular resource. The following descriptors are used in the body of this section for consistency in describing impact intensity in relation to significance.

- **No or Negligible Impact*:*** impact would cause no discernible change in the environment and does not require mitigation.
- **Less than Significant*:*** impact would cause no substantial adverse change in the environment and would not require mitigation. Less than significant determinations also apply to impacts that are determined to be significant based on the significance criteria, but for which mitigation could be implemented to avoid or reduce the environmental effects to less than significant levels.
- **Significant and Unavoidable*:*** impact would cause a substantial adverse change in the environment that cannot be avoided or mitigated to a less than significant level if the project is implemented.
- **Too Speculative for Meaningful Consideration*:*** impact may have a level of significance that is too uncertain to be reasonably determined and would therefore be considered too speculative for meaningful consideration. Where some degree of evidence points to the reasonable potential for significant impacts, the section may explain that a determination of significance is undetermined, but is still assumed to be “significant”, as described above. In other circumstances, after thorough investigation, the determination of significance may still be considered too speculative to be meaningful. This is an impact for which the degree of significance cannot be determined for specific reasons, such as unpredictability of the occurrence or the severity of the impact, lack of methodology to evaluate the impact, or lack of an applicable significance threshold.

Numerical scoring was used to quantitatively represent impacts to each resource, which is described in detail in sections below.

Significance varies with the setting of each alternative, and significance is dependent on the extent of the affected area and the extent of the impact. In considering the significance, the following are considered, as appropriate to the action:

- Both short- and long-term effects.
- Both beneficial and adverse effects.
- Effects on public health and safety.
- Effects that would violate Federal, State, Tribal, or local law protecting the environment.

4.1.5 Impact Score Ratings

An impact rating criterion was developed to assess the magnitude of adverse effects to natural and physical resources (**Table D.1-5**). Anticipated benefits are not included numerically in the impact rating score; rather, benefits are described in the resource section and noted in the impact rating scorecard with a positive sign "+". Note, it is possible for a resource to have both adverse impacts and benefits associated with the alternative measure assessed.

Table D.1-5: Scoring Methodology for Natural and Physical Environment Resources

Impact Rating and Numerical Score	Description
No impact (1)	There would be no impacts to the resource because the resource is unaffected.
Low (2)	Effects to the resource would either be negligible or, if detectable, have minor temporary impacts locally to the resource. The impacts would be below regulatory standards, as applicable, and mitigation measures may be implemented to sustain low to no impact to the resource.
Moderate (3)	Effects to the resource are expected to be moderate in the near-term and localized. Impacts would be within or below regulatory standards, as applicable, and the use of mitigation measures would manage potential adverse impacts, if applicable.
Moderate to High (4)	Effects to the resource would be locally and/or regionally significant. Impacts would be within regulatory standards, with or without compensatory mitigation; however, existing resource conditions are expected to be affected in the near-term, but not necessarily in the long-term. Mitigation measures to manage any potential adverse impacts would be necessary.
High (5)	Effects to the resource would have substantial consequences, locally and/or regionally. Impacts would exceed regulatory standards even with compensatory mitigation and would not be environmentally acceptable.

Impact score tables are provided in each of the resource sections and follow the numerical and color-coding criteria as described above.

4.2 Alternatives Analyzed

The alternatives evaluated in this section are described in Chapter 3 of the Final Integrated Feasibility Report/Environmental Impact Statement (FIFR/EIS), and are listed below for ease of reference:

- **Alternative B/NED Intermediate Curve**: Proposes nonstructural measures such as relocation, raise in place, floodproofing, and zoning in areas identified with frequent flooding.
- **Alternative F**: Uses a combination of structural, nonstructural, and NNBFs to defend at the existing shoreline, except for some managed retreat inland along the southern waterfront and tide gates at the mouths of Islais and Mission creeks. Additional retreat and adaptations are proposed as the rate of RSLC increases.
- **Alternative G/NED High Curve**: Uses a combination of structural, nonstructural, and NNBFs to defend against the high rate of RSLC. This alternative concedes the largest area for managed retreat and incorporates more nonstructural and NNBF measures.
- **Total Net Benefits Plan/Recommended Plan:** Hybridized plan that relies on defend measures, scaled to perform under a lower initial risk and to adapt to risk of a higher rate of RSLC as a potential end point. First actions are proposed to delay expenditures and add height or adapt measures as risk increases over later years. This alternative hybridizes nonstructural, structural, and NNBF from multiple action alternative. Incorporates the independent measures from the draft IFR/EIS.

4.3 Construction Techniques Common Amongst Alternatives

The following section describes construction techniques that are ubiquitous amongst all Action Alternatives. Note, this does not intend to suggest impacts from these techniques are uniformly distributed amongst alternatives, rather they are scaled based on the quantity and duration of the expected activity. The design details will be specified within each alternative; however, general descriptions have been provided here to eliminate redundancy in the alternative impact descriptions below. If additional details are warranted, they were included with the relevant alternative and resource impact.

Adverse impacts from these techniques are expected across several resources; however, those impacts are described below, and the magnitude of those impacts is reflected in the overall numerical score for each resource.

4.3.1 Building Demolition, Relocation, and Elevation

In some instances, the line of defense (LOD) moves landward of buildings along the waterfront. To protect these structures, the buildings would need to be floodproofed, relocated or removed, or elevated as described below. This approach was applied to all Action Alternatives, additional details on the criteria used to determine applicability of each approach can be found in *Appendix B: Engineering*.

4.3.1.1 Floodproofing

There are two types of floodproofing – wet and dry floodproofing. As the name implies, wet floodproofing allows floodwaters to enter the structure, while, in contrast, dry floodproofing prevents the entry of floodwaters. Dry floodproofing is proposed for industrial and commercial properties and critical infrastructures and wet floodproofing is proposed for residential structures.

Wet floodproofing measures involve permanent or temporary measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure. Generally, this includes properly anchoring the structure, using flood resistant materials below the Base Flood Elevation, relocating and/or protecting mechanical and utility equipment, and use of openings or breakaway walls to avoid structural damage due to hydrostatic pressure and to allow flows to enter and exit the structure. Wet floodproofing is practical only for portions of a structure that are not used for living spaces, such as basements, elevated structures, crawlspaces, or attached garages.

Floodproofing activities would be completed in phases based on flooding frequency over a given period. Those with imminent risk would be completed first and properties where the risk rises as sea levels rise would be floodproofed when appropriate. They type of floodproofing would be structure dependent. Each structure would be evaluated independently of the others for what would be the most appropriate and least invasive method of flood protection possible that would still retain the integrity of the structure.

4.3.1.2 Relocation/Removal of Structures

Structures may be removed from the existing location to eliminate the potential flood risk or to make room for the proposed flood protection system. Structures identified for relocation will be physically relocated or rebuilt in another location off-site to be determined during the preconstruction, engineering, and design phase (PED). Structures identified for removal will be permanently removed and not rebuilt in place or elsewhere.

For structures being relocated, the structure may be transported in whole or disassembled and then reassembled at the new location. For whole structure transport, the structure is typically done by attaching a temporary steel framework under the structure to support it, then lifted off the foundation using a network of hydraulic jacks placed under the framework and controlled by a unified jacking system. Once the structure is at a sufficient height, hydraulic dollies or a flatbed trailer(s) are placed under the supporting framework. These are used to move the structure to the new location. After the move, the steps are reversed, and the structure is lowered.

For buildings/structures moved to a new location, the new site would need to be prepped, which may include but is not limited to excavation, fill material, new concrete, etc. In some instances, buildings being relocated would require modifications for their new foundation and to retain their structural integrity. This is most likely to apply to historic structures that may require upgrades to make the building structurally sound.

In some instances, buildings being relocated would require modifications to allow for moving, and to make structural improvements to meet current building codes and standards once re-established on their new foundation. This is most likely to apply to historic bulkhead and shed building structures that are part of the Embarcadero Historic District.

For structures being permanently removed on-site, the material would need to be removed and disposed of. This will require heavy machinery such as wrecking balls, excavators, and bulldozers. Additionally, the building debris will need to be hauled off using large trucks or barges to an appropriate disposal facility.

Demolition of the structure would require heavy machinery such as wrecking balls, excavators, and bulldozers. Material would then need to be hauled offsite for disposal.

4.3.1.3 Elevation

Structure elevation involves raising each structure to a higher elevation to reduce the risk of flooding during high-water events. To do this, the structure is separated from its foundation and temporarily raised in place with hydraulic jacks. The new foundation system, such as fill, columns, posts, piers, or raised foundation walls, would be constructed and then the structure lowered into place on the new foundation system. The goal is to ensure the lowest habitable floor is at or above the base of flood elevation or higher. Selection of proper elevation method depends on flood characteristics such as flood depth or velocity.

4.3.1.4 Cast-in-Place Concrete

Cast-in-place concrete is poured into removable forms (or castings) erected on site and cured in the concrete's finished position. Temporary forms or castings would be constructed on site and would be reinforced with steel. Most formwork would be composed of steel, aluminum, and wood. Ready mixed concrete would be delivered via large cement trucks and poured into the castings with a truck chute, bucket, or pump. The concrete is left to cure in the castings before removal. Once cured, casting materials would need to be removed and reused for another measure or hauled off and disposed of.

4.3.2 Cofferdam

A cofferdam is an enclosure that allows water to be pumped out to establish a dry working environment. A cofferdam would be constructed from steel sheet piles with interior bracing. Sheet piles would be driven into the sediment in the bay through hydraulic or pneumatic tools, braced internally with waler beams and compression struts to keep the wall from collapsing. Braces would be installed using heavy machinery from work barges in the bay. Inside of the cofferdam would be un-watered and dewatered with a combination of surface pumps/sumps and deep wells as necessary to create a dry and stable work environment. Once construction completes, the cofferdam would be disassembled and removed.

4.3.3 Ground improvements

Amongst the array alternatives, several measures would require existing soils to be improved to address both static and seismic loading conditions because of poor soil conditions and the increased weight of the new construction. This could consist of a variety of ground improvement techniques such as deep material mixing (DMM), jet grouting (JG), compaction grouting (CG), or vibro-replacement (VR) of the existing soils (**Table D.1-6**).

Table D.1-6: Description of Ground Improvement Techniques that Could be Used During Construction Activities

Technique	Description
Deep Material Mixing (DMM)	Mechanically mixes soils with wet or dry cementitious binders. A high-speed drill advances a rod with radial mixing paddles located at the posterior of the drill into the ground to shear the soils. The cementitious binder is injected through the rod and mixed with the soil to produce individual or overlapped columns with improved strength and compressibility characteristics (Keller 2022a).
Jet Grouting (JG)	Uses high-velocity fluid jets to construct cemented soil (soilcrete) with a grouting monitor attached to the end of a drill stem. The jet grout monitor is advanced to the maximum depth, then high-velocity jets are used to erode and mix in situ soil with grout as the drill stem and monitor are rotated and raised (Keller 2023a)
Compact Grouting (CG)	Involves injecting a low slump, mortar grout into the subsurface to densify loose, granular soils and stabilize voids or sinkholes. An injection pipe is inserted typically to the maximum depth and the grout is injected as the pipe is slowly removed in segmented lifts, creating a column of overlapping grout bulbs. As the mobility grout bulbs expand, they displace surrounding soils (Keller 2023b).
Vibro-Replacement (VR)	Constructs loadbearing columns from gravel or crushed stone with a vibrator to reinforce ambient soils and densify surrounding granular soils (Keller 2022b). A vibrator tool penetrates to the design depth using the vibrator's weight and vibrations, as well as water jets located at its posterior. Stone is then either added using a top-feed method from the ground surface where the stone is allowed to fall into the void created by the vibrator or using a bottom-feed method where the stone is added to a hopper for placement down an attached feed pipe. For either stone placement method, the vibrator is lowered into the placed stone in lifts to densify and displace the underlying stone. These steps are repeated until a dense stone column is constructed from the design depth to the ground surface (Keller 2022b).

4.3.4 Equipment and Access Routes

Material to construct the features/measures would be commercially sourced and shipped/transported to the construction site for installation. Fill material would require heavy machinery to move the sediment and facilitate construction, and could include bulldozers, front-end loaders, track-hoes, backhoes, etc. Any stone used for construction would be bought from a commercial quarry or excavated at the construction site and retained for reuse. Purchased stone would be transported by

barge or truck to the construction site to be placed. Excavated stones would require heavy machinery (e.g., front-end loaders, backhoes) to remove the stone, and then would be stored onsite or on a barge. Various support equipment would be required such as crew and work boats, trucks, trailers, construction trailers, floating docks, and temporary access routes to facilitate loading and unloading of personnel and equipment. Additionally, temporary staging areas would be needed to store equipment and materials during active construction.

Identification of these areas would occur during the design phase. Each disturbance for access and staging would be placed outside of environmentally sensitive areas to the greatest extent practicable and utilize areas already disturbed when possible (e.g., stage on existing concrete areas, existing roadways, or Port of San Francisco lands). All ground disturbance for access and staging areas would be temporary and fully restored to result in no permanent loss.

4.4 Description of Measures applied to Action Alternatives

Table D.1-7 summarizes the measures applied to each of the alternatives and indicates at what implementation phase (around 2040 or around 2090) those measures are expected for construction. Note, the 2040 measures are constructed to be adapted in 2090; thus, measures in 2090 are additive to those of 2040 rather than separable new elements. Additionally, 2040 and 2090 are used as placeholder time steps that correspond with RSLC; however, these years may interchangeably be noted as first actions (2040) and subsequent actions (around 2090) that is intended to describe first construction actions (first actions, around 2040) and any subsequent adaptive action that would occur as RSLC triggers the need for additional protection (subsequent actions, around 2090). This theme continues throughout the resource impacts discussions. Alternative B is missing from **Table D.1-7** as it would be implemented in four stages and is non-structural. It is described in future sections.

Table D.1-7: Summary of Measures Proposed in Each Alternative and Implementation Year

Alternative Implementation Time Step	Bay Fill	Levee	Bridge Raise / Replacement	Bulkhead wall / Seawall	Deployable Flood Gate	Sheetpile Wall	Tide Gate	T-wall	Vertical Wall / Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh enhancement*	Vertical Shoreline*
Alternative C 2040		●			●	●		●	●	●	●		●	●		
Alternative D 2040		●			●	●		●	●	●	●		●	●	●	
Alternative D 2090			●	●				●	●	●	●	●	●		●	
Alternative E 2040	●	●		●	●			●	●	●	●	●	●	●	●	●
Alternative E 2090	●	●	●	●				●	●	●			●	●	●	
Alternative F 2040	●	●		●			●	●	●	●	●	●			●	
Alternative F 2090		●							●	●					●	
Alternative G 2040		●	●	●				●	●	●	●		●	●	●	
Alternative G 2090		●							●			●			●	
TNBP First Actions		●		●	●	●		●	●	●	●	●	●	●	●	●
TNBP Subsequent Actions	●	●		●				●		●	●	●	●	●	●	

Note: An asterisk (*) indicates a NNBF. Vertical shoreline is synonymous with living seawall, as such, the terms are used interchangeably.

Construction impacts to resources are expected to be commensurate with the spatial extent (e.g., total linear feet) and duration (i.e., length of construction) of the measures proposed for each action. **Table D.1-8** show the anticipated disturbance each measure is likely to have in the first actions based on the long-term footprints. It was assumed all construction would have a 100-foot buffer around the long-term footprint to assess for construction-related impacts, which is not captured in the tables. Alternative B is unique in that implementation would occur over multiple time steps, as such it was not included in **Table D.1-8** because actions would be implemented differently. Please refer to *Appendix A: Plan Formulation*, Section 11.2 for a description of Alternative B implementation.

It was assumed each alternative would require a total construction duration of 10 years. All alternatives assume 40-hour, 5-day work weeks with normal anticipated adverse weather days.

Table D.1-8: Anticipated Disturbance for the Final Array of Alternatives for First Actions

Measure	F	G	TNBP
Bay Fill (ACRES)	25	-	9
Paved Levee (LF; ACRES)	9,820 14	10,655 16	11,800 2
Bridge Raise/Replacement (LF)	-	3,340	-
Remove structures (SQFT)	93,420	192,115	195,000
Relocate structures (SQFT)	604,500	604,500	175,000
Bulkhead wall/Seawall (LF)	13,115	14,540	21,000
Deployable (SQFT)	-	-	50,000
Floodproofing (SQFT)	922,780	2,012,785	2,835,000
Seismic Ground Improvements (ACRES)	44	70	62
Sheetpile Wall (LF)	-	-	2,900
Tide Gate (n; LF)	2; 2,415	-	-
T-wall (LF)	4,250	13,280	1,000
Curb Wall (LF)	52,615	58,345	51,200
Wharf (LF; ACRES)	15,790;	27,270;	10,900

Measure	F	G	TNBP
	3	8	15
NNBFs (ACRES)	15	40	27

**Note: Linear Feet (LF) is rounded to the nearest 100 feet, and square feet (ft^2) is rounded to the nearest 5,000 ft^2, and acres are rounded to the nearest whole number. Values denoted as "--" indicate the measurement was not calculated or applicable*

4.4.1 Assumptions for Analysis

The scope of this analysis is based on the following assumptions and conditions:

- The No Action Alternative (i.e., FWOP) has significant impacts to the majority of resources including health and safety, transportation, and communities. An assessment of the No Action Alternative consequences by resource type is presented in **Table D.1-10**.
- This assessment is primarily focused on the structural measures of each Alternative. Structural measures include combinations of paved levees/planted levees, tide gates, floodwalls, elevated promenades, wharfs, bulkheads, road raising, and deployable gates.
- Potential impacts and benefits are based on the preliminary conceptual design of the SFWCFS study measures, which focuses on impacts within the structural measure's footprint of construction, clearing and general disturbance within that footprint, and long-term structural footprint. The measures and measure locations are subject to change during the design phase as engineering is further developed and following public, Agency, and local stakeholder input on the draft IFR/EIS. This assessment was updated and the potential impacts and benefits were re-evaluated for this final IFR/EIS. Where additional information (i.e., modelling or site-specific studies or surveys) is needed, consideration for how that information may be collected and assessed is provided.
- Nonstructural and NNBFs are part of Alternative plans C, D, E, F, and G, while Alternative B is a fully nonstructural plan. Currently, conceptual NNBF measures are developed for each of the Action Alternatives but require further analysis. The following sections will mention NNBFs generally given the level of design available at this stage. Refinements to the potential design of NNBFs occurred between the draft and final IFR/EIS; thus, sections have been updated with new renderings and information as applicable.
- Tidal gate closures are anticipated to primarily occur during a coastal storm (1% AEP) as water elevations rise or during maintenance procedures to ensure the gates are functioning properly in preparation for a coastal storm

event. While additional analysis is necessary to assess closure frequency and duration of the gate operations and maintenance criteria, this assessment has assumed a duration and frequency of 1 full tidal cycle (24 hours; 2 high tides and 2 low tides) per year as a baseline to which to compare environmental consequences of tide gate closures. The same assumptions were made for deployable flood gates.

- Projects within the SFWCFS study area that are being developed under separate authorizations or entities in the reasonably foreseeable future are considered in the cumulative impacts assessment, while projects currently being constructed are considered in FWOP.

This assumption-based assessment was refined following public and agency reviews were applicable for this final IFR/EIS.

4.5 Summary of Impacts

Table D.1-9 presents a high-level assessment of the SFWCFS study Alternative plans, starting with an initial screening to identify if there is a potential for adverse impacts (i.e., Yes or No) by measure type, followed by an assessment of the magnitude of those identified potential adverse impacts, rated on a scale of 1 (No impacts) to 5 (Significant impacts), by Alternative. Measures that also have a potential beneficial effect are marked with a “+” in these Sections to identify those added benefits without muting the potential adverse impact identification and associated rating scores.

As indicated in **Table D.1-9**, there are potential adverse impacts to resources from measures, both structural and NNBF, as well as potential benefits, depending on structure type, location, and existing conditions. Structural measures are anticipated to have greater direct impacts to resources than other measure types (i.e., nonstructural, NNBF) of which may require compensatory mitigation, agency coordination, and regulatory review. For each resource, the impact producing factors have been identified and a summary of impacts is provided in the sections below. In some instances, measures are discussed by location as “shore-based” or “in-water” to distinguish between potential impacts.

Table D.1-9: Potential for Impacts by Resource and Measure Type

Resource	Bay fill	Levee	Bridge raise	Road raising	Vertical wall	Bulkhead wall/Seawall	Cantilever wall	Pile supported	Sheetpile wall	T-wall	Elevated promenades	Wharf	Deployable flood gate	Tide gate	Shoreline extension	Ecological Armoring*	Embankment shoreline*	Naturalized shoreline*	Vertical shoreline*	Marsh*	Coarse beach*	Ecotone levee*
Regional Air Quality and Clean Air Act	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y	Y+	Y	Y+
GHG	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y	Y+	Y	Y+
Regional climate, climate change, RSLC	Y	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+
Geology	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	N	Y+	N	Y+
Sediments	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y	Y+
Seismicity	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Soils and Mineral Resources	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y	Y+
Floodplains	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+
Coastal hydrology, currents, and circulation	Y	Y	Y	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	N	N

Resource	Bay fill	Levee	Bridge raise	Road raising	Vertical wall	Bulkhead wall/Seawall	Cantilever wall	Pile supported	Sheetpile wall	T-wall	Elevated promenades	Wharf	Deployable flood gate	Tide gate	Shoreline extension	Ecological Armoring*	Embankment shoreline*	Naturalized shoreline*	Vertical shoreline*	Marsh*	Coarse beach*	Ecotone levee*
Tides, tidal exchange, and waves	Y	Y	Y	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+	N
Water Quality	Y	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y+	Y+	Y+	Y+	N	N
Groundwater	N	Y	N	N	N	Y	Y	Y	Y	N	Y	N	N	N	Y	N	Y+	Y+	N	N	N	Y+
Intertidal habitat	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	N	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+	N
Subtidal habitat	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	N	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+	N
Pelagic habitat	Y	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	N	N	N	N	N	N	N
Wetlands	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y+	N	N	N	Y+	Y+	N
Fish	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+	N
Commercial and Recreational Fisheries	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+	N
Macroinvertebrate	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	N
Terrestrial vegetation	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	N	Y+	Y+	N	Y	N	Y+

Resource	Bay fill	Levee	Bridge raise	Road raising	Vertical wall	Bulkhead wall/Seawall	Cantilever wall	Pile supported	Sheetpile wall	T-wall	Elevated promenades	Wharf	Deployable flood gate	Tide gate	Shoreline extension	Ecological Armoring*	Embankment shoreline*	Naturalized shoreline*	Vertical shoreline*	Marsh*	Coarse beach*	Ecotone levee*
Threatened & Endangered (T&E) Species - Terrestrial	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y	Y+	Y+	Y+
T&E Species - Aquatic	Y	Y	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	N
State listed species	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+
Designated Critical Habitat	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	N
Migratory Bird Treaty Act Species	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+
Marine Mammal Protection Act Species	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	N
Essential Fish Habitat (EFH) and EFH-designated species	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	N

Resource	Bay fill	Levee	Bridge raise	Road raising	Vertical wall	Bulkhead wall/Seawall	Cantilever wall	Pile supported	Sheetpile wall	T-wall	Elevated promenades	Wharf	Deployable flood gate	Tide gate	Shoreline extension	Ecological Armoring*	Embankment shoreline*	Naturalized shoreline*	Vertical shoreline*	Marsh*	Coarse beach*	Ecotone levee*
Habitat Areas of Particular Concern (HAPC)	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	N
Submerged Aquatic Vegetation (SAV) – Eelgrass	Y	N	N	N	N	Y	N	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	N
Coastal Zone Management Act Areas	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N
Coastal Barrier Resources System Areas	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Noise and vibration	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cultural Resources	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Native American lands	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Socioeconomics and community	Y	Y	Y+	Y+	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y	Y+	Y	Y+	Y+	Y+

Resource	Bay fill	Levee	Bridge raise	Road raising	Vertical wall	Bulkhead wall/Seawall	Cantilever wall	Pile supported	Sheetpile wall	T-wall	Elevated promenades	Wharf	Deployable flood gate	Tide gate	Shoreline extension	Ecological Armoring*	Embankment shoreline*	Naturalized shoreline*	Vertical shoreline*	Marsh*	Coarse beach*	Ecotone levee*
Transportation	Y	Y	Y+	Y+	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Utilities	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Recreation and Access	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+
Aesthetics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+
HTRW	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+
Land Use	Y	Y	Y+	Y+	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y	Y+	Y+
Public Health and Safety	N	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+	Y+

Notes:

Y – measure type has potential to adversely impact resource

N – measure type is not anticipated to adversely impact resource

+ - measure type anticipated to also have beneficial effects to resource

* - indicates NNBF measure

For those resources where no impact is expected for any of the measures, the resource will not appear in the analysis in subsequent sections.

4.6 No Action Alternative

This No Action Alternative section serves as a baseline comparison to the following alternative plans impact assessment, including the tentatively selected plan. While the No Action Alternative would have no additional impacts from construction or operations and maintenance of coastal flood risk measures under the SFWCFS study, it would leave the SFWCFS study area vulnerable to continued damages, loss of life, and destruction of study area resources caused by severe coastal hazards compounded by RSLC. A summary of potential impacts under the No Action Alternative to each resource is provided in **Table D.1-10**.

Table D.1-10: Summary of Potential Impacts of the No Action Alternative

Resource	Summary of No Action Potential Impacts
Regional Air Quality & Clean Air Act	The potential for emergency maintenance activities is expected to increase because of coastal flooding. Equipment and vehicles used for emergency maintenance activities would generate emissions and, thus, could expose receptors to increased pollutant concentrations. Future road closures would also be likely to increase emissions due to increased vehicle delays and congestion. Individuals displaced from their homes because of flooding may also experience increased health risks, particularly if they are relocated to areas with higher ambient air pollution or if they become unhoused.
Greenhouse Gases (GHG)	The potential for emergency maintenance activities is expected to increase because of coastal flooding. Equipment and vehicles used for emergency maintenance activities would generate GHG emissions. Disruption of the electrical grid could also generate GHGs, particularly if replacement power sources, such as diesel generators, are fossil fueled.
Regional changing meteorological conditions, RSLC	The trends described in the existing conditions section would continue. Climate change could lead to increased ocean and terrestrial temperatures, ocean acidification, RSLC, duration and intensity of extreme events, weather patterns, and has the potential to cause changes in the nature and character of the bay waterfront. Climate change is expected to result in more intense and frequent extreme precipitation, droughts, and heat waves within the next century (NCA 2014, 2018; Ault et al. 2014; Ault et al. 2016; Cook et al. 2016; Jones and Gutzler 2016). This is likely to cause flooding, erosion, and increases in the rate and amount of nutrients and sediments entering the bay.
Geology	No significant impacts are expected on the underlying geology or geologic processes, only minimal changes to the topographic features, geologic formations, and soils in the study area would be expected.
Sediments	No significant impacts are expected on the underlying sediment type. Sediment quality will continue to be impacted due to coastal flooding which potentially introduces contaminants into surface waters and nearby waterbodies. There is also the potential for contaminants to become trapped in sediments over time.

Resource	Summary of No Action Potential Impacts
Seismicity	The current risk from a seismic event would continue into the future which could affect life safety, infrastructure disaster response and recovery, maritime commerce, commerce, utilities, transportation, historic resources, environment (contamination), land use, recreational areas, and the economy (MHRA 2020). However, current zone, building codes, and policies would minimize some of the risk for buildings/constructions subject to those policies.
Soils & Mineral Resources	Soils and mineral resources are expected to continue as described in the existing conditions section. Future exploration and production of oil, gas, and minerals within the study area is highly dependent on market conditions, value of existing resources, presence of production fields, and future development. It is unlikely that urbanized areas would see any increase in oil and gas production.
Floodplains	The study area would continue to be at risk of flooding and could become more at risk due to RSLC and climate change. Without local or non-Federal interventions, it is expected that nuisance flooding in low-lying areas will continue, where the potential impacts from tidal and/or rainfall flooding will likely increase and worsen over time with climate change and RSLC. Coastal hazards such as wave overtopping, and storm surge is expected to increase over time with climate change and RSLC which would lead to more catastrophic flooding.
Coastal hydrology, currents, & circulation	RSLC would likely increase flooding and wave hazards, resulting in increased soil erosion, modifications to the shoreline, and release of contaminants. RSLC rates may also exceed normal sediment accretion rates in saline marshes resulting in increased inundation and subsidence. Hydrology patterns may be impacted as continued water temperatures rise and trends in the Pacific Ocean circulation patterns change.
Tides, tidal exchange, & waves	No significant impact to tides is expected. Tidal exchange and range, and wave hazards may be impacted based on RSLC whereby threats from wave hazards increase.
Wild and Scenic Rivers	No impact as Wild and Scenic Rivers are not designated within the SFWCFS study area.
Stormwater	Climate change, including more frequent and intense storms and flooding events, can increase stormwater runoff. An increase in stormwater runoff can exacerbate existing, or introduce new, contaminants into water sources and soils. Increased precipitation could overwhelm the study area's municipal stormwater management system, which can lead to backups that cause localized flooding or greater runoff of contaminants (e.g., trash, nutrients, bacteria) in waterways and soils (EPA 2023).
Water Quality	Current water quality trends could improve with changes in land use or improve through implementation of new water quality improvement programs such as TMDLs administered by Federal, state, and local agencies. However, with the existing status of water quality in the study area, it is more likely that conditions would worsen with increased flooding associated with climate change and RSLC. Increased flooding would lead to more runoff, potentially carrying contaminants, thereby lowering water quality. Climate change and RSLC introduce uncertainty of continued trends where changes in temperature, precipitation, chemical composition (e.g., ocean acidification), and increases in salinity could also impact water quality.

Resource	Summary of No Action Potential Impacts
Groundwater	Groundwater may be significantly impacted by RSLC by causing groundwater elevations to rise.
Intertidal habitat	Intertidal habitats are expected to continue as described in the existing conditions section. With climate change and RSLC, there could be an increase in intertidal habitats as fringe marshes and low-lying vegetated areas are converted.
Subtidal habitat	Subtidal habitats are expected to continue as described in the existing conditions section. With climate change and RSLC, there could be an increase in subtidal habitats as fringe marshes and low-lying vegetated areas are converted. RSLC could also potentially impact subtidal habitat suitability by increasing water depths resulting in reduced productivity and exposure to tidal exchange.
Pelagic habitat	Changes in water quality (e.g., temperature, salinity, DO), flow patterns, and habitat due to extreme events could degrade pelagic habitat quality. Climate change could cause a shift in plankton and benthic communities which are food sources for pelagic fish and mammal species.
Wetlands	Continued wetland losses and degradation through erosion and degrading water quality. Complete loss of Heron's Head Park wetlands and valuable habitat for T&E species.
Fish	Changes in water quality (e.g., salinity, dissolved oxygen) and flow patterns could disrupt fish use and cause a shift in prey availability. Fish could be impacted by increasing water temperature and ocean acidification which are anticipated to continue under climate change.
Commercial & Recreational Fisheries	Potential impacts to commercial and recreational fisheries include changes in species abundance and diversity due to direct and indirect impacts from flooding, RSLC, and climate change. Risk of coastal flooding and hazard increases may impact facilities that support commercial and recreational fishing thereby limiting ability to fish.
Macroinvertebrates	Changes in water quality (e.g., salinity, dissolved oxygen) could disrupt invertebrates and cause a shift in abundance or species diversity. Invertebrates could be impacted by increasing water temperature and ocean acidification which are anticipated to continue under climate change.
Terrestrial vegetation	Existing land use trends are expected to continue as described in the existing conditions section. The SFWCFS study area is highly urbanized with limited availability of terrestrial vegetation. Some undeveloped terrestrial habitats may be converted to urban lands with planned development. RSLC may convert some lower lying upland areas to wetlands or subtidal and/or intertidal habitats.

Resource	Summary of No Action Potential Impacts
T&E Species – Terrestrial	Continued habitat loss, particularly wetlands, intertidal and subtidal habitats, would reduce the space available for T&E terrestrial species. This may impact important foraging habitats for Ridgway's rail, refuge for salt marsh harvest mice, and available space for California seablite. RSLC may directly impact wetlands and intertidal habitats where erosion is persistent, which impacts foraging and nesting habitat for Ridgway's rail. Increased flooding from climate change, and erosion and subsidence from RSLC, may also lead to conversion of wetland habitats to intertidal habitats and loss of low-lying upland habitats that are necessary transition areas for species such as salt marsh harvest mice.
T&E Species - Aquatic	Climate change and RSLC may impact available foraging habitats for green sturgeon. Warming water temperatures can influence egg development and hatching rate, which may have more detrimental effects to the overall recovery of the species (NMFS 2022). Changes in flow patterns or currents may change the behavior of green sturgeon in marine environments which could make them more susceptible to human activities such as dredging and bottom disturbances (NMFS 2022). Climate change and warming water temperatures could shift prey availability for salmon and steelhead trout, as well as endangered marine mammals. Ocean acidification could have negative impacts of protected shellfish.
State listed species	Continued habitat loss would reduce the space available for state listed terrestrial species, while water quality degradation is likely to contribute to loss or shift in distribution of aquatic species. The study area is highly urbanized so any continued loss in habitat may prove to have significant impacts on the distribution and abundance of state listed species. Climate change and RSLC would increase flooding in the study area which disturbs available terrestrial habitat, wetlands, and can lead to water quality degradation (e.g., lowered DO, contaminants). Additionally, increases in water temperature or salinity may also impact state listed aquatic species ability to thrive or reside in the bay.
Designated Critical Habitat	Designated CH for green sturgeon and Chinook salmon in the SFWCFS study area would continue to be impacted by climate change, RSLC, and maritime use.
Migratory Bird Treaty Act Species	The Bay is critical stop over habitat for migratory bird species. Climate change and RSLC may exacerbate conditions for some of these species by contributing to loss of critical habitat.
Bald & Golden Eagles	Populations of bald and golden eagles are found in the less urbanized areas of San Francisco Bay and coastal range. While individual eagles may migrate through the area, the project area does not support nesting habitat for eagles as it generally lacks large mature trees. The loss of mature trees from repeated flooding would make the study area even less inhabitable to bald and golden eagles if found nesting.
Marine Mammal Protection Act Species	Climate change and RSLC may exacerbate conditions for marine mammal species migrations and habitat use from rising seawater temperatures and ocean acidification. It is uncertain, but plausible, that long-term habitat changes would have indirect effects on prey availability.

Resource	Summary of No Action Potential Impacts
EFH & EFH-designated species	EFH impacts would be focused on loss of shallow nearshore areas including SAV. The SFWCFS study area supports a diverse fish community including EFH. Shellfish resources are being impacted by ocean acidification and water quality degradation which would continue with climate change and frequent flooding. Impacts to water quality during storm events would occur in addition to the changes in temperature, precipitation, flooding patterns, and chemical composition over time.
HAPC	HAPC impacts would be focused on degradation of the quality of habitat through ocean acidification driven by climate change. More frequent flooding would increase contaminants delivery to HAPC which would reduce water quality.
SAV – Eelgrass	Due to the urbanized nature of the shoreline and water quality degradation, the amount of SAV has been greatly diminished in the study area over time. Climate change and RSLC introduce greater uncertainty of continued trends where changes in temperature, precipitation, flooding patterns, and chemical composition could impose additional impacts on water quality, algal blooms and SAV/macroalgae distribution and abundance. RSLC could also potentially impact habitat suitability for seagrasses by increasing water depths resulting in reduced light penetration, photosynthesis, and productivity (Strange 2008; USACE 2014).
Coastal Zone Management Act Areas	CZMA areas within the SFWCFS study area are extensive and would continue to be impacted by coastal flooding and the increasing threats of climate change and RSLC.
Coastal Barrier Resources System Areas	No impact as Coastal Barrier Resource System Areas are not designated within the SFWCFS study area.
Noise	Emergency flood defense and response, and cleanup actions would require the use of a considerable amount of heavy equipment, which would generate noise. Buildings and infrastructure damaged by flooding would need to be demolished and the services provided would need to be relocated to other areas of the city, requiring new construction. The use of heavy equipment for flood defense on an emergency basis would very likely be substantial and could be any hour of the day or night. As such, there is a high potential for sleep interference due to emergency flood-defense and response activities. Equipment noise from redevelopment could occur at any scale or location within the city and, as such, impacts of construction noise would be expected.
Vibration	Heavy equipment types used for flood defense and demolition would create a perceptible level of vibration in the immediate vicinity of the equipment. It is unlikely that high-impact equipment, such as pile drivers, would be used for these types of activities, although jackhammers and hoe rams may be used for demolition. The relocation of services and properties would use heavy equipment that may potentially produce vibration near sensitive receptors and historic buildings that are more susceptible to building damage. The frequency and duration of these activities would be commensurate with flooding events, which could occur on an emergency basis within residential areas with a high risk or flooding. In situations where deep support systems are needed for building foundations, vibratory or impact pile driving may be used.

Resource	Summary of No Action Potential Impacts
Cultural Resources	Taking no action to prevent water intrusion into the San Francisco waterfront would degrade the access and use of historic properties as well as contribute to physical impacts and potential loss of resources in the Area of Potential Effect. Impacts would consist of erosion from wave energy and inundation. Resources in low-lying areas are at highest risk for adverse effects from the No Action Alternative. Resources along the waterfront in the Marina and Northeast planning districts would be at risk of flooding, particularly Fisherman's Wharf and the Embarcadero. Identified resources in the Mission, South of Market, and South Bayshore planning district are at the highest risk for adverse effects as they are currently the lowest-lying areas and already experience flooding.
Native American lands	Because no traditional cultural properties have been identified at this time, there would be no or negligible impact.
Socioeconomics & community	Flooding events would physically divide the waterfront neighborhoods, inhibiting community function and interaction throughout every reach, cause the displacement of various structures including residences, commercial and industrial businesses, and community and public facilities in every reach. These events would have a substantial adverse effect on economics, with the coastal neighborhoods experiencing loss in employment, school district funding, and county and city property and sales tax revenues.
Transportation	Several important transportation corridors would be impacted by rising sea levels and flooding that carry or provide access to vehicles, transit users (rail, bus and ferry), bicyclists and pedestrians. Flooding and associated freeway on- and off-ramp, road, sidewalk, and bike path closures and repairs would become increasingly common and gradual retreat of these facilities is expected to occur over time as RSLC continues. There would also be several transportation facilities for maintenance and operations such as the MUNI Municipal East facility that would be subject to flooding and infrastructure affected that would lead to a high degradation of transit by the end of century (SFMTA, 2022).
Utilities	The reliability of potable water is necessary for many industries in the study area. Climate change could lead to a short-term or long-term water shortage which could significantly impact potable water-dependent industries. RSLC would continue to stress the water main system, requiring increased investment into utilities such as sewage and potable water. Corrosion from rising groundwater could shorten life expectancy of buried pipes and require more frequent report or replacement. If buried pipelines are compromised, saltwater infiltration from increased groundwater levels may occur and affect the quality of drinking water. Increased precipitation would challenge the study area's combined stormwater and wastewater drainage system, potentially leading to more combined sewer overflows. An increase in sewer overflows can reduce water quality (EPA 2023).
Recreation & Access	The study area would continue to be at risk of flooding and could become more at risk due to RSLC and climate change, which may impede the public's access to recreation areas. Access to the waterfront is critical for the public in the study area but flooding under RSLC may render it inaccessible. Additionally, loss of important natural recreation areas would be expected with climate change due to erosion and subsidence. Access to local piers and wharves may be temporarily inaccessible with nuisance flooding or lost with repeated storms and RSLC.

Resource	Summary of No Action Potential Impacts
Aesthetics	The aesthetics are expected to continue as described in the existing conditions section over time. No significant impacts are expected to the aesthetics in the study area, though climate change and/or RSLC could cause damage to structures that contribute to the aesthetics of the waterfront from repeated nuisance flooding or more significantly from storms.
HTRW	Capped and un-capped HTRW areas would be exposed to flooding and erosion from RSLC, which could result in releasing contaminants that impact water, soil, and sediment quality, as well as human health.
Land Use	Land use changes would occur either directly or indirectly as the sea levels rise. As the water levels begin to encroach into the developed waterfront, some buildings and uses are expected to be abandoned in these flooded parcels. From this retreat away from the San Francisco Bay, other parcels may alter their land use due to decreased access or connectivity from regular flooding, and transition to a land use that is better able to accommodate flooding or reduced connections. Although floodproofing some buildings can delay retreat, substantial changes to buildings, building demolition, and movement of residences, businesses, and industrial/institutional uses would be expected particularly in the Mission Creek and Islais Creek low-lying areas. Land uses included in current general plans, specific area plans, and zoning may not be achievable in the increasingly inundated locations, and planning for where these uses may instead be accommodated would be needed.
Public Health & Safety	The study area would continue to be at risk of flooding and could become more at risk due to RSLC and climate change, which may impede the publics access to critical safety infrastructures (i.e., hospitals) or the ability of public safety entities (i.e., ambulance, police) to aid the public. Currently planned life safety measures in the event of a major earthquake may not be accessible due to increased flooding. Nuisance flooding would make access to health and safety infrastructure troublesome, while severe flooding from storms may render them inaccessible. Increased flooding is likely to release contaminants from HTRW sites that pose a risk to human health.

The No Action Alternative was identified as the USACE low RSLC curve NED Plan. The No Action alternative is not discussed further in subsequent sections as summaries are provided in **Table D.1-10**.

4.7 Air Quality

See Annex D.1.1 for a discussion of the impacts of the alternatives on Regional Air Quality.

4.8 Changing Meteorological Conditions and Relative Sea Level Change

Impacts attributed to changing meteorological conditions were assessed quantitatively and qualitatively for the action alternatives by reviewing state and Federal reports, available data, and published literature.

Significance Criteria

Effects on climate were considered significant if implementation of an alternative plan would result in any of the following:

- **CC-01:** Directly or indirectly exceed applicable Federal or state GHG standards.
- **CC-02:** Conflict with an applicable plan, policy, or regulation adopted to reduce GHG emissions.

NEPA considers that hydrometeorological environmental effects can include both the potential effects of a proposed action on these conditions and the implications of changing conditions on the performance of the proposed action. Thus, hydrometeorological conditions are analyzed from these two perspectives when evaluating environmental consequences of a project.

NEPA does not specify significance thresholds that may be used to evaluate the effects of a proposed action on hydrometeorological conditions, rather, the appropriate approach to evaluate a project's impact is still under development. However, the Forest Service developed guidance for considerations under NEPA, which focuses on 1) the effect of the project on hydrometeorological change through greenhouse gas (GHG) emissions, and 2) the effect of these conditions on the project (USFS, 2009). GHG emissions may include short-term impacts and alteration to the carbon cycle caused by fuels or extraction of fossil fuels and minerals. Hydrometeorological conditions could affect the environment in such a way that it would impact the purpose and need of the project. For example, habitat suitability could be altered for target species or ecosystems in restoration efforts or increase flooding in a region that may render a project less successful. Finally, the implications of hydrometeorological changes for the environment with the proposed action should be considered with respect to other resources and/or actions that could lead to cumulative effects in the project area. For example, the potential for the project to lead to habitat fragmentation exacerbated by these conditions that could lead to listing of a species under the Endangered Species Act (ESA; Brandt and Schultz, 2016).

EPA reinstated California's authority under the Clean Air Act (CAA) to implement its own GHG emission standards and zero emission vehicle (ZEV) sales mandate in March 2022 (87 FR 14332). California passed legislation requiring the state to reduce its overall GHG emissions to 1990 levels by 2020 and 40% below 1990 levels by 2030 (Senate Bill 32; Assembly Bill 32). Additionally, the California Air Resources Board (CARB) was appointed to develop policies to achieve this goal. The 2030 target was further refined with Assembly Bill 1279 and E.O. B-55-18 which seeks carbon neutrality for the state by 2045. In 2020, CARB set the GHG emission limit for the state at 431 million metric tonnes of carbon dioxide equivalent ($MMTCO_2e$; CARB 2023).

In many natural habitats, GHG emissions can be combatted or reduced through the process of carbon sequestration – the practice of removing carbon from the atmosphere and storing it (USGS, n.d.). Biological carbon sequestration occurs in aquatic and vegetated habitats that have microbial communities which can break down carbon, plants to store carbon in their tissues, and carbon that can be dissolved in marine and aquatic water (USGS, n.d.). Blue carbon refers to atmospheric carbon that is captured by ocean and wetland habitats (USGS, n.d.). Saline marshes contribute 50% of carbon burial in marine sediments, making these habitats a critical component of CO_2 sinks and reservoirs globally for GHG emissions (Duarte et al. 2013). Coastal wetlands efficiently preserve carbon through dense foliage and root networks that protect carbon deposited in the soil from erosion. Restoring salt marshes is a Blue Carbon initiative, proposed in 2009 (Nelleman et al. 2009), to help reduce GHG emissions through natural ecosystem enhancements (Duarte et al. 2013).

By identifying the level of GHG emissions and carbon sequestration, in relative terms, it can be determined or suggested whether an action would have net adverse or beneficial impacts to hydrometeorological conditions.

ER 1100-2-8162, *Incorporating Sea Level Change in Civil Works Programs*, discusses the need to consider future sea level change impacts to coastal and estuarine zones in Civil Works projects due to the likelihood of continued or accelerated mean RSLC through the 21st century and beyond. Global average sea level is rising and is expected to rise at greater rates in the future (Parris et al. 2012), though this is not expected to be uniform along U.S. coasts. Higher sea levels lead to greater coastal erosion, change sediment transport and tidal flows, exacerbate flooding frequency, increase landward migration of barrier shorelines, fragment islands, and expand saltwater intrusion to aquifers and estuaries (IPPC 2007; Titus et al. 2009; Irish et al. 2010; Burkett and Davidson 2012; Rotzoll and Fletcher 2013). In San Francisco, sea level rose 9 inches between 1854 and 2016 (Gonzalez et al. 2018).

The closest NOAA tide gauge to the study area is the San Francisco Presidio (ID: 9414290). USACE has three RSLC scenarios (low, intermediate, and high) that are predicated on data from the National Research Council and IPCC. USACE policy does not ascribe likelihood for any of the future RSLC curves, because it is problematic to reliably assign a specific likelihood for future RSLC and ascertain its effect on a given coastal project. Instead, USACE guidance applies a scenario-based approach for evaluating RSLC risk on project performance which is based on all three USACE RSLC curves. Additional details about the USACE RSLC can be found in Appendix J. **Figure D.1-18** presents the USACE RSLC curves for the study period.

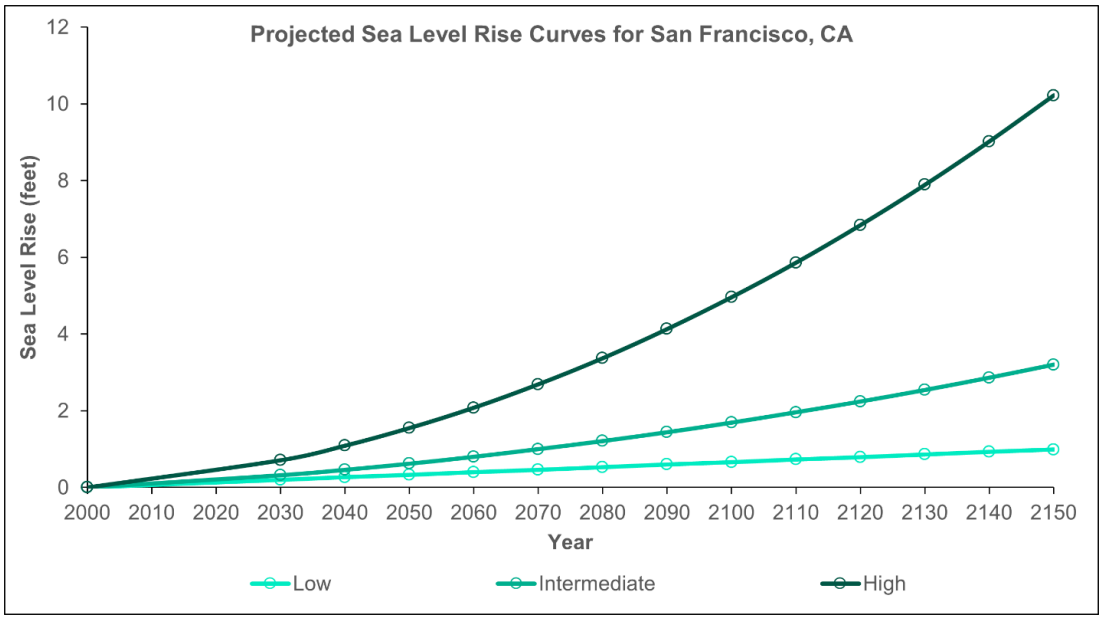


Figure D.1-18: USACE Relative RSLC Curves Compared to Mean Sea Level Change

Throughout the construction and life of the project, RSLC and hydrometeorological conditions are anticipated to continue causing increases in mean water elevation, precipitation, extreme events, and storm severity and frequency. Construction of measures are expected to mitigate damage from anticipated RSLC and hydrometeorological conditions at varying rates of RSLC. USACE projects RSLC to range in an increase from 0.93 feet for the low scenario, 2.86 feet for the intermediate, and 9.02 feet for the high scenario by 2140 in the study area. Coastal hazards and storms would cause flooding at increased heights and over larger areas than in the past as RSLCs. It is also projected that frequency and intensity of coastal storms and precipitation would increase over time (Chung et al. 2021).

4.8.1 Construction Impact Summary

The SFWCFS study is unique in that it has designed Action Alternatives predominantly to address the impacts of RSLC. Thus, the Action Alternatives are evaluated considering all three RSLC scenarios for FWP conditions. As stated throughout the final IFR/EIS, measures in each alternative are designed to an elevation relative to the RSLC scenarios. As such, the alternatives performance against different rates of RSLC impacted the overall score for this resource, as it was assumed if flooding breached the measure, this would lead to adverse impacts for the study area. However, for this analysis, it was assumed the measures would perform adequately under the RSLC scenario they were designed for.

Temporary localized emission increases would be produced from diesel-powered construction equipment working at the various project locations such as, operating on- and off-road mobile sources, heavy machinery, non-mobile mechanized equipment, and

support vehicles; released CO_2 embedded in steel and concrete during fabrication; and energy consumption (e.g., use of generators). The localized emission increases from the diesel-powered equipment would last only during the project's construction period in each location and then end when the project phase is complete, thus any potential impacts would be temporary in nature and geographically dispersed over the project duration. At final report, the study's General Conformity-related annual emissions do not exceed the de minimis threshold levels for the relevant pollutants; thus, a General Conformity Determination is not required for compliance with the CAA (Annex D.2.1).

The generation of GHG emissions associated with the project's construction activities would be temporary in nature, spanning only the construction period. The primary GHG emitted from diesel-fueled equipment is carbon dioxide (CO_2). Although nitrous oxides (N_2O) and methane (CH_4) have significantly higher global warming potentials (298 times and 25 times greater than CO_2 for N_2O and CH_4, respectively), they are emitted at significantly lower rates, resulting in minimal fractional increases in carbon dioxide equivalents (CO_2e) when compared with CO_2 alone. Other GHGs (e.g., hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) are typically associated with specific industrial sources and processes, thus would not be emitted during construction. Upon construction completion, all GHG emissions would cease, and the area would return to baseline conditions. There are no apparent negative impacts to carbon sequestration (e.g., loss of wetlands) that would result from implementation of the Action Alternatives; rather a net gain in carbon sequestration benefits is anticipated with the addition of marsh habitat through NNBFs features. On a global scale, however, this sequestration contribution would be negligible.

4.8.2 Operations and Maintenance Summary

The SFWCFS includes protection of critical infrastructure, business, life safety, residents, transportation corridors, and natural environments through a variety of Coastal Flood Risk Management measures and NNBFs. Grey features (e.g., levees, walls) all contribute to production of emissions during O&M activities, while NNBFs contribute to carbon sequestration. All features contribute to structural resiliency during storms and flooding events. The protection of the infrastructure and natural features provided by the project would minimize future storm damage further inland and associated reconstruction emissions. As a result, generation of emissions, including CO_2, during future emergency response clean-up and restoration of the coastline would be limited or avoided.

4.8.3 Recommended Plan

The TNBP is anticipated to have no to moderate to high impacts on hydrometeorological conditions during construction and operations and maintenance activities. **Table D.1-11** predominantly reflects the impact to GHG emissions as the TNBP is designed to sustain RSLC under the intermediate and high scenarios. Details of the GHG emission estimates can be found in Annex D.1.1.

Table D.1-11: Summary of Changing Meteorological Conditions and RSLC Impacts Associated with the TNBP

TNBP Changing Meteorological Conditions and RSLC Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	1	3	4	3	3	3	3	4	3+	3+	3+	3+	1
Construction/Footprint (Subsequent Actions)	4	3	4	1	1	3	1	4	3+	3+	3+	3+	3+
O&M Assumptions	1	2	2	2	2	2	2	2	2	2	2	2	2
Mitigated Rating	*3*	*2*	*3*	*2*	*2*	*2*	*2*	*3*	*2*	*2*	*2*	*2*	*2*

4.8.4 Alternative B

Alternative B is anticipated to have low to moderate to high impacts on hydrometeorological conditions. Alternative B is nonstructural and includes floodproofing, modifying, or relocating buildings and infrastructure to reduce flood risks. As sea levels rise, areas with higher flood risks could be managed for responsible retreat, while areas with lower risks could be floodproofed or modified. NNBFs would be added to retreat areas to reduce flood risks, while policy changes would be implemented to allow for increased housing density and business relocations in inland areas. Essential utilities and major transportation and transit corridors would be relocated or modified to continue providing service. Details of the GHG emission estimates can be found in Annex D.1.1.

4.8.5 Alternative F

Alternative F is anticipated to have no to moderate to high impacts on changing meteorological conditions during construction and operations and maintenance activities. **Table D.1-12** predominantly reflects the impact to GHG emissions as Alternative F is designed to sustain RSLC under the intermediate and high scenarios. Details of the GHG emission estimates can be found in Annex D.1.1.

Table D.1-12: Summary of Changing Meteorological Conditions and RSLC Impacts Associated with Alternative F

Alternative F Changing Meteorological Conditions and RSLC Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	4	3	4	4	3	3	4	3+	3+	3+
O&M Assumptions	1	2	2	2	2	2	2	2	2	2
Mitigated Rating	3	2	3	3	2	2	3	2	2	2

4.8.6 Alternative G

Alternative G is a retreat strategy that shifts the line of defense the furthest inland of any alternative. This alternative allows for the greatest flooding under the high RSLC scenario; however, it is not intended to flood beyond the line of defense. **Table D.1-13** summarizes the impact scores of hydrometeorological conditions and RSLC associated with Alternative G. Impact producing factors are air emissions as indicated in the Air Quality section, and GHG emissions, thus alternative impact scores are the same as those in Annex D.1.1. Details of the GHG emission estimates can be found in Annex D.1.1.

Table D.1-13: Summary of Changing Meteorological Conditions and RSLC Impacts Associated with Alternative G

Alternative G Changing Meteorological Conditions and RSLC Impact Rating by Measure		Levee	Bridge raise	Bulkhead wall/Seawall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*

Construction/Footprint		3	3	4	3	3	4	3+	3+	3+	3+	3+
O&M Assumptions		2	2	2	2	2	2	2	2	2	2	2
Mitigated Rating		2	2	3	2	2	3	2	2	2	2	2

4.8.7 Mitigation

While construction activities associated with the No Action cannot be defined and impacts to hydrometeorological conditions are fairly speculative at the current level of detail, mitigation measures are available to reduce construction emissions as necessary.

For Alternatives B, F, G, and the TNBP, the avoidance and minimization measures that follow would reduce impacts.

After detailed construction assessments are conducted, and impacts are identified, if necessary, measures to reduce GHG emissions would be included. Reductions in emissions can be accomplished by the measures listed below, as feasible. The list of strategies were informed by measures recommended by the BAAQMD (2023) to reduce construction-generated GHG emissions; as such, these measures should be updated as project-specific analyses are conducted.

- Require all on-road heavy-duty trucks to be zero-emission vehicles or meet the most stringent emissions standard at the time of construction, such as a model-year (MY) standard, as a condition of contract.
- Minimize idling time, either by shutting equipment off when not in use or reducing the time of idling to no more than 2 minutes (a 5-minute limit is required by the State airborne toxics control measure [Title 13, Sections 2449(d)(3) and 2485 of the California Code of Regulations]). Provide clear signage that posts this requirement for workers at the entrances to the sites and develop an enforceable mechanism to monitor idling time and ensure compliance with this measure.
- Prohibit off-road diesel-powered equipment from being in the “on” position for more than 10 hours per day.
- Use CARB-approved renewable diesel fuel in off-road construction equipment and on-road trucks.
- Use EPA SmartWay-certified trucks for deliveries and equipment transport.
- Require all construction equipment to be maintained and properly tuned in accordance with manufacturer’s specifications. Equipment should be checked by a certified mechanic and determined to be running in proper condition prior to operation.

- Where grid power is available, prohibit portable diesel engines and provide electrical hook-ups for electric construction tools, such as saws, drills, and compressors; use electric tools whenever feasible.
- Encourage and provide carpools, shuttle vans, transit passes, and/or secure bicycle parking to construction workers and offer meal options on-site or shuttles to nearby meal destinations for construction employees.
- Reduce electricity use in construction offices by using LED bulbs, powering off computers every day, and replacing heating and cooling units with more efficient ones.
- Minimize energy used during site preparation by deconstructing existing structures to the greatest extent feasible instead of demolishing structures and discarding all materials.
- Recycle or salvage non-hazardous construction and demolition debris, with a goal of recycling at least 15 percent more by weight than the diversion requirement in Title 24.
- Use locally sourced or recycled materials for construction materials (goal of at least 20 percent, based on costs for building materials and volume for roadway, parking lot, sidewalks, and curb materials). Wood products used should be certified through a sustainable forestry program.
- Use low-carbon concrete, minimize the amount of concrete used, and produce concrete on-site if it is more efficient and lower emitting than transporting ready-mix.
- Develop a plan to efficiently use water for adequate dust control because substantial amounts of energy can be consumed during the pumping of water.

When applicable, purchase local carbon offsets to the greatest extent practicable as required by Federal regulations or USACE policy. Future construction located within 1,000 feet of sensitive receptors would be required to perform a health risk assessment (HRA). If the HRA demonstrates health risks would be significant, additional feasible on- and off-site mitigation shall be analyzed to help reduce risks to the greatest extent practicable. Potential measures may include the following:

- Create buffers between residences and construction (e.g., vegetative barriers or other temporary buffers).
- Use construction equipment with the highest commercially available tier of emissions controls (in 2023, this is Tier 4).
- Use equipment during times when receptors are not present (e.g., when school is not in session or during non-school hours), as feasible.
- Establish staging areas for the construction equipment that are as distant as possible from off-site receptors, including existing residences.

- Where feasible, use haul trucks with on-road engines instead of off-road engines, even for on-site hauling.
- Provide financial assistance for high-efficiency air filtration systems to those affected for use in residences.
- Implement dust-suppression site controls to limit the exposure to potential contaminated soils, as necessary. Refer to the Hazardous, Toxic, and Radioactive Waste (HTRW)/soil quality section, as needed.

4.9 Geology

Direct and indirect effects on geologic resources were considered significant if implementation of an alternative plan would result in any of the following:

- **GEO-01:** Substantially alter the existing drainage pattern of the site or area that would result in substantial erosion or siltation on- or off- site;
- **GEO-02:** Increase in channel and/or bank erosion;
- **GEO-03:** Substantial loss of sediment supply;
- **GEO-04:** Substantially modify the geology which would induce seismic activity.

Impacts to geology were qualitatively described.

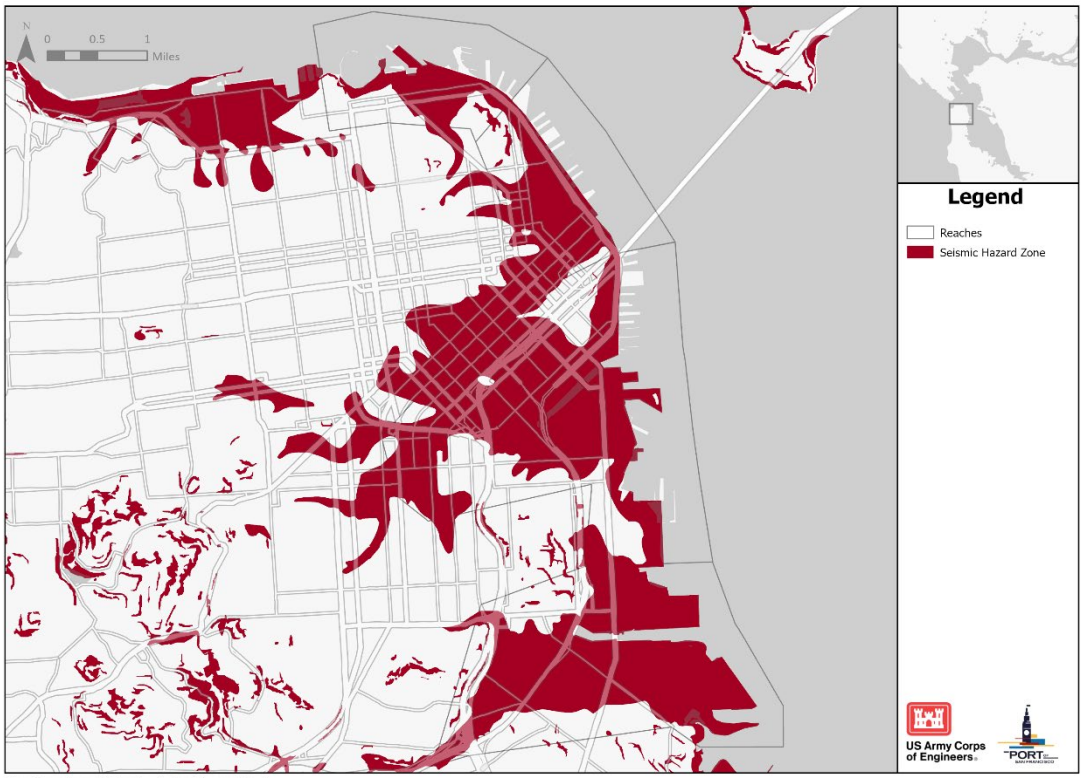
4.9.1 Construction Impact Summary

Excavation actions could expose shallow subsurface geologic layers, which may require drilling through, if necessary, to reach the design depths. Impacts would be localized and none of the proposed measures would affect regional geology. To raise surface elevation, commercially sourced fill material would be placed on excavated construction sites which introduces new surface geologic and soil layers. However, the addition of these soils is not expected to induce any seismic related failures or risks.

All Action Alternatives would design project features in accordance with USACE seismic regulations, policy, and design methodologies to provide measures that meet required seismic performance criteria including strength, ductility, displacements, mitigation, and overall performance standards. No seismic hazard would be induced by the construction of any project feature.

The features are proposed to be constructed along a seismically active area (**Figure D.1-19**) that could experience strong to violent ground shaking from a major earthquake. The San Francisco Bay area has a 72 percent chance of experiencing an earthquake of 6.7 magnitude or higher over the next 30 years, with the Hayward and Calaveras being the most likely faults to cause such an event (SFP 2022). Strong seismic shaking could adversely impact a proposed alternative by damaging foundations, misaligning sheet piles, dislodging stone/concrete structures, or causing fill settlement. Additionally, measures could be damaged by soil displacement caused by

lateral spreading in areas of liquefiable soils. Measures more vulnerable to damage from seismic activity are being reinforced with ground improvements to reduce the risks of damage from seismic ground shaking and lateral ground movement. Construction of features in the study area would have ***no impact*** on the risk of fault rupture, landslides, substantial soil erosion or loss of topsoil, expansive soils, or directly or indirectly destroy unique paleontological or geological resources.



Source: City of San Francisco (https://data.sfgov.org)

Figure D.1-19: Seismic hazard zone in the study area

4.9.2 Operations and Maintenance Impact Summary

O&M activities are anticipated to have ***no impacts*** to geologic resources. Maintenance actions would occur on the surface, thus, would not impact geologic structure or integrity, nor is it expected to induce seismic activity.

4.9.3 Recommended Plan

The TNBP is anticipated to have no to low impacts on geologic resources during construction of measures and operations and maintenance activities (**Table D.1-14**).

Table D.1-14: Summary of Geology Impacts Associated with the TNBP

TNBP Geology Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	1	2+	2+	2	2	2+	1	2+	2+	2+	2+	2+	2+
Construction/Footprint (Subsequent Actions)	2	2+	2+	1	1	2+	1	2+	2+	2+	2+	2+	2+
O&M Assumptions	1	1	1	1	1	1	1	1	2+	2+	2+	2+	2+
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*1*	*1*	*1*	*1*	*1*

Construction of features that overlap with Alternative F and G are anticipated to have similar impacts as those described in the sections below. Unique to the TNBP is the addition of sheetpile walls and deployable flood gates. Sheetpile walls are anticipated to have similar impacts as those described for vinyl sheetpile walls in levee features in Alternative F. Deployable flood gates would require excavation, fill, and grading to prepare the construction site for installation which would have local minor impacts to geology. Operations and maintenance of the gates are anticipated to have no impacts to geology as they occur on the surface and should not disturb underlying soils. Overall, impacts are anticipated to be similar during construction in 2040 and 2090 and would be ***less than significant*** for both periods.

4.9.4 Alternative B

Alternative B is not anticipated to have any additional impacts beyond minor surface work for infrastructure that is being demolished or moved elsewhere, which may include some excavation and use of heavy machinery. Soil movement would be limited to upper layers to remove structure debris and regrade the construction site. Thus, Alternative B is expected to have ***no impacts*** to geologic resources.

4.9.5 Alternative F

Alternative F impacts to geology range from no to low adverse impacts, as well as have some beneficial impacts (**Table D.1-15**). Impacts to geology are predominantly attributed to seismic ground improvements needed before construction of the features.

Table D.1-15: Summary of Geology Impacts Associated with Alternative F

Alternative F Geology Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	2	2+	2+	2+	2+	2+	1	2+	2+	2+	2+
O&M Assumptions	1	1	1	1	1	1	1	1	2+	2+	2+
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*1*	*1*	*1*

Ground improvements are needed to stabilize existing soils to address seismic concerns associated with the new loads born to the underlying geology. Ground improvements could be completed with a variety of techniques, as described in the construction techniques section above (section 4.3), which would be determined during the design phase. These techniques reinforce soils, stabilize slopes, support embankments, and mitigate for liquefaction after hardening (Denies and Huybrechts 2015); however, adverse impacts to local geology and soils are also expected. **Table D.1-8** provides the acreage anticipated to be impacted by ground improvements for Alternative F in 2040. Alternative F is anticipated to have lesser impacts to local geology than Alternative G and the TNBP in 2040 and 2090 given the smaller footprints.

Addition of cementitious or binding materials would change the geologic signature and structure and would destroy any soil development or composition that was present. As existing soils are blended with a cementitious material, or binder, the soil composition would no longer resemble the pre-existing structure. Mechanical equipment (e.g., auger, cutter machine) physically dislodges soil to mix with a binding material, which would displace existing soils and distribute them along varying depth gradients. Additionally, the binding material introduced into the soil would render it unsuitable for soil invertebrates and may lead to lower soil biodiversity.

Soil represents one of the largest reservoirs of biological diversity and is responsible for critical ecosystem functions such as nutrient cycling, organic matter decomposition, soil formation, and plant performance (Bardgett and Van Der Putten 2014). Soil invertebrates enhance water filtration and retention, and removal of pathogens, nutrients, and contaminants in urban areas. Removal and/or replacement of soil and compaction affects soil biodiversity, with subsequent impacts to ecological function (Sun et al. 2023). The ground improvements are expected to have localized, minor, short-term impacts to soil composition, as well as soil biodiversity. Although the ground improvements are anticipated to be long-term solutions, the impacts to soil biodiversity are expected to be short-term and ***less than significant***, as soil invertebrates would adapt to the change in environment and likely return to pre-existing conditions over time. The soil impacted in the study area would be artificial fill overlying bay mud deposits (Baldwin et al. 2018), thus, ***no impacts*** to native soils and geology are anticipated as they are too deep for the construction actions to penetrate.

The linear extent of ground improvements ranges from 50 ft to 100 ft wide depending on proximity to the waterfront. Additional details for ground improvements designs and dimensions can be found in *Appendix B: Engineering*. These improvements are intended to reinforce liquefiable soil hazards to reduce the risk of damage from seismic ground shaking and lateral ground motion. The reinforced soils ensure that features, and the foundations, could withstand a strong to violent ground shaking seismic event without the underlying soils experiencing loss of bearing strength, lateral spreading, or seismically induced settlement from liquefaction. As such, the construction of these features is anticipated to have a beneficial impact to geologic resources in the long-term. Final design geotechnical investigations would be conducted during the design phase to evaluate ground shaking and liquefaction potential to verify that foundation designs and ground improvements would be adequate to protect the features.

Levees with a height greater than 4 ft would require the installation of a vinyl sheet pile wall driven into the ground for stabilization. Vibratory hammers or impact hammers would be used to install the sheet piles which generate ground vibrations during operation. The scale and impact of ground vibrations is measurable; however, these are typically used to determine safe operating distances from existing structures rather than impacts to geology (e.g., Weng et al. 2020). The vibrations can dislodge soils and geologic layers locally as sheet piles are driven into the ground, as well as change the interaction of neighboring soils once sheet piles are present. Overall, the use of impact/vibratory hammers are anticipated to have direct, minor, localized, short-term, adverse impacts to geologic structure and soil composition at the surface in the study area. These impacts would be ***less than significant***.

Sheet pile walls are expected to reduce erosion on embankments with soils exposed to wave energy once installed. In this instance, soil erosion is improved, which would have direct, minor, localized, short-term, beneficial impacts to geology along the shoreline.

Best Management Practices (BMPs) used to manage soil erosion and sediment loss can be followed to further minimize impacts to geologic resources. Refer to the Mitigation section for additional information.

4.9.6 Alternative G

Table D.1-16 summarizes the impact scores from construction to geologic resources, which is driven by those described in Alternative F. Impacts to geologic resources range from no to low for Alternative G.

Table D.1-16: Summary of Geology Impacts Associated with Alternative G

Alternative G Geology Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Foot print	2+	2+	2+	2+	2+	1	2+	2+	2+	2+	2+	2+
O&M Assumptions	1	1	1	1	1	1	1	1	2	2	2	2
Mitigated Rating	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*

Alternative G measures would have similar impacts as those described in Alternative F, with a greater impact from seismic ground improvements. Seismic ground improvements span nearly twice the total geographic extent as Alternative F (**Table D.1-8**), ranging from 50 ft to 100 ft wide dependent on proximity to the waterfront. However, these impacts are anticipated to be ***less than significant*** with the use of BMP's (see Mitigation). Beneficial impacts are expected because the reinforced soils aim to avoid measure failure in a seismic event.

4.9.7 Mitigation

No compensatory mitigation is expected to be required for impacts to geologic resources. However, avoidance and minimization measures would be used to reduce impacts to soils, sediments, and geology to the greatest extent practicable.

BMPs would be used to manage sediment and erosion during the construction of any of the alternatives. Construction period preparedness and weather condition BMPs control erosion and sediment through management and monitoring that includes:

- Ensuring the contractor has the appropriate equipment and materials available at the start of construction to complete the project within the planned time frame.
- All disturbed areas are treated with erosion control measures.
- Coordination between vegetative planting and grading is in place prior to construction.
- Daily weather monitoring for possible precipitation events and a plan in case of significant rainfall.
- Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control erosion, storm water runoff, sedimentation, and other construction-related pollutants during all phases of construction, until the construction is complete and all disturbed areas are permanently stabilized throughout the project area.

The short-term increase in sediment would be reduced by implementing the following erosion control measures during construction:

- All soils would be stabilized within 14 days of completed work.
- Construction equipment would be limited to the actual area being disturbed and vehicles may not travel in areas outside of designated staging areas or access routes.
- Short-term staging of soil material (less than 1 week) would be surrounded by a silt fence, fiber rolls, or other perimeter.
- Long-term staging of soil material (longer than 1 week) would be placed away from surface waters, vegetated, and surrounded by a levee perimeter to control runoff and erosion.
- Excavation would be limited to the extent practicable. All excavated material that is not relocated to another portion of the project area would be completely removed to a disposal site located outside the study area.
- Existing vegetation would be left in place to the maximum extent possible.
- Bare ground would be monitored for dryness and watered, if necessary, to reduce wind and water erosion.
- The contractor would be required to conduct water quality tests specifically for increases in turbidity and sedimentation caused by in-water construction activities. Water samples for determining background levels would be collected in San Francisco Bay in the vicinity of the construction site. Testing to establish background levels would be performed at least once per day when construction activity is in progress. The contractor would monitor turbidity and settleable solids at least daily and turbidity at least hourly when a

turbidity plume is visible. If turbidity limits are exceeded, the contractor would slow the rate of earthwork or use other means to comply with the requirements, including stopping construction activities until the plume has cleared.

- Sediment barriers would be installed on graded or other disturbed slopes, as needed, to prevent sediment from leaving the project sites and entering nearby surface waters.
- The contractor would have a designated vehicle and equipment maintenance staging area that is self-contained to protect groundwater, surface water, and soils from contamination.
- Construction traffic would be restricted to predetermined routes.
- Traffic during wet weather or within the wet zone would be minimized.
- Pivoting excavators would be used within the wet zone to prevent rutting and excess erosion.
- A spill prevention and containment countermeasure plan that addresses all potential mechanisms of contamination would be developed. Suitable containment materials would be on site in the event of a spill. All discarded material and any accidental spills would be removed and disposed of at approved sites.
- Equipment and vehicles operated within the floodway would be checked and maintained daily to leaks of fuels, lubricants, and other fluids to surface waters. Hardened armoring would be used in areas susceptible to high erosion rates as identified by hydrologic and sedimentation modeling.

4.10 Soils and Mineral Resources

Impacts to soils and mineral resources were assessed qualitatively and quantitatively. A summary of impacts is described in the section below.

Significance Criteria

The following significance criteria were used to determine significances:

- **MIN-01:** Surface access to mineral estate would be severely limited impacting the mineral estate's right to freely use the surface estate to the extent reasonably necessary for the exploration, development and production of the oil and gas under the property.

4.10.1 Construction Impact Summary

Soils would be disturbed, and the topsoil and several inches to feet of subsoil would be removed to construct new access roads, flood risk features, and any staging areas. During removal, there is a chance that shallow soil horizons could be mixed, resulting in

the blending of soil characteristics and types. This blending would modify physical characteristics of the soil structure, texture, and rock content, potentially leading to a loss of soil productivity and reduced reclamation potential. Native soils could be impacted during excavation and replaced with fill material or buried during foundation installation of project measures. This would be a long-term permanent impact to soils within the project construction footprint.

Compaction from repetitive use or use by heavy equipment would reduce aeration, permeability, and water-holding capacity of soils. An increase in surface runoff can be expected, potentially leading to erosion during construction. After heavy precipitation events, additional soil impacts may occur, such as soil saturation and water erosion. When saturated areas are used, tire ruts develop, increasing the compaction rate and affecting the ability for vegetation to reestablish unless mitigated. Wind erosion would be expected to be a minor contributor to soil erosion except for dust from vehicle traffic traveling on dry access roads during construction.

The magnitude, extent, and duration of construction-related impacts depend on the erodibility of the soil; proximity of the construction activity to receiving waters; and the construction methodologies, duration, and season.

To avoid and minimize these potential impacts, a National Pollutant Discharge Elimination System (NPDES) Construction General Permit from the Waterboard would be required. To obtain this permit, a contractor would be required to prepare and implement a SWPPP that would incorporate erosion and sedimentation control measures to minimize the potential for contamination of water resources. A SWPPP typically specifies BMPs they would implement to minimize disturbances to soils, such as minimizing ground disturbance to the smallest extent necessary, utilization of existing access roads and previously disturbed areas (e.g., parking lots) for staging, implementation of silt fences to minimize soil movement, and restoration actions for disturbed areas. Similar BMPs to those described in the Geology Mitigation section would also apply to soils to reduce project related impacts.

Based on existing conditions, contaminated soils are present within the project area. As additional details and site-specific testing can be done, soil and sediments may be characterized prior to construction per existing Federal and State regulations.

All alternatives are anticipated to have ***no impact*** on mineral resources, thus, it is not discussed further. The Burton Act reserved mineral rights to the State of California, thus, accessing minerals would be done so in a manner as to not interfere with any lease, franchise, permit, or license. Additional information can be found in *Appendix F: Real Estate Plan*.

4.10.2 Operations and Maintenance Summary

Operations and maintenance of the proposed measures are expected to have no to low impacts to soils and mineral resources overall. The majority of adverse impacts would occur during construction when soils are at the highest risk of being disturbed. Some features may require additional fill material (e.g., marsh restoration) with RSLC;

however, this would likely be placed on existing fill material rather than mixing or replacing native soils.

4.10.3 Recommended Plan

Impacts to soils and minerals would be the same as those described in the construction and O&M summary sections, and Alternatives B, F, and G. Impacts ranged from no to low to soils and mineral resources for the TNBP (**Table D.1-17**).

Table D.1-17: Summary of Soil and Mineral Resources Impacts Associated with the TNBP

TNBP Soils and Mineral Resources Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	1	2	2	2	2	2	1	2	2+	2+	2+	2+	1
Construction/Footprint (Subsequent Actions)	2	2	2	1	1	2	1	2	2+	2+	2+	2+	2+
O&M Assumptions	1	1	1	1	1	1	1	1	2+	2+	2+	2+	2+
Mitigated Rating	2	2	2	2	2	2	1	2	1	1	1	1	1

Adverse impacts to the resources associated with construction activities in the TNBP would be comparable to those of Alternative G, but more than those for Alternative F in 2040 (**Table D.1-8**). The TNBP has a greater spatial extent of measures that would have adverse impacts to soils (e.g., seismic ground improvements, roadway impacts, levees). In 2090, the TNBP would have greater impacts to soils than Alternative F and G. The TNBP features have a greater impact than measures from Alternative F, particularly in reaches 3 and 4 where new feature construction would need to occur. features are comparable in size between the TNBP and Alternative G in 2090; however, Alternative G adds a considerable amount of NNBFs that would have long-term beneficial impacts to soils and minerals that the TNBP does not offer.

No adverse impacts are anticipated from construction of the coarse beach; however, the vertical shoreline construction is likely to have low adverse impacts during installation.

Planted levees are anticipated to have beneficial impacts to soils as the vegetation would help to reduce soil loss and erosion. In general, NNBFs are anticipated to have long-term beneficial impacts to soils by reducing loss through erosion protection.

4.10.4 Alternative B

Alternative B is not anticipated to have any additional impacts beyond minor surface work for infrastructure that is being demolished or moved elsewhere, which may include some excavation and use of heavy machinery. Soil movement would be limited to upper layers to remove structure debris and regrade the construction site. Thus, Alternative B is expected to have ***less than significant*** impacts to soils and mineral resources.

4.10.5 Alternative F

Impacts to soils are anticipated to be similar to those described in the Geology section, ranging from no to low impacts (**Table D.1-18**).

Table D.1-18: Summary of Soil and Minerals Impacts Associated with Alternative F

Alternative F Soils and Minerals Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	2	2	2	2	2	2	1	2	2+	2+	2+
O&M Assumptions	1	1	1	1	1	1	1	1	2+	2+	2+
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*1*	*1*	*1*

The greatest impacts are expected during construction activities, predominantly from earthwork as described in the construction impact summary above. The adverse impact to soils differs from geology because earthwork would disturb soils during construction of any of the measures, as well as during some O&M activities. O&M for levees could result in the need for additional fill material which would require earthwork similar, but likely less impactful, to that used during initial construction. Maintenance of ecological armoring would require placement of additional stone along banks that has the potential to compact soils while using heavy machinery, and or, erosion if the soil becomes too

saturated. No impacts are expected to occur with construction of vertical walls and curb extensions as these activities should not disturb soils. Curb extensions would be constructed around piers in 2040 which would not have contact with soils. In 2090, vertical walls are intended to be added to the top of existing features and should not require disturbance of underlying soils.

It was assumed fill material would be purchased from commercial sources, but there is potential to beneficially use dredged material if it is determined to be suitable for construction. Adverse impacts to soils and minerals are expected to be temporary and localized to the construction area while earthwork activities are underway. Although permanent changes to soil composition would occur, the construction area would be returned to pre-existing conditions with native vegetation, such that permanent adverse impacts are not realized. Thus, construction effects to soils are anticipated to be ***less than significant***.

NNBFs, such as ecological armoring and marshes, are anticipated to have long-term beneficial impacts to soils as these habitats are known to reduce the loss of sediment transfer through erosion protection. Ecotone levees could improve soil quality by adding new areas of native vegetation that offer ecologically favorable conditions by improving nutrient transfer, oxygenating soils, moisture retention, offer refuge and forage space, as well as potentially increasing soil biodiversity. Additionally, native vegetation planted in ecotone levees should alleviate soil erosion and loss. This would have long-term beneficial impacts to soils.

4.10.6 Alternative G

Impacts to soils are expected to be the same as those described in the Geology section for Alternative G (**Table D.1-19**).

Table D.1-19: Summary of Soil and Mineral Resource Impacts Associated with Alternative G

Alternative G Soil and Minerals Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	2	2	2	1	2	2+	2+	2+	2+	2+
O&M Assumptions	1	1	1	1	1	1	1	1	2	2	2	2

Alternative G Soil and Minerals Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Mitigated Rating	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*

Adverse impacts to soils for Alternative G range from no to low impact (**Table D.1-19**). Earthwork (i.e., excavation, regrading, fill activities) associated with the construction of features would likely disturb, modify, and mix native soils as described in the construction impact summary above. Fill material was assumed to be commercially sourced but has the potential to be beneficial use of dredged material. Overall, adverse impacts to soils are expected to be ***less than significant*** in Alternative G.

Adverse impacts to soils are anticipated to be synonymous with those to geologic resources and sediments; however, beneficial impacts to soils vary from those described for geology. NNBFs are anticipated to have long-term beneficial impacts to soils similar to those described in Alternative F. Embankment and naturalized shorelines could improve soil quality, thereby potentially increasing soil biodiversity. Additionally, planted vegetation should alleviate soil erosion and loss. Alternative G proposes the largest extent of NNBFs, particularly in 2090, thus, offers the greatest beneficial effects to soil resources of all alternatives.

4.10.7 Mitigation

The BMPs described in the Geology Mitigation section is also applicable to reduce impacts to soils in the study area.

4.11 Hydrology and Hydraulics

This section describes the adverse impacts expected to coastal hydrology, currents, circulation, tides, tidal exchange, and waves under the Action Alternatives.

Significance Criteria

Effects on hydrology (i.e., changes in inflow, changes in water surface profiles, and flow distribution, assessment of local and system-wide resultant impacts, upstream and downstream impacts, etc.) and geomorphic conditions may be considered significant if implementation of an alternative would:

- **HYD-01:** Substantial increase in the rate or amount of surface runoff in a manner that would result in flooding on or off site
- **HYD-02:** Significantly change flood stage elevations
- **HYD-03:** Substantially change the frequency and duration of inundation of lands
- **HYD-04:** Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.

While this section addresses the significance of project-induced changes in flood risk, the significance of other types of water hydrology-related effects, both direct and indirect, is assessed in the sections of related resource areas (e.g., geological resources, water quality, fisheries, recreation, etc.). The features for any of the action alternatives are designed to reduce coastal flood risk in the study. Sustained flooding with a coastal flood event varies with the approach of each alternative, such that one the defends at the shoreline (Alternative F) should not experience flooding beyond the line of defense when construction is completed for the anticipated risk. Whereas an approach that recedes from the shoreline (Alternative G) should experience flooding inland flooding bayward of the line of defense as these areas are converted to open space and would likely transition to coastal habitats with increased flooding. The performance of alternatives is detailed in *Appendix B: Engineering*, while the following sections focused on the impacts of construction to hydrology and hydraulics.

4.11.1 Construction Impact Summary

Temporary impacts to currents may result during construction of shore-based measures as this is located at the MHHW line, such as levees, and some NNBFs such as marshes and ecological armoring. Localized, temporary impacts from the in-water measures such as bulkhead walls/seawalls, wharfs, and bay fill are also anticipated to adversely impact currents due to increased velocities at the toe of the structural measures, which may change wave energy in the bay. Wave energies could increase at the hardened structures which may increase tidal current velocities and lead to temporary indirect impacts from sedimentation or scour. The waterfront is highly urbanized at present; however, some new hardened structures may be introduced to protect against flood risks. Temporary impacts during construction include physical seabed disturbance that increase current velocities such as foundation installation, excavation, and fill activities.

Measures installed in the bay below the high tide line would likely alter the bay shoreline permanently. Such an alteration could affect the movement of water in the bay due to altered circulation patterns, which could substantially change the bay floor adjacent to the new shoreline as a result of sediment scour. Sediment transport induced by waves and currents interacting with the new structures could alter the hydraulic forces exerted on the bay floor and shoreline, thereby inducing changes in scour and deposition.

Standard engineering hydrodynamic and wave modelling of tidal currents and wind waves would need to be conducted to analyze the proposed projects impacts

associated with altered coastal hydraulics, which could occur from the proposed features. This type of model analysis could evaluate whether the project would include changes to currents and waves that could change the bay's bed elevations, and if so, the amount of change in depth and extent that it could be expected.

4.11.2 Operations and Maintenance Impact Summary

Operational impacts involve long-term effects related to the proposed features, including NNBFs measures, to maintain the adequacy of performance against RSLC. Operations and maintenance activities could include inspections, repairs, and fill activities. Hardened structures would require regular inspection for natural wear and/or damage following coastal and combined flooding or seismic events. NNBFs such as marshes, coarse beaches, and ecological armoring would require supplementation as sea levels rise over time. In the long-term this would offer benefits to coastal hydrology by dissipating wave energy, but would result in temporary, localized impacts to currents and hydrology during O&M activities. Maintenance for wharves would have temporary impacts to coastal hydrology through use of in-water construction equipment, similar to that described in construction impacts. However, these are expected to be far less impactful than those from construction because of the shorter duration.

4.11.3 Recommended Plan

Impacts to hydrology and hydraulics from the TNBP range from no to moderate to high (**Table D.1-20**).

Table D.1-20: Summary of Hydrology and Hydraulics Impacts Associated with the TNBP

TNBP Hydrology and Hydraulics Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*	Vertical Shoreline*
Construction/Footprint (First Actions)	1	1	1	1	1	1	1	3	2+	1	2+	2+	1	4+
Construction/Footprint (Subsequent Actions)	4	1	4	1	1	1	1	3	2+	1	2+	2+	2+	4+
O&M Assumptions	1	1	1	1	1	1	1	2	2+	1	1	1	2+	2+

TNBP Hydrology and Hydraulics Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*	Vertical Shoreline*
Mitigated Rating	*4*	*1*	*4*	*1*	*1*	*1*	*1*	*3*	*2*	*1*	*1*	*1*	*1*	*1*

Impacts from construction of the new seawall range from no to moderate to high depending on the year and location of construction. In 2040, the seawall is anticipated to be built landward of the existing seawall and thus would require no in-water work, nor cause any change to the existing hydrology, like in Alternative G. In 2090, the new seawall would be constructed bay ward of the existing seawall and require bay fill in the void between the two structures. These impacts are anticipated to be like those described in Alternative F. Overall, the TNBP would have lower adverse impacts in 2040 than Alternatives F and G (**Table D.1-8**), but greater adverse impacts in 2090 than Alternatives F and G, given the spatial extent of the new seawall.

Installation of a sheetpile wall is expected to have ***no impacts*** to coastal hydrology. A new sheetpile wall is proposed along the waterfront at Pier 96 in 2040 and would be constructed of steel/reinforced concrete that has a vertical interlocking system to create a continuous wall. Sheetpiles would be driven into the bay sediments using a vibratory hammer or impact hammer. Construction would occur in sections, installing one sheet pile after another to ensure each are interlocked and driven to the correct depth. In-water work is not anticipated for installation of the sheetpile wall. The new sheetpile wall would be built parallel to the existing approximately five feet bay ward. This is not expected to change the local or regional hydrology as the original hardened structure is being replaced with a similar feature across the same spatial extent.

The NNBFs vertical shoreline are anticipated to have moderate impacts. Adverse impacts would occur during construction of wharf, which may also have long-term impacts by changing current velocities and wave patterns in the bay. Hydrodynamic modelling would be needed to assess these impacts and long-term changes. Overall, as previously described, these impacts are anticipated to be ***less than significant.***

Increased surface roughness of NNBFs vertical shorelines could mitigate extreme wave overtopping hazards by dissipating wave energy; however, this is largely driven by length and density of surface protrusions (Salauddin et al. 2021). Hydrodynamic modelling could be used to assess the level to which wave energy is dissipated, as well as how that impacts currents and wave refraction throughout the bay. It is unclear if a

textured seawall would cause erosion at other areas of the bay through wave refraction or scouring at the base of the seawall. In the short-term, installation of vertical shorelines is anticipated to have moderate impacts to waves and currents as cofferdams would be installed in sections to install pre-cast panels onto the new or existing seawall surface. Similar to that described in Alternative F, cofferdams would temporarily alter hydrologic patterns and could intensify current velocity near and around the construction site.

Bay fill and seawall construction would have moderate to high impacts during construction, as well as likely permanent changes to bay hydrology, as described previously. Both measures are expected to have ***significant and unavoidable*** impacts to bay hydrology. Construction of the coarse beach would require some in-water work activities, including work barges to stage equipment or transport material for placement, as well as heavy equipment that would be needed to move and grade material. These impacts are expected to be localized and temporary but would alter coastal hydrology in the construction area. Construction impacts are expected to be ***significant and unavoidable***. Upon construction completion, coarse beaches are anticipated to have beneficial impacts on coastal hydrology by attenuating wave energies during tidal exchange and coastal surge. The coarse beach would require augmentation to be adapted to RSLC, which would use similar techniques as those during construction, but would likely take less time. Maintenance activities are anticipated to have low impacts and be ***less than significant***.

4.11.4 Alternative B

Alternative B includes demolition of piers and buildings, dry and wet floodproofing of structures, and building relocation. Demolition, relocation, and floodproofing measures should have ***no impact*** on hydrology and hydraulics as all construction related activities would be shore-based and does not change the structure of the waterfront. However, demolition of piers could have a potentially significant impact to hydrology and hydraulics. Artificial structures, such as piers, affect local wave and current patterns by reducing current speeds and attenuating waves which deposits sediments in some areas, while scouring others. By removing these structures, current speeds and wave energies are no longer slowed, increasing the potential for erosion and sediment suspension (Cosentino-Manning et al. 2010). Detailed hydrodynamic modelling would be needed to determine how removing the piers would change the wave energy and sediment deposition in the bay. Overall, there is fairly minimal pier removal in Alternative B – Hyde Street Pier in 2040 and Pier 47 in 2115 – thus, impacts to hydrology and hydraulics are expected to be ***less than significant***.

No impact from O&M are expected for Alternative B. Details about the changes in flooding can be found in *Appendix A: Plan Formulation* and *Appendix B: Engineering*.

4.11.5 Alternative F

Impacts to hydrology and hydraulics from Alternative F are scored in **Table D.1-21**.

Table D.1-21: Summary of Hydrology and Hydraulics Impacts Associated with Alternative F

Alternative F Hydrology and Hydraulics Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	4	1	4	1	3	1	1	3	2+	1	2+
O&M Assumptions	1	1	2	1	2	1	1	2	2+	1	2+
Mitigated Rating	*4*	*1*	*4*	*1*	*2*	*1*	*1*	*3*	*1*	*1*	*1*

Impacts are expected to range from no impact to moderate to high for hydrology and hydraulics (**Table D.1-21**). Measures that are not expected to impact coastal hydrology are those shore-based features that should not require in-water work during construction and would not be adding hardened structures to the bay shoreline upon construction completion. Those include levees, t-walls, and vertical walls. Additionally, roadway impacts such as excavation, grading, and re-pavement are not anticipated to have any impact to hydrology. NNBFs ecotone levees are intended to be in upland habitats and constructed from shore, thus, would also have no impact to wave climate or currents.

NNBFs ecological armoring would impact currents and hydrology temporarily during construction as in-water barges and/or cranes would be used to place the riprap or other stone along the shoreline. In the long-term, ecological armoring is anticipated to be beneficial for wave dissipation during tidal exchange and surge during coastal events. It is unclear how addition of ecological armoring could impact bay-wide current movement or wave refraction, though this is expected to be minor. Additionally, NNBFs marsh enhancement may have temporary, adverse impacts during construction if in-water work is performed. While the marsh is establishing, some sediment loss may occur contributing to increased sedimentation in the bay. In the long-term, marsh creation and/or enhancement is anticipated to have beneficial impacts by dissipating wave action in the bay. Construction and maintenance of these NNBFs are expected to have ***less than significant*** impacts on bay hydraulics.

The construction of tide gates at the mouths of Islais and Mission Creeks is anticipated to have moderate impacts. Tide gates would require construction of deep foundations with cast-in-place techniques and installation of gates, such as sector and/or lift gates. Cofferdams would be used to dewater the construction site to facilitate the building

process, and the heavy equipment used to construct the features would be staged on floating plants or barges outside of the cofferdam. This would temporarily disrupt tidal flows and could increase current velocities in and around the construction site. Construction would occur in sections to minimize the overall impacts to waves and currents. Construction is expected to have adverse impacts to local hydraulics, this is believed to be ***less than significant***, though detailed hydrodynamic modelling would provide a better understanding of impacts to current velocities and wave climate in the bay.

Annual operations and maintenance of the tide gates are anticipated to be low overall. When the tide gates are in the open position, potential long-term direct impacts from decreasing current velocities could occur. The number of gates would be designed to mimic existing tidal flow as closely as possible. When the gates are in the closed position, temporary impacts to tidal currents are anticipated due to decreasing current velocities; however, permanent changes to the hydrodynamics and water flow of the bay are not expected. Hydrodynamic modelling simulating tidal gate operation would be needed to determine the extent of these impacts, though they are anticipated to be ***less than significant***.

Construction of a new seawall is anticipated to have moderate to high impacts to coastal hydrology. The new seawall would be constructed bay ward of the existing seawall and bay fill would be placed in the void between the two structures. In-water activities to construct the new seawall may include but are not limited to stationary barges for staging equipment and/or machinery, and pile driving. Use of in-water equipment would temporarily alter currents and wave energies as described above in the construction impact summary. Although a hardened structure already exists where the new seawall is planned for construction, extending into the bay may have long-term permanent changes to the overall current flow and pattern in and around the new shoreline. This impact could be ***significant and unavoidable***, though hydrodynamic modelling would be needed to determine if the new seawall installation would have direct, long-term impacts to bay wide current velocities and wave action.

Alternative F is proposed to replace wharf in limited locations along the waterfront in 2040 and 2090 (**Table D.1-8**), which is anticipated to have moderate impacts to waves and currents. Pile driving of new steel or corrosion resistant piles would have temporary, localized impacts to coastal hydrology as previously described. In the long-term, the new wharf could change current and wave patterns near the shoreline resulting in sediment scouring and/or erosion, as well as altering current velocities. Hydrodynamic modelling would be needed to determine the extent of this impact on coastal hydrology, though it is anticipated to be ***less than significant*** overall.

4.11.6 Alternative G

Impacts to hydrology and hydraulics from Alternative G are scored in **Table D.1-22**.

Table D.1-22: Summary of Hydrology and Hydraulics Impacts Associated with Alternative G

Alternative G Hydrology and Hydraulics Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	1	1	1	1	1	1	3	2+	1	2+	2+	2+
O&M Assumptions	1	1	1	1	1	1	2	2+	1	1	1	2+
Mitigated Rating	*1*	*1*	*1*	*1*	*1*	*1*	*3*	*1*	*1*	*1*	*1*	*1*

Construction impacts range from none to moderate, with wharf being the only structure anticipated to have greater impacts during construction and potentially lead to long-term changes in currents and wave patterns. All measures expected to have ***no impact*** are constructed using shore-based techniques and do not change the hardened surfaces along the shoreline, thus would not alter coastal hydrology. NNBFs that are constructed landward of the tidal zone to provide transition zone habitat from terrestrial to tidal wetland ecosystems, such as ecotone levees would also have ***no impact*** to waves and currents.

The other NNBFs proposed in Alternative G include ecological armoring, embankment and naturalized shorelines, and marsh enhancement. Construction of these features is intended to be shore-based, thus would not impact hydraulics directly. The proposed alignment would construct planted levees inland along the Mission Creek area and would demolish all buildings that exist bay ward of the line of defense. The new open space would be returned to nature. The new shoreline alignment would alter coastal hydraulics and could substantially alter the bay floor adjacent to the new shoreline due to changes in scour, sedimentation, and sediment supply. Sediment transport induced by waves and currents interacting with the new shoreline features could alter hydraulic forces exerted on the bay floor and shoreline, thereby inducing changes in scour and sediment deposition. RSLC would increase the water depth along the entire shoreline which has the potential to exacerbate the effects of altered coastal hydraulics, though this is expected to be reduced with the design of NNBFs. Significant impacts could occur if altered erosion, scour, or depositional patterns increase suspended sediment or sediment transport leading to degraded water quality. Impacts could also be significant if the proposed project substantially changed erosion, scour, or sediment deposition to the degree that foundations or other shoreline features at or adjacent to the project area

are compromised, undermined, or degraded to an extent that causes additional hydrologic or water quality impacts. To determine the significance of impacts from the altered bay shoreline, hydrodynamic and wave modelling would need to occur. In the long-term, these NNBFs would change the structure and function of the shoreline, particularly in 2090, offering wave dissipation benefits. Additionally, they offer naturalized shorelines as opposed to hardened shorelines while providing protection against coastal hazards. This is the same for the O&M of these features as they would likely require augmentation to adapt to rising sea levels. Overall, the impacts from NNBFs are expected to be beneficial and ***less than significant*** to coastal hydrology.

Wharves would have similar impacts as those described in Alternative F, but construct more than double the acreage, and thus is anticipated to have greater impacts. Short-term impacts are likely to be the same as Alternative F, but there is uncertainty about the potential long-term impacts that could occur by permanently alternating waves and currents. As with Alternative F, hydrodynamic modelling would be needed to determine the extent of change to hydraulics and whether that would cause significant adverse impacts. However, given wharf structures already exist in the area and would be replaced, it is assumed construction and long-term impacts would be ***less than significant*** to hydrology and hydraulics.

Overall, Alternative G is anticipated to have the least adverse and most beneficial impacts to hydrology and hydraulics.

4.11.7 Mitigation

To reduce overall impacts of in-water construction activities, BMPs described in Geology and Water Quality would be used.

4.12 Water Quality

This section describes the adverse and beneficial impacts expected to water quality in the study area, including surface water and stormwater runoff.

Significance Criteria

The alternative could pose a significant impact to water quality if implementation of an alternative would result in any of the following conditions:

- **WQL-01:** Violate any water quality standards or otherwise substantially degrade water quality to the detriment of beneficial uses;
- **WQL-02:** Provide substantial additional sources of polluted runoff; or
- **WQL-03:** Require or result in construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

4.12.1 Construction Impact Summary

Construction related impacts to water quality are separated by shore-based and in-water activities.

4.12.1.1 Shored-based Activities

Direct and indirect construction-related impacts on surface water hydrology and water quality could occur during shore-based construction activities. Shore-based construction activities include levees, bridge raising, vertical walls, t-walls, deployable flood gates, roadway improvements/impacts, and some NNBF. Shore-based construction could result in water quality related impacts such as during grading and excavation; demolition of existing structures; construction of access roads; placement of rock revetments along levees; and construction of stormwater conveyance and discharge infrastructure. Localized and temporary impacts to water quality include reduction of water clarity; change in color; and release of organic material with varying quantities of ammonia, nitrogen, and phosphorous, which could stimulate growth of algae and other aquatic plants. The factors responsible include, but are not limited to, increased turbidity, increased suspended sediments, and organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels.

Moderate temporary impacts to turbidity could result during construction of shore-based measures during land disturbing activities such as foundation installation, excavation, and fill activities. Dust and sediments could become airborne with wind and transported to surface waters, which become dispersed in the water column resulting in increased turbidity and reduced water clarity. Likewise, temporary minor impacts to DO may result from shore-based construction that cause increased turbidity and sediment suspension. No impacts to salinity are anticipated during the construction of shore-based measures.

During construction, stormwater runoff and associated discharges have the potential to exceed water quality criteria or waste discharge requirements, including National Pollutant Discharge Elimination System (NPDES) permit effluent limitations. An NPDES permit would be required because more than 1 acre of surface disturbance would occur. Any discharges of shallow groundwater produced during excavation dewatering could also exceed these criteria. Stormwater runoff from disturbed soils associated with construction activities is a common source of pollutant to receiving waters. Earthwork can render soils and sediments more susceptible to erosion from stormwater runoff, causing it to migrate to storm drains and downgradient water bodies such as the bay. It is likely project construction would involve using materials such as paint, solvents, oil and grease, petroleum products, concrete, and corrosion resistance coating, which if not handled properly, could be mobilized, and transported offsite by stormwater runoff thereby degrading water quality of receiving bay waters.

Any such impacts would be minimized and controlled by using BMPs, such as those described in the Geology Mitigation section and mitigation section below, as well as a site-specific SWPPP. Following shore-based construction, degraded water quality conditions would be expected to return to baseline conditions.

4.12.1.2 In-Water Activities

Any work along the San Francisco Bay shoreline below the high tide line is considered in-water construction. In-water construction activities would include the use of equipment such as support barges, small support vessels, and vibratory or impact hammers for installation of sheet pile walls and support piles. In-water construction have the potential to exceed water quality criteria or waste discharge requirements, including water quality standards and NPDES permit effluent limitations.

Support vessels could be used as work platforms during construction, for staging equipment and construction supplies, and refueling. As such, support vessels would require anchoring to the bay floor, which disturbs the seabed and increases turbidity.

To varying extents, historic creosote wood piles that currently support existing wharf structures would be removed from the bay and discarded. Historic pilings are typically constructed of wood that has been treated with creosote and encased in concrete, which is no longer permitted for structures in the bay because of its toxicity to marine organisms. Creosote-treated pilings would be replaced with non-toxic materials such as steel, concrete, or corrosion resistant composite materials, which would result in a long-term improvement in water quality. However, temporary adverse impacts would occur during pile removal through resuspension of sediments and potential debris released during removal efforts. Wood piles would be removed in a manner that minimizes and avoids impacts to water quality of the receiving water.

Temporary impacts to salinity would be expected during in-water construction measures, which may occur if there is a physical barrier in the water that prevents full tidal exchange (e.g., cofferdam).

In-water construction activities would result in disturbance of localized bay sediments, which could contain legacy chemical contamination. Disturbance of these sediments could temporarily increase turbidity and resuspend these contaminants in bay waters. In-water construction activities would involve the use of diesel-fueled construction equipment, and potentially require the use of petroleum-based oils and lubricants, as well as application of anti-corrosion coatings to steel sheetpiles, by which accidental spills could introduce these into the bay. Several measures require placement of fresh cement, which if released or accidentally spilled into the bay would degrade water quality resulting in potentially significant impacts.

To protect overall water quality during construction, BMPs such as those described in the Geology Mitigation section and the mitigation section below, as well as a site-specific SWPPP would be used.

4.12.2 Operations and Maintenance Impact Summary

Operations and maintenance activities would include inspections, damage repair, and reapplication of corrosion resistant coatings to steel sheetpile walls. Deployable flood gates would be inspected annually for visible damage or misuse and repaired as needed. Corrosion resistant coating would be applied to sheetpiles by hand to localized areas where needed using brushes or paint sprayers. Maintenance activities would be required to adhere to the same BMPs and SWPPP as construction activities; however,

accidental spills could occur. If hazardous material is released into the bay, they would degrade water quality and potentially have a significant impact. Using the BMPs described in the Mitigation section would reduce the overall impacts to ***less than significant*** if a spill were to occur with mitigation.

4.12.3 Recommended Plan

Impacts to water quality from the Total Net Benefits Plan are scored in **Table D.1-23**.

Table D.1-23: Summary of Water Quality Impacts Associated with the TNBP

TNBP Water Quality Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*	Vertical Shoreline*
Construction/Footprint (First Actions)	4	2	4	2	3	2	2	4+	2	2	2+	2+	1	4+
Construction/Footprint (Subsequent Actions)	1	2	4	1	1	2	1	4+	2	2	2+	2+	2+	4+
O&M Assumptions	1	2	3	2	1	2	2	3	2	2	2+	2+	2+	2+
Mitigated Rating	*4*	*2*	*3*	*2*	*3*	*2*	*2*	*3*	*1*	*2*	*1*	*1*	*1*	*3*

The adverse impacts to water quality are expected to range from no to moderate to high. Low impacts are anticipated for construction shore-based measures such as levees, flood gates, t-walls, and NNBFs. These impacts would be equivalent to those discussed in the shore-based construction impact summary and overall are expected to be ***less than significant***.

As with Alternative F and G, wharf, seawall, and roadway construction are anticipated to have moderate to high impacts to water quality in the TNBP. These impacts would be realized in 2040 and 2090 for the TNBP as additional seawall, roadway, and wharf construction were undertaken. In 2040, the TNBP would be expected to have less impact from seawall construction as compared to Alternative F and G (**Table D.1-8**), but far greater impacts in 2090. Similarly, the impacts from roadway construction would be less for the TNBP in 2040 than Alternative F and G (**Table D.1-8**). However, by 2090, impacts would be greater in the TNBP than Alternative F and comparable to that of Alternative G. Overall, the TNBP would have the greatest adverse and beneficial

impacts from wharf replacement in 2040 (**Table D.1-8**) and 2090 as compared to the other alternatives. Impacts from wharf construction would be ***significant and unavoidable*** to water quality.

Sheetpile walls are anticipated to have moderate adverse impacts to water quality during construction, and low impacts during maintenance activities (see Operations and Maintenance Impact Summary). Sheetpile walls would be installed as described in the Hydrology and Hydraulics section. Construction would include shore-based and in-water activities like those described in the construction impact summary, which could result in the impacts discussed therein. If installed, steel sheetpile walls would be susceptible to corrosion if in contact with saltwater like in reach 4. Corrosion resistant coating would be applied after installation and during routine maintenance as needed. However, corrosion is one of the most common problems amongst iron and steel, thus, it is plausible for steel sheetpiles to undergo corrosion. If gone untreated, corrosion can cause the wall to deteriorate (Royani et al. 2019). Corrosion could impair water quality by introducing metal particulates (e.g., lead, iron, zinc) and discoloring the water (CEWA 2023). Release of metal particulates could become a significant water quality issue if not properly remediated. A site-specific pollution prevention plan would be developed prior to construction to reduce the likelihood of spills and contamination occurring, as well as instilling BMPs (as described in Geology and Water Quality mitigation sections).

Water isolated within sheetpile walls have the potential to contain elevated concentrations of suspended sediment resulting from ground disturbance within the isolated construction area and presents the potential for fine-grained Young Bay Mud sediments to become mobilized and remain suspended in water for extended periods of time (days to weeks). The direct discharge of such waters into San Francisco Bay or the storm drain system could result in localized increases in suspended sediment and turbidity that persists. Mitigation measures could be used to reduce the potential impact on water quality to less than significant by requiring implementation of monitoring and standard BMPs to remove sediment from the discharge. With implementation of mitigation measures, adverse impacts to water quality from construction and maintenance of sheetpile walls would be ***less than significant with mitigation***.

In-bay fill is required, in which impacts are expected to be similar to those described in Alternative F on a smaller scale (Section 4.12.5). Additionally, a new seawall similar to that described in Alternative F would be included. Rebuilt wharf would have adverse impacts during construction but would offer long-term beneficial impacts to water quality with the removal of creosote pilings. A coarse beach would be constructed over the bay fill which would likely employ shore-based and in-water construction techniques as described in the construction impact summary above. As such, impacts would be similar to those described in the construction impact summary. In the long-term, coarse beaches have minor benefits to water quality by reducing turbidity through enhancing sedimentation at the feature. Adverse impacts from construction are anticipated to be temporary and localized to the construction area; however, addition of in-bay fill is a permanent impact to water quality by removing open water, thus, would have ***significant and unavoidable*** impacts.

The NNBFs could help to improve water quality with sediment retention, improved oxygen with vegetation, and nutrient cycling. Construction of these features are assumed to have low impacts and would overall be ***less than significant***.

It was assumed dewatering, as described in Alternative F and G, would be required to install textured panels onto the existing, or new, seawall. It was assumed pre-cast textured panels would be installed with steel bolts using pneumatic tools in 50 ft sections. The impacts are expected to be similar to those as described in Alternative F for the construction of a new seawall, thus, would be expected to be ***significant and unavoidable***. In the long-term, a living seawall could provide beneficial impacts by improving water quality through recruitment of bivalves. Bivalves can alter adverse water quality conditions by filtering algae and removing an overload of nutrients (Featherstone 2011; Kreeger et al. 2018).

4.12.4 Alternative B

Alternative B relies on demolition, relocation, and floodproofing infrastructure at risk of flooding implemented in four-time steps commensurate with the trajectory of RSLC inundation levels that would trigger the need for protective measures. Demolition and removal would require the use of heavy machinery including backhoes, cranes, wrecking balls, large trucks, etc. Relocating buildings would require storage of infrastructure while a new site was prepared, which may include grading, excavating, and constructing new foundations. Alternative B is anticipated to only include shore-based activities; thus, the impacts would be similar to those described in the construction impact summary. With the use of Water Quality BMP's, impacts from Alternative B are anticipated to be ***less than significant***.

4.12.5 Alternative F

The impacts to water quality from Alternative F range from no to moderate to high, with in-water activities expected to have more adverse impacts (**Table D.1-24**). The greatest adverse impacts are expected to be associated with construction of new seawall, tide gates, wharves, filling the bay, and roadway improvements. Shore-based measures are expected to have low impacts and would be the same as those described in the construction impact summary above.

Table D.1-24: Summary of Water Quality Impacts Associated with Alternative F

Alternative F Water Quality Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	4	2	4	4	4	2	2	4+	2	2	2+
O&M Assumptions	1	2	2	1	2	1	1	2	2	2	2+
Mitigated Rating	*4*	*2*	*3*	*3*	*2*	*2*	*2*	*3*	*1*	*2*	*1*

As previously described, historic creosote wood pilings would be removed prior to construction of the new wharf, which would have temporary adverse impacts during removal but long-term beneficial impacts to water quality. Wood pilings would be replaced with steel, concrete, or corrosion resistant composite materials which requires pile driving. As described above, installation of piles can increase local turbidity, suspend sediments, and potentially release contaminants from sediments. Additionally, existing concrete deck and surfacing (concrete or asphalt) would need to be demolished, hauled offsite, and disposed of. This is likely to be accomplished using shore-based and in-water construction activities. In-water construction activities are likely to consist of support vessels and work barges, both of which have the potential to increase turbidity and sediment suspension while anchored or in operation. Demolition activities have the potential to release debris into the bay. Impacts of debris removal would be minimized with a debris prevention and removal plan. A new reinforced concrete deck would be constructed on the wharf pilings of pre-cast elements or using cast-in-place construction over the water. During either construction methods, there is potential for debris and release of contaminating materials (e.g., fuel, concrete) as described in the in-water and shore-based construction impact summaries above. A release of construction materials into the bay could pose a significant impact to water quality if not effectively and efficiently treated. The BMP's specified in the Geology and Water Quality mitigation sections would be followed to reduce the likelihood of contamination, as well as a site-specific SWPPP. However, given the extent of wharf that would be replaced in 2040 (**Table D.1-8**) and 2090, the impacts from constructing these structures is anticipated to be ***significant and unavoidable***.

A new seawall is proposed to be constructed bay ward of the existing seawall to raise the elevation of the waterfront, as described in the Hydrology and Hydraulics section with pile driving and in-water work equipment. Piles would be driven in the wet with a

pile driver likely operating from a floating work barge and would include other in-water construction activities as described above. Any structure driven into the bay sediment could cause a release of buried contaminants that would be released into the Bay, which could violate water quality standards and degrade water quality. A plan for removing any contaminants prior to discharge would be required before construction began. Additionally, Young Bay Mud sediments could become mobilized and suspended in the water column during pile driving, increasing turbidity in the construction area. The extent of this turbidity would be maintained using BMP's, such as turbidity curtains, to reduce the spread of suspended sediments. However, the isolated work area would likely remain turbid for extended periods of time (days) while the pile driving is undertaken.

Following piles, wooden casts would be built using the cast-in-place techniques described previously to fill with cement for construction of the new seawall. Water that is within the casts would need to be dewatered and effluent discharged appropriately. The dewatered effluent could contain pollutants (e.g., sediment, residual petroleum hydrocarbons, heavy metals) that would need to be removed before discharge to avoid potential water quality impacts. Dewatering could result in a significant impact if contaminated effluent were not managed properly and released untreated into surface waters. Such a release would violate water quality standards and degrade the quality of receiving waters. Prior to discharge, effluent would need to be sampled and analyzed for pollutants by a qualifying lab to determine if all water quality constituent parameters are below acceptable discharge limits. If determined suitable, effluent could be discharged directly into the Bay, or stormwater, industrial, or sanitary systems.

During effluent discharge, construction of the casts, and pile driving, receiving waters would result in increased turbidity and resuspended sediments, temporarily degrading water quality in the Bay. The extent of increased turbidity would primarily depend on the potential for dispersion and dilution by tidal effects or water circulating currents, composition of the sediments, and duration of operations. Dewatering could temporarily lower dissolved oxygen, reduce light, and increase temperatures of receiving waters. A SWPPP would be in place during construction to help with spill prevention, as well as provide guidance on cleanup if an accidental spill were to occur. Given the linear extent of new seawall that would be constructed, the impacts to water quality are anticipated to be ***significant and unavoidable***.

Placement of fill in the bay would be required to be uncontaminated and suitable for use for in-bay fill. For this analysis, it was assumed the fill would be sourced commercially; however, dredged material could be used during construction if determined suitable. In Alternative F, the intent is to construct the new seawall bay ward of the existing and then fill the void between the two structures. To do this, the area between the structures would need to be dewatered prior to placing in-bay fill. Water would be extracted at the construction site using pumps on floating barges or on land and the effluent would be discharged appropriately following testing (e.g., Bay, treatment plant). Impacts of discharging effluent are expected to be similar to those described for seawall construction, but on a larger scale. Once the area is de-watered, the void would be filled. BMP's as described in the mitigation section would be used to reduce impacts to water quality; however, in Alternative F, in-bay fill would result in a loss of 25 acres of

open water and discharge of dewatered effluent, thus, impacts are ***significant and unavoidable***.

Updates to roadways would be required in Alternative F with the elevation increase, construction of features, and seismic ground improvements. The majority of roadway impacts in 2040 are expected in Reaches 1 and 2 along the Embarcadero, while impacts in Reaches 3 and 4 would be realized in 2090. To construct features and seismic ground improvements, any existing paved roadways, walkways, sidewalks, track lines, and paths within the construction area would need to be demolished to place earthen fill material to raise ground elevation. Once fill is placed, the new surface would be regraded and repaved with asphalt, concrete hardscape, and landscaped surfaces. Any track work removed would need to be replaced and updated. Concerns for impacts to water quality during roadway construction are the same as those described for shore-based activities above.

Stormwater, sewer, and inland drainage systems are currently located throughout the study area, including below tracks and roadways. Additionally, combined sewer outfalls are located along the waterfront throughout all four reaches. Construction of the new roadways and seawall would require construction of new stormwater drainage facilities, as well as an expansion of existing facilities to maintain changes in water flows and reconfiguration of the waterfront. An analysis conducted by the SFPUC estimated that three new pumps should be added between reaches 1 and 2 in 2040 to account for increased flood risk and to reduce impedance of flow of interior drainage, as well as new flap gates added on existing combined sewer outflows. In reaches 3 and 4, new flap gates would be added onto existing combined sewer outflows also, as well as two box culverts with backflow prevention added in reach 4. Maps and additional details for new drainage infrastructure can be found in *Appendix B: Engineering*. During roadway construction, existing drainage systems would temporarily be disturbed and rerouted, which may result in additional water accumulation after heavy rains and inland drainage to enter the construction site requiring dewatering and redistribution of water. Similar to dewatering impacts described above, this has the ability to introduce contamination from the construction site or upland areas to receiving waters. Additionally, this would increase turbidity and suspended sediments in receiving water, as well as could lower dissolved oxygen levels, increase nutrient input, and lower salinity directly in the discharge areas. A SWPPP and BMP's would be used to help reduce these impacts; however, it was assumed the change to inland drainage facilities would have a ***significant and unavoidable*** impact to water quality during construction.

Tide gates would be constructed as described in the Hydrology and Hydraulics section requiring installation of new underwater foundations and gate systems, which would be completed in dry conditions by building cofferdams. Similar to impacts described for construction of the new seawall, tide gates are expected to have moderate to high adverse impacts to water quality during installation. Operations and maintenance of the tide gates are expected to have low impacts overall. Tide gates are anticipated to undergo annual maintenance testing to ensure sufficient operation. This is expected to occur at low tide and may temporarily cause turbidity, resuspension of sediments, and changes in salinity. Long-term, tide gates could influence water quality conditions by reducing tidal exchange and water connectivity that may have cascading effects

including but not limited to lower dissolved oxygen, high nutrient concentrations, and intensified algal blooms (Chen and Orton 2023; Zhao et al. 2020; Choudri et al. 2015; Paalvast and van der Velde 2014). A recent study suggested gate closures coupled with low stream flows temporarily lead to salt intrusion and stratification in the Hudson River, by which recovery to normal conditions was highly dependent on duration, flow velocity, and estuary length (Chen and Orton 2023). Moreover, increased frequency of closures (monthly) did not afford recovery to normal estuary conditions under low stream flow scenarios which could lead to measurable permanent changes to physical conditions in the estuary (Chen and Orton 2023). As with this study, hydrodynamic modelling would be undertaken in the design phase to determine the anticipated impacts to water quality for tide gate operations to limit permanent impacts to estuary conditions. Given the uncertainties in tide gate construction, design, and operation, this measure is anticipated to have ***significant and unavoidable*** impacts to water quality.

All shore-based measures and NNBFs are anticipated to have low impacts during construction, as described in the shore-based construction impact summary above and thus are anticipated to be ***less than significant***. The use of BMP's described in the mitigation section would help reduce impacts to water quality during construction and maintenance.

4.12.6 Alternative G

Impact scores for water quality are summarized for Alternative G (**Table D.1-25**).

Table D.1-25: Summary of Water Quality Impacts Associated with Alternative G

Alternative G Water Quality Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	3	4	2	2	4+	2	2	2+	2+	2+
O&M Assumptions	2	2	2	1	1	1	2	2	2	2+	2+	2+
Mitigated Rating	*2*	*2*	*3*	*3*	*2*	*2*	*3*	*1*	*2*	*1*	*1*	*1*

Impacts to water quality would range from low to moderate to high, with shore-based activities contributing the lowest impacts and wharf, seawall, and road construction

causing the highest. The potential adverse impacts for shore-based construction of measures was described above in the construction impact summary, and thus, is applicable to Alternative G. Additionally, wharf impacts as described in Alternative F are applicable to this alternative as well. These impacts, both beneficial and adverse, are expected to be greater as compared to Alternative F as more wharf is proposed for construction (**Table D.1-8**). As with Alternative F, the impacts to water quality are anticipated to be ***significant and unavoidable.***

Updates to roadways and interior drainage systems would also be required in Alternative G. An analysis conducted by the SFPUC estimated that three new pumps should be added between reaches 1 and 2 in 2040 and another seven pumps between reaches 3 and 4. New flap gates would be added to existing combined sewer outfalls in all four reaches. Two circular culverts with backflow prevention would be added in reach 3, while two box culverts with backflow prevent would be added in reach 4. Maps and additional details for new drainage infrastructure can be found in Appendix B. As described in Alternative F, impacts to water quality from the construction disturbance to interior drainage systems with new roadways would be ***significant and unavoidable***.

Seawall construction is expected to have moderate impacts to water quality during construction. The new seawall in Alternative G is proposed to be constructed landward of the existing seawall, thus is not anticipated to require any in-bay fill. However, similar techniques as Alternative F are expected to be used from shore, including driving piles and using cast-in-place techniques. Dewatering is expected to occur for installation of the new seawall as groundwater tables are disturbed. Additionally, interior drainage would need to be modified during construction as previously described. Dewatering involves extracting excess water from the construction area and then discharging effluent onto land, nearby storm drains, sanitary sewer systems, temporary storage tanks, or released back into receiving waters such as the Bay depending on the suitability of effluent. BMPs described in the Mitigation section would be followed to limit impacts to water quality to the greatest extent practicable, thus construction of the new seawall in Alternative G is anticipated to be ***less than significant with mitigation***.

NNBFs such as marsh enhancement, naturalized and embankment shorelines, and ecotone levees would have low impacts during construction and O&M activities similar to those described in the shore-based construction methods. O&M would include augmentation of NNBFs to adapt to raising sea levels. In the long-term, NNBFs would offer beneficial impacts to water quality by minimizing or eliminating runoff, particularly with contaminated waters, stabilizing the shoreline, and reducing erosion. Aquatic vegetation in the marsh helps to purify water quality by reducing excessive nutrients and aerating surrounding water with oxygen (Audubon n.d.). Overall, the beneficial impacts of NNBFs far outweighs the adverse impacts of construction and maintenance and would be ***less than significant***.

Alternative G would have the least negative effects to water quality and the greatest beneficial effects.

4.12.7 Mitigation

In order to avoid and/or minimize potential impacts to waters of the U.S. and state, water quality, and biological resources, the following minimum construction BMPs would be implemented as part of the proposed project. These minimum measures would be subject to modification and additions based upon regulatory and resource agency review.

- No debris, trash, creosote-treated wood, soil, silt, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products shall be placed in a location where it would be subject to erosion by rain, wind, or waves and allowed to enter jurisdictional waters, including as a result of fueling activities and storage of hazardous materials.
- No fresh concrete or concrete washings shall enter into jurisdictional waters. Fresh concrete would be isolated until it no longer poses a threat to water quality using appropriate measures, including exclusion of poured concrete from jurisdictional waters, such as open San Francisco Bay waters. Contractor(s) shall use only designated concrete transit vehicle cleanout stations for cleanout.
- Protective measures shall be utilized to prevent accidental discharges to waters during fueling, cleaning, and maintenance.
- Floating booms shall be used to contain debris discharged into waters and any debris shall be removed as soon as possible, no later than the end of each workday.
- Machinery or construction materials not essential for project improvements shall not be allowed at any time in the intertidal zone. The construction contractor shall be responsible for checking daily tide and current reports.
- Well-maintained equipment shall be used.
- A spill prevention contingency plan for hazardous waste spills into San Francisco Bay shall be prepared for review and approval. The plan shall include, at a minimum, floating booms, and absorbent materials to recover hazardous wastes.
- Contractors shall prepare an anchoring plan that applies to all ships, barges, and other open water vessels and describes procedures for deploying, using, and recovering anchorages.

BMPs for construction water-handling procedures and requirements for dewatering discharges in the study area include:

- Dischargers shall not violate any discharge prohibitions contained in applicable Basin Plans or statewide water quality control panels.

- The discharge does not cause or contribute to a violation of any water quality standard.
- The discharge is not prohibited by the applicable Basin Plan.
- The discharger has included and implemented specific BMPs required by their permit to prevent or reduce the contact of the non-stormwater discharge with construction materials or equipment.
- The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants.
- The discharge is monitored and meets the applicable numeric action levels.

4.13 Groundwater

As relative sea levels rise within San Francisco Bay, the groundwater table would be expected to rise, intersecting with buried infrastructure first and eventually emerging to the surface impacting drainage, infrastructure, and operations. In the absence of groundwater-specific flood risk reduction measures, rising groundwater would impact the feasibility of the flood protection alternatives in protecting landward areas from flooding and drainage challenges.

There is not sufficient engineering and design detail to evaluate how the measures may alter or influence the inland groundwater table, thus, detailed groundwater analyses would occur during the design phase. Thus, this section qualitatively describes the adverse and beneficial impacts expected to groundwater in the study area during construction and maintenance of the alternative measures.

Additional details on an assessment of groundwater in the study area can be found in Appendix B.

Significance Criteria

The alternative could pose a significant impact to groundwater if implementation of an alternative would result in any of the following conditions:

- **GW-01:** Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin;
- **GW-02:** Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan;
- **GW-03:** Adversely alter the rate or direction of flow groundwater.

4.13.1 Construction Impact Summary

The groundwater closest to the surface and most relevant to implementation of the proposed project is shallow groundwater (i.e., water table, shallow aquifer). Potential impacts to shallow groundwater could result from activities associated with construction

and operation of the alternatives. Construction-related impacts could occur during excavation, grading or trenching that could expose soils and shallow groundwater; placement of fill materials into waterways; shore-based dewatering operations; concrete pouring and washout activities; seismic ground improvements; or the storing and use of chemicals, fuels, and lubricants. Constructing measures along the shoreline would change the three-dimensional characteristics of flow and may require infrastructure or design features to manage inland water, of which, would be refined and determined in the design phase.

Construction of barriers, grouting, and compaction aimed to lower liquefaction potential (seismic design requirements) would reduce permeability and potentially porosity, which could lead to higher shallow groundwater tables. The level of change would be highly dependent on the specific conditions at the construction site and the mechanisms proposed for improving soils to withstand seismic loading. Conversely, if the groundwater table is already high and requires dewatering, the reduced porosity and permeability could reduce the connectivity of coastal groundwater to San Francisco Bay and allow for more efficient dewatering and less capture of the Bay water. Quantitative modeling would be required to determine the specific impacts of ground improvements on groundwater responses, which would occur during the design phase. At this stage, there is insufficient evaluation to determine level of significance; however, groundwater flows are expected to be adversely impacted by seismic design requirements. Because data and/or modelling is lacking to determine the extent, it was assumed the adverse impacts would be ***significant and unavoidable***.

Small volumes of petroleum products (e.g., fuel, engine oil, hydraulic line oil) would be temporarily used and handled to operate the construction equipment. These materials could be released in accidental spills. An NPDES permit would be required, and as part of that permit, a SWPPP that describes BMPs to be implemented to control accelerated erosion, sedimentation, and other pollutants during and after project construction. The specific BMPs that would be incorporated into the SWPPP would be determined during the final stages of the project design. However, the SWPPP would likely include many, if not all, of the BMPs listed in the Geology and Water Quality Mitigation sections to substantially reduce the potential for groundwater impairments as a result of ground and vegetation disturbance to ***less than significant***.

Construction activities would not deplete groundwater resources from the deeper groundwater basins in the study area because, other than temporary and limited dewatering during construction, the proposed project would not require continuous extraction of groundwater for water supply. Most areas proposed for measures are currently developed and largely covered by impervious surfaces, which have historically been used for industrial, residential, and commercial facilities, or bay waters that do not contribute significant substantial recharge to local aquifers used for water supply. Therefore, construction impacts would have ***no impact*** on deep groundwater resources, thus, this resource is not discussed further.

The proposed project would be designed in a manner as to not conflict or obstruct implementation of a sustainable groundwater management plan. Groundwater impacts would not be worsened by the construction of features and thus, impacts are expected to be ***less than significant***.

4.13.2 Operations and Maintenance Impact Summary

Operations and maintenance activities would include inspections, damage repair, excavation, and fill activities. Hardened structures would require regular inspection for natural wear and/or damage following coastal and combined flood or seismic events. Repairs could range from minor (e.g., cracked concrete walls) to major (e.g., replacement of walls) dependent on the severity of damage. Major repairs would be expected to rarely occur – with the most likely opportunity being after a major seismic event. NNBFs would require supplementation with fill material and excavation/grading as sea levels rise over time. Impacts during operations and maintenance are expected to be similar to, or less than, those described for construction. Maintenance activities would be required to adhere to the same BMPs and SWPPP as construction activities. Thus, adverse impacts from operations and maintenance activities are expected to be reduced to ***less than significant*** for shallow groundwater resources when following the BMPs and mitigation measures. As with construction impacts, O&M is anticipated to have ***no impact*** on deep groundwater resources.

4.13.3 Recommended Plan

The TNBP is anticipated to have no to moderate impacts on groundwater resources during construction of measures and operations and maintenance activities (**Table D.1-26**).

Table D.1-26: Summary of Groundwater Impacts Associated with the TNBP

TNBP Groundwater Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	1	2	3	2	3	2	1	2	2	2+	2+	2+	2+
Construction/Footprint (Subsequent Actions)	3	2	3	1	1	2	1	2	2	2+	2+	2+	2+
O&M Assumptions	1	2	2	1	2	1	1	1	1	1	1	1	1
Mitigated Rating	*3*	*2*	*3*	*2*	*3*	*2*	*1*	*2*	*1*	*1*	*1*	*1*	*1*

Construction of features that overlap with Alternative F and G are anticipated to have similar impacts as those described in the sections below. Unique to the TNBP is the addition of sheetpile walls and deployable flood gates. Sheetpile walls are anticipated to have similar impacts as those described for seawalls as groundwater flow would be interrupted during construction activities. These impacts are likely to be ***less than significant with mitigation*** and would require quantitative modelling to design the features in such a way as to not cause permanent adverse impacts to groundwater storage and drainage.

Installation of the vertical shoreline is anticipated to have ***no impact*** on groundwater resources because panels would be installed on the seawall once construction of that feature was completed. It was assumed any groundwater outflow and storage improvements that were needed as a result of seawall construction would be completed prior to the living seawall panels being installed.

Moderate construction impacts associated with bay fill are expected; however, are assumed to be mitigated with the addition of a NNBFs coarse beach. Similarly, constructing planted levees is anticipated to have low impacts, but also converts impervious surface to a NNBF with long-term beneficial impacts.

4.13.4 Alternative B

Alternative B moves assets away from flood risk over time or uses a variety of dry and wet floodproofing methods to protect infrastructure at risk of RSLC. These strategies are expected to have ***no impact*** on groundwater, as there would be no surficial disturbing activities that would come in contact with the resource.

Nonstructural measures such as relocation and demolition could have temporary adverse impacts to shallow groundwater that are expected to have low impacts. Demolition activities would use heavy machinery, such as excavators, that may penetrate shallow groundwater during excavation and removal activities. Additionally, if groundwater becomes exposed during demolition, site areas would need to be dewatered to move groundwater outside of the construction area. This would temporarily disturb natural routes of groundwater flows and may cause minor surface flooding. Demolition activities are expected to have ***less than significant*** adverse impacts to groundwater as these would be temporary and only last during construction.

Relocation would involve demolition of existing substructure/foundation during the removal process and site preparation for the new location. Site preparation could involve excavation and dirt work that utilizes heavy machinery, bulldozers, graders, and excavators. As with demolition, this disturbance of surface soils could penetrate and expose shallow groundwater that resides within the upper three to six feet of the surface elevation. Under existing conditions, the majority of shallow groundwater is present more than nine feet below the surface; however, as relative sea level changes, it would be expected that groundwater levels would also rise, raising the likelihood of encountering the resource during excavation and site preparation. If groundwater is exposed, the construction area would need to be dewatered to drain the groundwater elsewhere, temporarily disturbing groundwater flows and causing minor surface flooding. If structure relocation results in the conversion of pervious surfaces to

impervious surfaces, there is a potential for long-term adverse impacts to groundwater flows. However, it is anticipated that quantitative modelling would be conducted prior to relocating structures to avoid permanent impacts and loss of groundwater resources. Relocation activities would also include construction of new foundations and those associated with placing structures at new locations, and paving surfaces. These activities are expected to have similar impacts as those already described. Overall, nonstructural measures are expected to have ***less than significant*** impacts to groundwater resources and be temporary, only lasting through construction activities.

4.13.5 Alternative F

Alternative F is expected to have the following impacts to groundwater resources associated with construction activities on measures and operations and maintenance (**Table D.1-27**). Impacts to groundwater would range from no impacts to moderate dependent on the measure. Several O&M activities are assumed to have no impact to groundwater as they should not require subsurface activities that would disturb the resources. Alternative F is expected to have similar low impacts to groundwater as described in Alternative B for nonstructural measures. ***No impacts*** are anticipated to occur during construction of vertical walls. In 2040, walls would be constructed around existing piers, while in 2090 walls would be constructed along the new seawall. No groundwater resources are expected to occur on the edge of piers where walls would be constructed. In 2090, walls are intended to add vertical height to features constructed in 2040, and thus, should not require disruption of surficial material that would result in contact with groundwater.

Low adverse impacts to groundwater are expected during construction of wharf, ecological armoring, and marsh enhancement. Construction of these measures would predominantly include in-water construction activities, as well as some shore-based activities. Fairly minimal wharf is proposed to be replaced for Alternative F (**Table D.1-8**). The wharf being replaced is largely located over San Francisco Bay and would utilize in-water construction activities such as work barges, pile drivers, support vessels, etc. As the Bay does not contribute significantly to recharge of groundwater, the in-water construction is not expected to have adverse impacts to this resource. However, some shore-based construction activities associated with replacing the wharf, such as any grading, excavation, site preparation, and fill is likely to have low adverse impacts to groundwater during construction similar to those previously described. Construction of the wharves is not likely to permanently modify or adversely impact groundwater as it would not drastically change the porosity, permeability, or perviousness of the existing area. The areas proposed for wharf replacement are already impervious surfaces that would remain impervious and simply raise in elevation.

Placement of ecological armoring would have low impact to groundwater resources during construction as some excavation and grading may need to occur prior to placing stones. However, upon construction completion, the stone should be placed in a manner that does not impede groundwater flow and allows for drainage to continue into the Bay. Similarly, marsh enhancement would require grading and excavation activities to prepare the area for placement of fill material and native plants. However, this is intended to enhance or create pervious surfaces that are beneficial to groundwater

drainage and absorption. Construction would have low impacts for reasons described above, but long-term would be beneficial to groundwater. Overall, these three measures are expected to have temporary impacts during construction that would be ***less than significant***.

Table D.1-27: Summary of Groundwater Impacts Associated with Alternative F

Alternative F Groundwater Impact Rating by Measure	**Bay fill**	**Levee**	**Bulkhead wall/Seawall**	**Roadway Impact**	**Tide Gate**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Marsh Enhancement***
Construction Footprint	3	2	3	2	3	2	1	2	2	2+	2+
O&M Assumptions	1	2	2	1	2	1	1	1	1	1	1
Mitigated Rating	*3*	*2*	*3*	*2*	*2*	*2*	*1*	*2*	*1*	*1*	*1*

Construction of the seawall and tide gates, and addition of bay fill, are anticipated to have moderate impacts on groundwater. The seawall is intended to be raised to accommodate future RSLC and the inland ground elevation would be raised and graded to effectively meet the new seawall elevation. The inland ground elevation is expected to be raised high enough to avoid groundwater seepage under RSLC conditions; however, additional quantitative modelling would be needed to refine final designs to ensure this during the design phase. Construction of the new seawall and addition of bay fill is likely to adversely impact groundwater flows while activities are underway but would be returned to a condition that allows for proper drainage to San Francisco Bay upon completion. During installation, the seawall would disconnect the existing groundwater drainage to the bay, particularly when bay fill is added. This would turn a once open bay bottom and open water habitat into an impervious surface. Because the Bay is not a significant contributor to groundwater recharge, the impact to supplies is not anticipated to be adverse. Drainage would be redirected or require dewatering during construction as the permeability would be permanently changed. These activities are likely to require mitigation to lessen the adverse impacts to groundwater, set to be determined by BCDC and the Waterboard. Upon construction completion, groundwater discharge routes and storage would need to be addressed as to not impede water flows, thus, eliminating the likelihood of permanent adverse impacts to the resource. Adverse impacts from the construction of the seawall and addition of bay fill are expected to be ***less than significant with mitigation***.

Alternative F includes water control structures (i.e., tide gates in 2040 converted to pump stations in 2090) at the mouth of both Islais and Mission Creeks. In the near-term, the intent is for the tide gates to be designed (i.e., number of gates) in a manner to maintain similar inflow and outflow volumes and to remain open to allow flushing of the creeks with tidal fluctuations under normal conditions. Tide gates would be closed during low tide in the event excessive tidal conditions and storm surge combine to warrant closing them. This would allow maximum storage in the creek from inland storm runoff or rising groundwater, that would be released once conditions allow, to drain into San Francisco Bay. The operation and maintenance of tide gates is anticipated to have low impacts to groundwater resources, as storage and drainage would not be impeded during normal conditions.

Construction of the tide gates would temporarily impede and redirect groundwater resources for sections that are constructed on land; however, no long-term permanent impacts are anticipated as construction is set to occur on areas of impervious surface. Any excavation, demolition, and grading work that would need to be completed would have similar impacts on the resource as described above. In later years, when RSLC increases to the point tidal exchanges become too difficult to regulate the creek water levels to avoid flooding, the tide gate structure would be converted to a pump station utilizing the majority of the existing structure. If this were to occur, groundwater levels would likely be rising with RSLC and any drainage to the creek area (now likely a managed lagoon) behind the water control structure would be manually pumped into the bay by the pump station. From theory (i.e., Darcy's Law), maintaining a lower water level in the creek/lagoon with a water control structure would direct groundwater flow to the creek/lagoon. During high Bay levels, groundwater discharge to the creek could be substantially increased, leading to sufficient discharge to raise creek water levels. However, this effect requires more analysis on groundwater response timescales and groundwater discharge effects on the water budget of the creek, which would be completed during the design phase. It is likely mitigation would be needed to reduce adverse impacts to groundwater, set to be determined by BCDC and the Waterboard. Overall installation of tide gates are anticipated to have moderate impacts to groundwater and would be ***less than significant with mitigation***.

4.13.6 Alternative G

Alternative G is expected to range from no impacts to moderate impacts to groundwater resources associated with construction activities on measures and operations and maintenance activities (**Table D.1-28**).

Table D.1-28: Summary of Groundwater Impacts Associated with Alternative G

Alternative G Groundwater Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	3	2	2	1	2	2	2+	2+	2+	2+
O&M Assumptions	2	1	2	1	1	1	1	1	1	1	1	1
Mitigated Rating	*2*	*2*	*3*	*2*	*2*	*1*	*2*	*1*	*1*	*1*	*1*	*1*

Construction related impacts are anticipated to be similar to those described in Alternative F for overlapping features, but overall would have lower impacts to groundwater than Alternative F or the TNBP because of the conversion of industrial areas to NNBFs as the LOD is retreated inwards with increasing flood risks. The amount of pervious and impervious surfaces over a groundwater-shed has a large influence on both groundwater emergence and intrusion. Pervious surfaces help to reduce runoff and saltwater intrusion, but may enhance recharge and raise water tables, leading to more groundwater emergence. However, converting impervious surfaces to pervious surfaces is anticipated to have beneficial impacts to groundwater supplies overall.

Marsh vegetation could transpire sufficient groundwater to reduce the effect of RSLC minorly and locally. The vegetative barrier would likely have a cyclic effect on groundwater levels with transpiration occurring during daytime, such that the net flux would need to overcome local groundwater flow conditions. NNBFs would be designed to slope towards the Bay to allow for adequate drainage of shallow groundwater under normal and extreme storm conditions. Because of the NNBFs, Alternative G impacts to groundwater are anticipated to be ***less than significant*** and overall beneficial.

4.13.7 Mitigation

Mitigation and BMPs would be the same as those described in the Water Quality section.

4.14 Aquatic Resources

This section describes impacts, adverse and beneficial, to aquatic habitats and wildlife including intertidal and subtidal habitats, wetlands, pelagic habitat, fish, and macroinvertebrates. Impacts to aquatic resources in the study area are anticipated during construction and operations and maintenance activities depending on the measure and existing conditions. The following are impact producing factors to aquatic wildlife and habitat: physical seabed/land disturbance, sediment suspension, discharge/release and withdrawals, habitat conversion/loss, land use, economic change, and noise.

4.14.1 Construction Impact Summary

Short-term direct impacts from construction-related activities are anticipated to adversely affect aquatic habitat and wildlife, whether they occur as a resident, migrant, or incidental, within or near the project area. Impacts include habitat removal and/or fragmentation and habitat avoidance due to increased noise, dust generation, vibrations, debris, accidental discharge, and overall lower quality habitat. Impacts to water resources are the same as those described in Water Quality.

There are two wetlands and associated water resources in the study area – Pier 94 wetlands and Heron's Head Park. They are considered significant in the study area, particularly Heron's Head, due to the rare nature in the otherwise urban environment. Temporary impacts to wetlands are anticipated to occur during the construction of shore-based measures near the wetlands, such as levees, t-walls, and vertical walls, as well as during construction of NNBF such as marsh enhancements and ecological armoring.

Preparation of the construction sites would require clearing and grading of vegetation that could result in temporary wetland, subtidal and intertidal habitat, and water quality impacts. Any temporary impacts to vegetation are anticipated to be replaced on-site. Placement of dredged or commercial material in wetlands and aquatic areas would have temporary impacts during construction, as well as to adjacent transition areas that are likely to be impacted by clearing, soil disturbances, and suspended sediments. Temporary impacts would be managed through implementation of a site-specific SWPPP and construction BMPs. The specific BMPs to be incorporated into the SWPPP would be determined during PED; however, BMPs expected to be used to reduce impacts to aquatic resources include but are not limited to those described in the Geology and Water Quality mitigation sections.

Temporary in-water impacts include increased turbidity during construction activities and resuspension of sediments into the water column during pile driving, placement of concrete blocks, dewatering, and excavation and fill activities. Temporary and localized impacts to aquatic habitats from vessel anchoring and dewatering activities may occur but are expected to return to pre-existing conditions following active construction. Spills or leaks of fuels, lubricants, and coolant from construction equipment could significantly impact water resources as described in the Water Quality section. Additionally, sheetpiles would be treated with corrosion-resistant coating prior to installation, which

may require application by hand as necessary to touch-up areas potentially damaged during the installation process. These activities could pose a temporary risk of exposing resident aquatic organisms to toxic contaminants and non-edible forage. A site-specific spill prevention control and countermeasure plan (SPCC) would be developed and implemented to prevent spills and minimize the potential impacts for any inadvertent spills. With implementation of the SPCC and BMPs, impacts from spills or leaks are anticipated to be minor. Water quality is anticipated to return to baseline conditions after construction activities are completed.

Impacts to fish during construction are the same as those described for similar EFH-designated species (demersal and pelagic) in the Special Status Species section and are primarily associated with in-water measures such as wharfs, bulkhead/seawalls, sheetpile walls, and NNBFs (e.g., marsh enhancement/creation, ecological armoring). Temporary direct impacts include altered habitats associated with noise, vibration, sediment suspension, physical disturbance, and impaired water quality (e.g., lower dissolved oxygen). Permanent adverse impacts include habitat loss through measures such as bulkhead wall construction and wharf extensions. Impacts associated with Noise and Vibration are described in Annex D.1.2. Fish are expected to actively avoid most in-water work areas, opting for another appropriate habitat nearby. This avoidance behavior would occur only in those areas where construction is underway. Fish species are expected to return to the area when construction is completed.

Losses of slow moving and less mobile species (e.g., aquatic invertebrates, benthic species) are anticipated within the construction footprint due to burial of individuals and/or increased turbidity. Suspension/filter feeding organisms could be impacted due to clogging of gills and feeding mechanisms, which would cause death or reduce growth and reproduction. Visual predators would have a reduced success rate at catching prey due to lower visibility levels. Following construction activities, water quality is expected to return to pre-construction conditions.

In general, most fish, wildlife, and benthic species would become habituated to the work and adapt to the habitat changes; however, species with low tolerance are anticipated to be displaced for the duration of activities. The severity of the impacts is dependent on the final design of features, type of equipment used, and duration of construction activities. Once construction is complete, it is anticipated that construction-related impacts to aquatic organisms would cease. These adverse impacts would be minimized and controlled by implementing the best available practical techniques and BMPs during construction.

Long-term beneficial impacts to aquatic resources are expected with NNBFs such as enhanced or created wetlands, ecological armoring, and vertical shorelines/living seawalls, as they would result in improved habitat conditions and an expansion of available habitat for aquatic species, including special status fish. Wetlands improve water quality, flood control, and ecological benefits to aquatic resources. The NNBFs would allow for improved diversity and provide refuge for aquatic plant and animal species to promote higher abundances than would likely be supported in their absence. Wetlands, ecological armoring, and vertical shorelines would provide surface area to colonize, which establishes a more sufficient food supply to support primary (i.e., herbivores) and secondary (i.e., carnivores) consumers. Intertidal marsh and marsh

edge would provide increased foraging opportunities for shorebirds and wading birds using the shoreline habitats. Nesting habitat would be improved as the enhanced/created marsh would provide more desirable nesting habitat in an area that would otherwise be inhabitable for nesting under FWOP conditions. The increase in vegetative structure would also provide shelter for prey species to evade predators.

4.14.2 Operations and Maintenance Summary

During operations and maintenance, potential impacts to aquatic resources may occur, but are anticipated to be low overall. Temporary in-water impacts include increased turbidity from resuspension of sediments, noise, vibration, spill of toxic material, and physical disturbance. Inspection and maintenance of sheet pile walls may require re-application of corrosion-resistant coatings, which would be applied by hand to localized areas where needed. Accidental spills of anti-corrosion coatings or diesel fuel could occur during O&M activities. This could be a significant impact that would require mitigation to reduce the impact to a less-than-significant level. A SPCC and BMPs would also be employed to reduce overall impact and likelihood of a spill occurring. Additionally, similar impacts as described in the Water Quality operations and maintenance section would be applicable to aquatic resources.

4.14.3 Recommended Plan

The impacts to aquatic resources from the TNBP range from no to moderate to high, with in-water activities expected to have more adverse impacts (**Table D.1-29**).

Table D.1-29: Summary of Aquatic Resource Impacts Associated with the TNBP

TNBP Aquatic Resources Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*	Vertical Shoreline
Construction/Footprint (First Actions)	4	2	2	2	3	2	2	4	2+	2+	2+	2+	1	4+
Construction/Footprint (Subsequent Actions)	1	2	4	1	1	2	1	4	2+	2+	2+	2+	2+	4+
O&M Assumptions	1	2	2	2	3	1	1	2	2+	2+	2+	2+	2+	2+
Mitigated Rating	*3*	*2*	*3*	*2*	*3*	*2*	*2*	*3*	*1*	*1*	*1*	*1*	*1*	*2*

The impacts for construction of a new bulkhead wall varies between 2040 and 2090 as they would be located in different areas. In 2040, the bulkhead wall would be constructed similar to that described in Alternative G and would be expected to have low impacts to aquatic resources. However, in 2090, the bulkhead wall is constructed more similar to described in Alternative F, requiring in-bay fill (though much smaller quantities), and is anticipated to have moderate to high impacts to aquatic resources. As with the other action alternative, shore-based measures are expected to have low impacts to aquatic resources.

As described in Alternative B, F, and G, replacement of wharf structure would have moderate to high impacts to aquatic resources during removal of existing piles and pile driving of new ones. Additionally, over-water work has the potential to have significant impacts to aquatic resources if any construction-related material is dropped into the water. As with the other alternatives, wharf replacement in the TNBP is expected to have impacts that are ***less than significant with mitigation***.

Sheetpile walls would have similar impacts to those of bulkhead walls constructed bayward of the existing seawall, albeit at a much smaller scale, and may require dewatering activities as described in Alternative F. Installation of sheetpile walls is expected to have impacts that are ***less than significant with mitigation*** by employing BMPs described in this mitigation section, as well as the water quality and geology sections.

NNBFs features are anticipated to have low impacts during construction and maintenance activities but would overall be beneficial to aquatic resources through the creation of habitat ideal for foraging, resting, and refuging. Adverse impacts from construction and maintenance of NNBFs measures are expected to be ***less than significant***.

Bay fill, wharf replacement, and addition of bulkhead walls are anticipated to have moderate to high impacts to aquatic resources. Similarly described in Alternative B and F, impacts from bay fill and bulkhead wall features have ***significant and unavoidable*** impacts to aquatic resources during construction. Wharf replacement would have ***less than significant impacts with mitigation***, with the use of BMPs as described in this mitigation section, as well as water quality and geology BMPs. Additionally, a compensatory mitigation plan has been developed to offset unavoidable impacts to aquatic resources with addition of bay fill, which can be found in Appendix K. A coarse beach is proposed to overlay some bay fill, which could have long-term beneficial impacts on foraging for shorebirds and wading birds, as well as provide habitat for invertebrates.

The construction of the living seawall/vertical shoreline was assumed to be textured panels that would be installed on the existing or new seawall in the dry, which would require dewatering activities. It is reasonable to expect the comparable dewatering impacts as described in Alternative F, as nearly the same linear feet of shoreline would be impacted (**Table D.1-8**). As described in Alternative F, the process of dewatering and constructing a cofferdam would have adverse impacts to aquatic species, particularly fish and invertebrates, including special status species. Any invertebrates and/or aquatic vegetation (e.g., algae) present on the seawall would be removed prior to

installation of the textured panels. This is most likely to occur on areas where panels are attached to the existing seawall as it has been available for colonization. Long-term beneficial impacts to aquatic resources are expected after construction ceases. Living seawalls create varied microhabitat conditions through surface relief that promotes vegetation growth, provides foraging habitat, and creates shelter from predation benefiting invertebrates, algae, and fish species (O'Shaughnessy et al. 2020, Morris et al. 2017). The structure can also improve water quality through recruitment of bivalves, benefiting aquatic resources.

Overall, in 2040, impacts would be comparable between the TNBP and Alternative F or G (**Table D.1-8**). More adverse impacts would be realized for the TNBP during the subsequent construction phase which includes exceedingly more bulkhead wall and wharf replacement than Alternative F or G.

4.14.4 Alternative B

Construction related impacts are associated with demolishing buildings and installing floodproofing barriers. These are expected to have low impacts to aquatic resources, particularly because most activities would be shore-based. However, some impacts to aquatic resources may still occur, including noise, physical disturbance, and turbidity which would result from operating machinery in the construction area. BMPs such as those described in the Noise and Vibration and Water Quality sections would be used to reduce impacts from these activities to aquatic resources. All impacts are anticipated to be temporary and ***less than significant***, only lasting as long as the construction period.

O&M for Alternative B are expected to have no impacts to aquatic resources. The non-structural alternative is designed to be implemented in four-time steps commensurate with the trajectory of RSLC inundation levels that would trigger the need for protective measures. These implementation steps are expected to have "construction" related impacts, particularly in the case for building demolition. Details about assumptions for building demolition and relocation are described in *Appendix B: Engineering*.

Two piers are proposed for demolition in Alternative B, one in 2040 and another in 2115. Pier demolition would have temporary adverse impacts to aquatic resources, including physical disturbance, impaired water quality, increased turbidity, release of contaminants, and noise. However, permanent impacts, both adverse and beneficial, are also expected which may include but are not limited to altered hydrology and sediment deposition, habitat and shade structure loss, increased turbidity and erosion, and contaminant removal. Impacts to water quality and hydrology can be found in those respective sections. For aquatic resources, particularly fish, the loss of a shade structure could be beneficial by increasing abundance of visual predators. Overwater structures are known to interrupt visual predator behavior and localized movements of migratory fish (Munsch et al. 2017); thus, the removal of these structures could have beneficial effects.

Sessile (e.g., oysters, mussels), non-native (e.g., bryzoans, tunicates, anemones, sponges), and motile (e.g., herring) organisms use the pier pilings as habitat, refuge, nursery, and for foraging. Removal of these structures would have direct negative impacts to existing organisms through injury and death. Many of the pier pilings were

injected with creosote to minimize fouling, which contain polycyclic aromatic hydrocarbons (PAHs) that are toxic to some organisms. By removing creosote pilings, long-term beneficial impacts would likely result to marine species through improved water quality.

Strong circulation around pilings may minimize direct effects of creosote on motile organisms; however, those that forage on sessile prey species inhabiting the pilings are likely exposed to creosote through their food (Cosentino-Manning et al. 2010). It is unclear what long-term impacts would occur by eliminating the piers, both in terms of habitat and local wave, current, and sedimentation patterns. It is clear the pier pilings support valued ecosystem services and removal could have detrimental impacts to aquatic resources (Cosentino-Manning et al. 2010). It is expected BMPs during removal would be used to minimize impacts of contamination, while mitigation would help to offset permanent losses to aquatic resources. There remains uncertainty of the local and regional impacts of removing the piers, in which more detailed analyses would be needed during the design phase. However, given few (two) piers are expected to be demolished in Alternative B, overall, the impacts are expected to be ***less than significant***.

4.14.5 Alternative F

The impacts to aquatic resources from Alternative F range from no to moderate to high, with in-water activities expected to have more adverse impacts (**Table D.1-30**).

Table D.1-30: Summary of Aquatic Resource Impacts Associated with Alternative F

Alternative F Aquatic Resource Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	4	2	4	2	3	2	2	3	2	1	2+
O&M Assumptions	1	2	2	1	3	1	1	2	2	1	2+
Mitigated Rating	*3*	*2*	*3*	*2*	*3*	*2*	*2*	*3*	*1*	*1*	*1*

Low impacts are predominantly for shore-based measures that could negatively impact water quality as described in the section above, as this would conversely have negative impacts to aquatic resources. A levee is planned for construction adjacent to Heron's Head Park; however, all work is shore-based and should not impede natural functions of the wetland during or after construction. The low impacts are similar to those described in the Water Quality section. In the same location, NNBFs marsh enhancement and an ecotone levee are planned for construction to compliment the levee feature. Construction of these NNBF measures could have direct and indirect and temporary and permanent impacts on jurisdictional wetlands and waters. Temporary adverse impacts would result if excavation and dirt work were to cause sediment suspension or the inadvertent entry of deleterious construction-related materials (e.g., fuel, lubricant) into the bay during construction. The long-term permanent impacts are expected to be beneficial as marsh is enhanced and expanded, while the ecotone levee that would offer additional space for conversion to wetlands with RSLC.

Low impacts to intertidal and subtidal habitats are anticipated with the installation of ecological armoring and marsh enhancement features. Placement of rock for ecological armoring would remove open benthic space in these habitats but are anticipated to create microhabitats within crevices and textured surfaces that could still be occupied by organisms that utilize these areas. Additionally, ecological armoring is likely to increase sediment retention that could have a long-term benefit for replenishing intertidal and subtidal habitats. Enhanced marsh habitat would be beneficial for intertidal and subtidal habitats offering improvements to water quality, vegetation for habitat, forage, and refuge, and additional space for aquatic organism colonization. As RSLC, marsh habitat would convert to intertidal and subtidal zones, increasing the available space of these habitats in the long-term. Overall, addition of these NNBFs would offer long-term beneficial impacts that would outweigh the temporary and low impacts from construction and maintenance.

Jurisdictional waters of San Francisco Bay would be filled with the bulkhead wall/seawall measure, resulting in direct, adverse, permanent impacts to aquatic resources. Additionally, wharf being replaced would install new pilings and overhang structure to support the facilities. Installing piles for the seawall and wharf would require in-water work including but not limited to pile driving, support vessels, work barges, etc. Construction of the wharf would utilize over-water work, but not necessarily in-water work methods. However, this could still inadvertently drop construction-related materials into the bay that could have significant impacts to aquatic resources. Placement of in-bay fill would require water quality certification and/or waste discharge requirements from the regional Waterboard, and also a permit from BCDC, as the fill area is within 100-feet of the shoreline band and within San Francisco Bay. Collectively, the regulatory agencies and the permits and authorizations would require the placement of new fill in jurisdictional waters be avoided or minimized to the maximum extent practicable while still accomplishing the proposed project's purpose. These permits would require water quality protection measures to avoid and/or minimize temporary impacts from in-water and above-water construction activities that would be implemented in conjunction with water quality BMPs. Permanent placement of new fill would result in the loss of 25 acres of jurisdictional waters (**Table D.1-8**) which would likely trigger a requirement for compensatory mitigation aimed at restoring or enhancing

ecological functions and services like those displaced. The temporary and permanent impacts anticipated to jurisdictional waters because of in-bay fill are ***significant and unavoidable*.**

Likewise, in-bay fill would result in a permanent loss of open water and benthic habitats in the affected areas. Any sessile and/or benthic organisms present on the seabed during fill would be smothered and likely lost. The 25 acres of bay fill would be rendered inhabitable and inaccessible to aquatic organisms. The lost habitat would also impact food availability locally for fish, including special status species, that rely on pelagic phytoplankton or benthic organisms for food sources. BMPs would be in place to reduce the likelihood of inadvertent spills of fill material outside of the intended area; however, if spill were to enter the water column, it would result in turbidity that could temporarily affect visual predators and/or suffocate filter feeding invertebrates. The study area is highly urbanized; thus, additional loss of aquatic habitat could have significant impacts to marine resources. As with jurisdictional waters, BCDC and the regional water board would have to grant permits for the permanent placement of fill, which is likely to trigger a requirement for compensatory mitigation. The permanent loss of aquatic habitat, and potential loss or injury of marine species because of in-bay fill renders the impacts ***significant and unavoidable***.

Similar to the impacts described for pier removal in Alternative B, wharf replacement in Alternative F is anticipated to have moderate impacts to aquatic resources. Removal of pilings would have temporary impacts to aquatic resources, including habitat and wildlife, through sediment suspension and/or inadvertently through entry of deleterious construction-related materials into the bay during over- or in-water work. Removal of creosote-laden pilings is likely to have long-term beneficial impacts to aquatic wildlife by removing contaminated structures from the water. However, any sessile organisms present on pilings during removal would be injured or lost. Additionally, an important forage source for fish would temporarily be removed and may take months to years to be replenished once the new wharf is installed. There remains great uncertainty about the local and regional impacts of removing and replacing wharfs, as well as the long-term impacts to aquatic resources, in which more analyses would be needed during the design phase. Wharf replacement would permanently impact pelagic and benthic habitat, though replacement is expected to cover the same or similar footprint to existing wharf structures. The number, size, and composition of pilings would be determined during the design phase. BMPs described in this, and the Water Quality section would be used to reduce impacts of wharf replacement on aquatic resources to ***less than significant with mitigation***.

Dewatering would likely be required for construction of bulkhead/seawalls, tide gates, and during in-bay fill. Tide gates would utilize cofferdams to allow dry work conditions during installation of foundations and gate segments. When constructing new seawalls, cements casts would require dewatering prior to being filled, and the open bay area between the new and existing seawall would also need to be dewatered prior to placement of in-bay fill. Bay waters present between the two seawalls and within the cofferdam may contain fish, including special status species, that could become entrapped, injured, or killed, if present at the time when water levels are lowered during dewatering, which would be a significant impact. Benthic invertebrates would be lost

during dewatering activities and installation of cofferdams, and it is uncertain at what point they would reinhabit the bay bottom after construction is completed. Benthic faunas recover from other bottom disturbing activities such as dredging and benthic trawling within 1-4 years on average (Wilber and Clarke 2007; Kotta et al. 2009; Wang et al. 2021); therefore, it could be reasonably assumed the temporal recovery of benthic invertebrate populations would be the same or less for dewatering and cofferdams. BMPs described in the Mitigation section would be used to reduce the impact to ***less than significant with mitigation***.

Construction of the tide gates is anticipated to have similar impacts to those described in wharf replacement and dewatering, thus would be ***less than significant with mitigation***. Operation and maintenance of tide gates can temporarily impede fish passage, though this is expected to be short durations (hours to days). Additionally, changes to salinity, temperature, and dissolved oxygen can occur when tidal exchange is reduced with operation of tidal gates (Chen and Orton 2023). There remains large uncertainty around the design and operation of tidal gates, which would need to be determined in PED; however, frequent closures may result in measurable permanent changes to the physical conditions in the estuary (Chen and Orton 2023) that could cause a regime shift in aquatic species. Detailed hydrodynamic modelling would be needed to help develop the design and determine closure frequency to assess potential long-term impacts to aquatic species. The intent would be to design the structures in a manner that would limit changes to tidal exchange to allow for continued use by aquatic species. Later, in 2090, when the tide gates are expected to be converted to pump stations, the interior of creeks would be inaccessible to marine fish and invertebrates unless designed otherwise. This would reduce habitat and food availability and could lead to pulsed releases of water that may change local salinity, dissolved oxygen, and temperature conditions in the bay. The impacts are anticipated to be temporary, occurring during flooding events, but hydrodynamic modelling would be needed to determine the overall sustainability of this feature. In general, the loss of habitat could have a significant impact to aquatic species that have already experienced substantial habitat loss in the San Francisco Bay Estuary.

Overall, Alternative F is expected to have the greatest adverse impacts to aquatic resources due to loss of pelagic and benthic habitat.

4.14.6 Alternative G

Alternative G is anticipated to range from no to moderate impacts on aquatic resources (**Table D.1-31**).

Table D.1-31: Summary of Aquatic Resource Impacts Associated with Alternative G

Alternative G Aquatic Resource Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	2	2	2	2	3	2	2+	2+	2+	2+
O&M Assumptions	2	2	1	1	1	1	2	2	2+	2+	2+	2+
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*3*	*1*	*1*	*1*	*1*	*1*

All features for Alternative G, apart from wharf replacement, would be shore-based measures that are anticipated to have low impacts to aquatic resources. Impacts would be similar to those described for Shored-based Activities in the Water Quality section, stemming mostly from accidental spills and possibility of turbidity from windblown sediments or dust. Otherwise, shore-based construction should not impact aquatic resources. BMPs as described in the mitigation sections of Water Quality and Geology would be used to reduce impacts to these habitats and resources.

Similar to impacts described for Alternative B and F, Alternative G is anticipated to have moderate impacts with wharf construction, predominantly from pile driving activities. There is the potential for over-water construction to have significant impacts to aquatic resources if debris is inadvertently dropped in the water, but this would be minimized with the use of BMPs to be ***less than significant with mitigation***.

Alternative G maximized the inclusion of NNBFs, particularly in 2090, when the line of defense is moved inland. The land bayward of the line of defense would be converted to a range of NNBFs including enhanced and created marshes, ecotone levees, and naturalized and embankment shorelines that creates essential habitat for aquatic species, including fish, invertebrates, and birds. By 2090, Alternative G would convert nearly 700+ acres of once urban area to vegetated, naturalized green space. These newly vegetated areas would provide habitat for an array of aquatic species, enhance structural diversity of plants which could lead to increased wildlife diversity, and create large transitional zones from the water to inland green space. Aquatic vegetation in the marsh would provide forage and refuge for amphibians, fish, invertebrates, waterfowl, and wading birds (Audubon n.d.), including special status species. The beneficial impacts of NNBFs far outweighs the potential adverse impacts of construction and

maintenance. The construction and maintenance of NNBF measures would be ***less than significant***.

Overall, Alternative G would have the least adverse impacts and most beneficial impacts to aquatic resources.

4.14.7 Mitigation

In order to avoid and/or minimize potential impacts to aquatic resources, the following minimum construction BMPs would be implemented as part of the proposed project. These minimum measures would be subject to modification and additions based upon regulatory and resource agency review.

- Prevent fish entrapment and entrainment during dewatering, such that fish rescue operations shall occur where dewatering and resulting isolation of fish may occur. Fish rescue and salvage operations shall occur prior to and during dewatering. If the enclosed area is wadable (less than 3 ft deep), fish can be herded out of the enclosure by dragging a seine (net) through the enclosure, starting from the enclosed end and continuing to the opening. After completing fish herding, the net or an exclusion screen shall be positioned at the opening to prevent fish from reentering the enclosure. Screens shall be checked periodically and cleaned of debris to permit free flow of water.
- Sheetpiles, block nets, or other temporary exclusion methods (e.g., silt curtains) could be used to exclude fish or isolate the construction area prior to a fish removal process.
- A dewatering plan shall be submitted as part of the SWPPP and Water Pollution Control Program, detailing the location of dewatering activities, equipment, and discharge point. Dewatering pump intakes shall be screened to prevent entrainment of fish in accordance with the NMFS screen criteria.
- A qualified fish biologist or fish rescue team shall be onsite during the dewatering process to minimize the number of fish that become trapped in isolated areas or impinged on pump screen(s) or isolation nets.
- Prior to any in-water construction that would require pile driving, a NMFS-approved sound attenuation monitoring plan to protect fish and marine mammals, and the approved plan shall be implemented during construction.
- All in-water construction shall be conducted within the environmental work window between June 1 and November 30, designed to avoid potential impacts to fish species.
- A soft start technique (release of pile-driving hammer without hydraulic pressure) to impact hammer pile driving shall be implemented, at the start of each workday or after a break in impact hammer driving of 30 minutes or more, to give fish and marine mammals an opportunity to vacate the area.

- During in-water installation of piles, when feasible, vibratory hammers should be used in place of impact hammers, as well as cushion blocks should be used.
- During in-water installation of piles, when feasible, bubble curtains will be considered for use with impact hammers to reduce impacts to fish.
- Functional grating or glass prisms will be considered in the design for new wharf decking to maximize light transmittance in nearshore zones (first 10-15 feet from the bulkhead).
- During construction near the water, artificial light should be directed away from sensitive habitats and species, to include shielding and/or downward-directed, to prevent disruption to aquatic species.
- Ecological armoring features will be designed to the extent feasible to include tide pools or water-retaining shapes over flat textured panels where practicable to increase surface area for invertebrate prey colonization.
- Rocky intertidal bluffs will be designed to the extent feasible include variable slopes, rather than uniform, to create micro-habitats and velocity refugia for fish.

The USACE and its contractors shall minimize impacts on waters of the U.S. and waters of the state, including wetlands, by implementing the following measures:

- The proposed project shall be designed to avoid, to the extent practicable, work within wetlands and/or waters under the jurisdiction of the USACE, the regional waterboard, the CDFW, and BCDC. If applicable, permits or approvals shall be sought from the regulating agencies as required. Where wetlands or other water features must be disturbed, the minimum area of disturbance necessary for construction shall be identified and the area outside avoided.
- Prior to construction within 50 ft of any wetlands and drainages, appropriate measures shall be taken to ensure protection of the wetland from construction runoff or direct impact from equipment or materials, such as installation of a silt fence, and signs indicating the require avoidance. No equipment mobilization, grading, clearing, or storage of equipment or machinery, or similar activity, shall occur until a qualified biologist has inspected and approved the fencing installed around these features. The contractor shall ensure the temporary fencing is maintained until construction activities cease.
- Where disturbance to jurisdictional wetlands or waters cannot be avoided, any temporarily affected areas shall be restored to pre-construction conditions or better at the end of construction, in accordance with regulating agencies.

4.15 Upland Resources

The evaluation methodology is based on a comparison of existing to future conditions in terms of surface area (acres) and consideration of the value of cover types of terrestrial habitat, wildlife, and fish. Impacts to biological resources can be short-term or long-term. Short-term impacts are primarily associated with construction activities and are described below. Long-term impacts would likely occur with a changing landscape associated with the proposed action.

Significance Criteria

Adverse effects on vegetation and wildlife were considered significant if implementation of an alternative plan would result in any of the following:

- **BIO-01:** Result in a substantial change of native vegetation;
- **BIO-02:** Substantially change the quality of important habitat or access to such habitat for wildlife species;
- **BIO-03:** Result in substantial change of a resource(s), including fish and wildlife and their associated habitats, that are technically, institutionally, or publicly recognized as having substantial nonmonetary value.

4.15.1 Construction Impact Summary

During construction, vegetation removal would be required for construction equipment mobilization, staging areas, and haul routes. Where possible, existing disturbed areas would be used to avoid additional vegetation removal and surface disturbing activities. Where not possible, existing vegetation would be removed and disposed of off-site. The area would be restored to pre-construction conditions once use of the area is complete. Similar vegetation removal practices would also be required in and around areas where excavation, grading, or constructed structures are being implemented. However, the extent of vegetation restoration would be dependent on whether the site has been converted to an impervious surface or not.

Adverse effects may occur to vegetation outside of the proposed project area during construction from fugitive dust emissions produced by construction machinery and worker traffic along unpaved roads/routes. Dust emissions could impede photosynthesis by reducing light penetration into plant leaves and increase the risk of growth of plant fungal disease (Farmer 1993). Impacts from dust generated during construction activities would be short-term and controlled by dust suppression measures (e.g., water spraying) as required by regulations. After construction, local off-site vegetation is expected to recover with no long-term losses.

Use of construction equipment and surface disturbance could contribute to the establishment and spread of non-native plants by transporting species between work areas. Aggressive non-native species could become established if ground disturbance during construction is extensive and lengthy. These potential impacts can be reduced through typical construction BMPs such as minimizing soil disturbances, cleaning equipment of plants prior to moving between project areas, stabilizing disturbed soils as soon as possible, and using certified weed-free seed for revegetation.

While operating construction equipment, there lies the possibility for spillage of fuels and other material that could damage plants and has the potential to cause shifts in population structure, abundance, diversity, and distribution of plants. Certain materials could remain in the environment for an extended period following a spill event. However, these are expected to be minor as protocols would be in place through the SWPPP, NPDES Construction Permit, and water quality certification to contain and remedy any spill appropriately.

Construction activities are anticipated to adversely impact resident, migrant, or incidental wildlife within or near the project area. Impacts include loss of habitat through removal or alteration of vegetation, habitat fragmentation, and avoidance (e.g., Jackson and Griffin 2000). Vegetation would be removed within the construction zone which would result in temporary or permanent loss, or alteration of available habitat. Mobile wildlife would be capable of relocating to adjacent suitable habitats, whereby such displacement may cause temporary declines in local populations as individuals move to neighboring territories. This dislocation may induce competition between displaced individuals and established populations of the same species, or related species with similar habitat and food requirements, for limited resources. In a highly urbanized environment, like the study area, resources are already scarce and likely stressed, thus may not be capable of supporting a higher population density, which could have cascading impacts leading to further displacement or mortality of wildlife. In general, wildlife would be expected to return and resume use of disturbed areas after construction ceases and habitat recovers or is restored, except where long-term impacts are expected as described in each of the Action Alternative sections. Sessile species, species with small home ranges, or those with specialized habitat requirements, may not be as capable of seeking suitable habitat outside of the construction zone and would likely result in mortality of individuals.

Short-term, localized, adverse effects to wildlife are expected to occur during construction from noise, light pollution, and general physical disturbance of the environment. Wildlife relies on meaningful sounds for communicating, navigating, reproduction, avoiding danger, and foraging. The level of impact from noise on wildlife depends on decibel levels, durations, the physical characteristics of the environment, and the species threshold to disturbance (Sordello et al. 2020). These impacts are referred to as noise pollution, which can harm the health, reproduction, survivorship, habitation, distribution, abundance, and biodiversity of wildlife. Noise pollution can also lead to changes in behavior, including avoidance and disturbance of normal patterns. For example, noise pollution can lead to intrusion-induced behavioral changes among birds such as nest abandonment and decreased nest attentiveness, which have led to species declines (Knight and Gutzwiller 1995). Overall, impacts from noise would be localized to the general vicinity of the construction zone and limited to the duration of the construction activity. In most instances, work would not be concentrated in any one area in exceedance of one year, limiting impacts to breeding and migration seasonally. This reduces the likelihood of long-term population declines resulting from construction activities. Any wildlife displaced by noise would likely return to remaining habitat once construction is complete. The study area is highly urbanized, thus anthropogenic noise is omnipresent, stemming from traffic and other industrial and commercial activities on a

regular basis. Noise generated from construction activities would be temporary and localized but would be expected to increase the ambient city noise.

Direct injury and/or mortality of birds, small mammals, reptiles, amphibians, and invertebrates may occur during construction through inadvertent destruction of dens, nests, cryptic organisms, or trampling of slower moving or sessile species by heavy equipment or personal vehicles. Mobile species are expected to be capable of avoiding injury or death while crossing haul roads and by avoiding the construction area.

The severeness and duration of these impacts to wildlife is dependent on the final design of each measure, type of equipment used, length of construction activities, and mitigation, if required. Construction-related impacts are expected to be localized and cease once construction completes, thereby are not anticipated to have population-level effects on any species.

Overall, limited upland vegetation is present in the study area due to the urbanized nature. There exists shrubbery and trees planted amongst urban infrastructure, as well as parks and open space in the vicinity of the study area; however, no native vegetated natural resources exist within the study area. Coastal saltmarsh is present in the study are at Heron's Head Park.

4.15.2 Operations and Maintenance Impact Summary

O&M impacts would be similar to those described in the construction impact summary but on a much-reduced scale, given the level of activity that would occur. Limited impact to vegetation and upland wildlife would be expected, except in areas where vegetation may occur (e.g., planted levees) that require augmentation or future adaptive actions. Impacts would mostly be limited to short-term, localized effects from noise, light pollution, and general physical disturbance of the environment.

4.15.3 Recommended Plan

Impacts from construction the TNBP are expected to range from no to low, with shore-based measures posing the greatest risks to these features (**Table D.1-32**).

Table D.1-32: Summary of Upland Resource Impacts Associated with the TNBP

TNBP Upland Resource Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Roadway Impact	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	1	2	2	2	2	2	2	2	1	2	2+	2+	2+	1
Construction/Footprint (Subsequent Actions)	1	2	1	1	2	1	2	1	1	2	2+	2+	2+	2+
O&M Assumptions	1	2	1	1	1	2	2	2	1	2	2+	2+	2+	2+
Mitigated Rating	*1*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*1*	*1*	*1*	*1*

As described in the construction impact summary and Alternatives F and G, adverse impacts in the TNBP are anticipated to result from shore-based measures, albeit would be minor given the limited vegetation in the construction areas. Construction and maintenance of shore-based measures would be ***less than significant***. In-water measures such as wharf and bay fill would have ***no impact*** on upland resources as no work would be performed in vegetated areas.

The TNBP includes NNBFs that would have long-term beneficial impacts to upland resources by created new vegetated areas available for foraging, refuge, and colonization. In general, there is fewer acreage of NNBF measures in the TNBP as compared to Alternative F and G (**Table D.1-8**). Construction and maintenance of NNBFs would have ***less than significant*** impacts to upland resources.

4.15.4 Alternative B

Adverse impacts to upland resources from Alternative B would be the same as those described in the construction impact summary, particularly when a building would be removed, relocated, and/or demolished. Floodproofing activities would have less impacts as these would be less disruptive and effect a smaller footprint. Given the design of Alternative B, impacts from the non-structural measures would be realized over varying time scales, but occur more frequently than the other action alternatives. Alternative B was designed to act at varied time steps, dependent on risk of RSLC, which resulted in an estimated four-year implementation strategy. It would be expected that impacts to upland resources would be minimal given the urbanized nature of the

study area. ***No impact*** to coastal saltmarsh is expected from construction related activities in this alternative. All other impacts would be ***less than significant***.

4.15.5 Alternative F

The adverse impacts for constructing Alternative F range from no to low impacts (**Table D.1-33**).

Table D.1-33: Summary of Upland Resource Impacts Associated with Alternative F

Alternative F Upland Resource Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	1	2	1	2	2	2	2	1	2	2+	2+
O&M Assumptions	1	2	1	1	1	2	2	1	2	2+	2+
Mitigated Rating	*1*	*2*	*1*	*2*	*2*	*2*	*2*	*1*	*2*	*1*	*1*

Construction and maintenance related impacts would not differ from those described in the construction impact summary. Limited vegetation is present within the construction footprint, mostly reduced to planted trees, shrubbery, and man-made green space. Heron's Head Park is present near the construction site of a NNBFs ecotone levee and marsh enhancement. Minor adverse impacts would be expected with excavation, dirt work, and fill operations during construction; however, in the long-term addition of ecotone levees and marsh would have beneficial impacts to upland resources. Building the ecotone levee near Heron's Head Park would offer a transitional zone for aquatic and upland wildlife, as well as provide habitat for special status species such as the saltmarsh harvest mouse.

Shore-based measures are anticipated to have low impacts to upland resources based on those descriptions provided in the construction impact summary. These are anticipated to be low, short-term, and localized to the construction area and would be returned to pre-existing conditions upon construction completion. Thus, shore-based measures would have ***less than significant*** impacts. In-water measures such as wharfs and seawalls are expected to have ***no impact*** to upland resources.

4.15.6 Alternative G

Alternative G is anticipated to have impacts ranging from no to low, like Alternative F, but would also offer a substantial beneficial impact to upland resources with the addition of NNBF measures in the 2090 action (**Table D.1-34**).

Table D.1-34: Summary of Upland Resource Impacts Associated with Alternative G

Alternative G Upland Resource Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	2	2	2	2	1	2	2+	2+	2+	2+
O&M Assumptions	2	1	1	1	2	2	1	2	2+	2+	2+	2+
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*1*	*1*	*1*	*1*

As previously described, shore-based measures are anticipated to have impacts like those in the construction impact summary. No rare or unique native vegetation exists within the construction area, thus, is not likely to be impacted by any of the construction or maintenance activities. Indirect impacts through dust generation would be minimal and would not have long-term negative impacts. Alternative G maximized the addition of NNBFs as the line of defense was retreated inland with RSLC. As such, the alternative adds 700+ acres of new green space that transforms the waterfront from mostly urbanized to potential habitat for vegetation and wildlife.

Coastal saltmarsh is present at Heron's Head Park which is intended to be enhanced and expanded with marsh augmentation, as well as addition of an ecotone levee and naturalized shorelines. This provides new wildlife corridors and habitat connectivity that is not currently present in the study area. Native grasses would be planted in NNBFs to maximize the survivability and function of the environment, while invasive species would be controlled and managed to reduce establishment or spread. Overall, this would have substantial positive benefits for upland resources. Adverse impacts from construction and maintenance of these features would be meniscal as compared to the long-term beneficial effects of established such extensive new habitat area.

All shore-based construction activities would be ***less than significant*** in terms of short-term and long-term impacts to upland resources. In-water based measures, such as wharf, would have ***no impact*** to upland resources. Alternative G would have the greatest net beneficial impacts to upland resources of any action alternative.

4.15.7 Mitigation

BMPs described in the Geology and Water Quality mitigation sections would be used to reduce overall impacts to upland resources during construction and maintenance activities.

4.16 Special Status Species

This section describes adverse and beneficial impacts to special status species including Federally-listed threatened and endangered species, state-listed threatened and endangered species, designated CH's, migratory birds, marine mammal protection act species, EFH, and HAPCs.

Effects to species and habitats are considered adverse if they result in any one of the following:

- Direct mortality;
- Temporary effects to habitats such that the species suffers increased mortality or lowered reproductive success;
- Permanent loss of habitat determined to be critical and/or essential to the species;
- Substantial reductions in the size of a population of the species.

Significance Criteria

An alternative would be considered to have a significant effect on special-status species or habitats if it would result in:

- **SS-01:** Substantial adverse effects, either directly or through habitat modification, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, regulations, or by the USFWS, NMFS, or CDFW
- **SS-02:** Take of a Federally- or State-listed threatened or endangered species
- **SS-03:** Adversely affect designated critical habitat

4.16.1 Construction Impact Summary

The impacts described in the Aquatic Resources and Upland Resources sections would be applicable to marine and terrestrial protected species, respectively, under each of the Action Alternatives. A Biological Assessment (BA) was prepared to document the impacts of implementing the Recommended Plan on ESA-listed species (Sub-appendix

D-6). Details of construction-related impacts and effects determinations for affected species can be found in the BA. A brief impact assessment was conducted for each of the Action Alternatives; however, some species were not expected to be impacted by any of the Action Alternatives as the study area is outside of their known range and/or the area lacks suitable habitat. The USACE determined all of the Action Alternatives would have ***no effect*** on the following list of ESA species:

- **Mammals**: Blue whale, Fin whale, Killer whale, North Pacific right whale, Sei whale, Sperm whale
- **Birds**: Western snowy plover
- **Reptiles**: Alameda whipsnake, San Francisco garter snake, Green sea turtle, Leatherback sea turtle, Loggerhead sea turtle, Olive Ridley sea turtle
- **Amphibians**: California red-legged frog
- **Fish**: Delta smelt, Tidewater goby, White abalone
- **Insects**: Monarch butterfly
- **Flowering plants**: Franciscan manzanita, Marin dwarf-flax, Presidio clarkia, Presidio manzanita, San Francisco lessignia, Showy Indian clover, Sonoma sunshine, and White-rayed pentachaeta

The mammalian species are mostly migratory and only transit to California waters seasonally, though not within the study area. Most of the whale species identified prefer deeper offshore water in the Pacific Ocean or Gulf of California, with only three species (Gray whale, Humpback whale, Killer whale) known to transit in shallower coastal waters periodically. Gray whales can be found in shallow coastal waters in the North Pacific Ocean but are highly unlikely to be encountered in the San Francisco Estuary.

Impacts to special status species can be direct or indirect. Direct impacts could result in the take of species, physical displacement, change/removal of habitat, change to localized topography, and the temporary and localized impacts from construction activities (e.g., noise, vibration, land disturbance). Indirect impacts would indirectly affect the well-being of a species through activities that cause a loss of forage species, for example, or conversion of potential habitat to grey features.

4.16.1.1 Terrestrial Impacts

Terrestrial mammal species (i.e., salt marsh harvest mouse) would experience temporary impacts from vegetation removal, noise, and vibrations during construction site preparation activities. The salt marsh harvest mouse is generally restricted to brackish and saline marshes but can frequently use terrestrial grassland habitats adjacent to marsh and grass-*Sarcocornia* ecotones (Johnson and Shellhammer 1988; Shellhammer et al. 1988). Construction activities are avoided in wetlands where the mouse would likely be most present; however, all action alternatives would experience construction of a feature adjacent to Heron's Head Park that would generate noise, air emissions, visible structures, and physical land disturbance that could adversely impact

salt marsh harvest mouse populations. No *Sarcocornia* vegetation is expected to be removed or degraded during construction activities, which is the preferred habitat for the mouse species.

Special status birds that could be present in the study area are predominantly marine or waterfowl that use both aquatic and terrestrial habitat for survival, but there are also small terrestrial species (i.e., bank swallow) that could be adversely impacted during construction. Temporary impacts associated with habitat disturbance, lighting, and noise are expected during construction of measures and NNBFs from activities such as earthwork, use of heavy machinery, pile driving, demolition, placement of fill, installation of stone and concrete, and ground improvements. Construction noise can hinder migratory birds' ability to call and communicate. The study area is highly urbanized with minimal natural habitat available. No nesting habitat for special status species are expected to be directly impacted or removed during construction as none are present. The primary indirect impact to protected bird species is the effect of construction on forage species for birds and insects in the action area. Construction activities may include bottom habitat disturbance, loss of forage organisms, loss of vegetation, and impacts to benthic, tidal invertebrates, and fish from shore-based measures that could adversely impact prey availability.

Turbidity from runoff and dust accumulated in the water column from shore-based construction could temporarily disrupt foraging rates of shore birds, migratory birds, and pelagic species that utilize open water or benthic habitat. It is anticipated that birds would utilize suitable adjacent habitat until construction is complete. Turbidity impacts would be localized and expected to cease when construction is complete. The overall area that would be impacted at any given time is a small percentage of the study area, thus, habitat would be available for birds to forage and roost in adjacent areas. Protected birds are anticipated to move away from the area of construction to suitable available habitat adjacent to the project sites.

Federally listed California seablite could indirectly be impacted due to construction of shore-based measures if present in the study area. This plant grows in a restricted area within the intertidal zone of salt marshes, which are present at Heron's Head Park. The last observation of California seablite at Heron's Head Park was in 2003 from an extant population that was reintroduced in 1999 (USFWS 2010). Direct impact from physical disturbance would be avoided because no removal or damage to wetland areas should occur. Indirect impacts from air emissions or fugitive dust from operation of heavy equipment and construction of measures could impede photosynthesis temporarily. Any indirect impact to special status plant is expected to be localized, temporary, and minor.

4.16.1.2 Aquatic Impacts

Protected aquatic species are expected to experience temporary impacts from habitat disturbance with construction of in-water features such as displacement of marine fauna associated with noise, vibration, and physical disturbance. Potential direct impacts during construction include physical contact with construction equipment such as entanglement and vessel strikes, entrainment, exposure to underwater noise, degraded water quality, and exposure to water or effluent discharges.

During construction of in-water features, changes in turbidity levels would be localized and temporary, particularly with the use of BMP's described in the mitigation section for Water Quality. For fish, turbid water concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). High total suspended solids (TSS) levels can cause a reduction in dissolved oxygen levels, which may result in protected fish becoming stressed. For example, young sturgeons have experienced high levels of mortality at low dissolved oxygen levels while older sturgeon tolerated reduced levels for short durations. However, tolerances may decline if chronic exposure to low dissolved oxygen occurs (Jenkins et al. 1993). Behavioral and physiological effects could occur if sturgeon are exposed to TSS levels of 1,000 mg/L above ambient for greater than 14 days at a time (Johnson 2018). While increases in suspended sediments may cause fish to alter their normal movements, these movements are expected to be minor and temporary. Other suitable habitat would be available in adjacent areas to the construction zone. TSS is not likely to exceed 1,000 mg/L above normal during construction for an extended duration (e.g., 2 weeks) as the turbidity causing activity would not be fully continuous for the duration of construction. For example, pile driving for wharf replacement would occur during daylight hours and cease at night, affording suspended sediments and turbidity time to settle before the next workday. TSS is most likely to affect fish if a plume causes a barrier to normal behaviors; however, the aquatic protected species are mobile and are anticipated to move from the areas of in-water construction to more suitable habitat during those activities. Additionally, BMPs such as seasonal restrictions and protected species observers would be used to mitigate and minimize impacts to ESA and protected species during operations. Details can be found in the Mitigation section.

Sessile and some benthic invertebrates would be lost during removal and replacement of pilings for wharf replacement actions. This would temporarily disrupt prey availability in localized areas for marine protected fish and birds. Other areas would be available for consumption and foraging within and adjacent to the study area, so it is assumed mobile fish and birds would shift elsewhere. Because of the temporary duration of work and that it would be conducted in distinct sections, impacts to protected species forage ability is expected to be ***less than significant***.

Construction of in-water features such as foundations, piles, and walls (e.g., seawall, sheetpile wall) could cause changes to community composition and attraction of structure-oriented invertebrates. The new foundations and structure installations can produce the artificial "reef effect", attracting species of algae, fish, shellfish, and other invertebrates to the hardened structures (Langhamer 2012). The loss of benthic habitat, in some instances, is expected to be offset by the introduction of new hard-bottoms substrate that would support benthic communities. This may attract prey species important in supporting protect marine mammals, birds, and fish. However, biofouling or colonization by invasive species could also occur, causing a long-term permanent impact.

Construction of in-water structures may indirectly affect pelagic birds that use the San Francisco Estuary for foraging by disturbing benthic habitat, invertebrates, and potentially the fish on which they feed. The area of impact would be relatively small at

any given time as the measures would be constructed in sections so that birds could forage in other areas that are not being affected.

No impacts to special status plants are anticipated from in-water construction activities.

4.16.2 Operations and Maintenance Impact Summary

Operations and maintenance activities are expected to have minimal impacts to special status species. O&M would consist of inspections, construction to repair damaged features, and application of corrosion resistant coating for some in-water structures (e.g., sheetpile wall). Adverse impacts from O&M would not differ from those described in the construction impact summary, except that the effects would be on a much smaller scale and over a shorter period. No loss or take of special status species would be expected with operations and maintenance.

4.16.3 Recommended Plan

The Recommended Plan is anticipated to have adverse impacts on protected species that range from low to moderate to high (**Table D.1-35**).

Table D.1-35: Summary of Special Status Species' Impacts Associated with the TNBP

TNBP Special Status Species' Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*	Vertical Shoreline*
Construction/Footprint (First Actions)	4	2	4	2	4	2	2	4	2+	2+	2+	2+	1	4+
Construction/Footprint (Subsequent Actions)	1	2	4	1	1	2	1	4	2+	2+	2+	2+	2+	4+
O&M Assumptions	1	2	2	2	2	2	2	2	2+	2+	2+	2+	2+	2+
Mitigated Rating	*4*	*2*	*3*	*2*	*3*	*2*	*2*	*3*	*1*	*1*	*1*	*1*	*1*	*2*

Impacts would be similar to those described for Alternative B, F, and G for measures that overlap with those alternatives. Shore-based measures would have ***less than significant*** impacts and, in general, be on a smaller scale for most measures as compared to Alternative F and G. Impacts would be temporary and localized to the

construction area, as such, terrestrial protected species and birds would be expected to move to adjacent habitat and avoid the site until construction completes.

Wharf construction is anticipated to have the same impacts as Alternative F and G, but on a much larger scale with nearly 8 and 5 times the acreage being disturbed, respectively. This is still expected to generate impacts that are ***less than significant with mitigation***.

Bay fill would permanently remove protected habitat (e.g., EFH, critical habitat) and suitable habitat for protected species. This would be on a much smaller scale that Alternative F, but would remove habitat nonetheless, thus impacts are expected to be ***significant and unavoidable***. In areas of bay fill, a new seawall would be constructed bayward of the existing, and as with Alternative F, would permanently remove habitat. Similarly, this is expected to have ***significant and unavoidable*** impacts during the subsequent actions when the impact would occur. During the first action, the seawall construction would occur landward of the existing, thus no impacts to aquatic species or habitat are anticipated. Temporary adverse impacts, like those described for shore-based measures, would be realized during this action.

A sheetpile wall is proposed to be constructed in Reach 4 adjacent to Heron's Head Park. Heron's Head Park is important habitat for protected terrestrial and aquatic species, thus, the impacts from noise, vibration, physical and visual disturbance are anticipated to be moderate during construction. Aquatic species are likely to avoid the area during construction given the noise and physical disturbance (e.g., turbidity, sediment suspension) from pile driving. It is also expected that migratory birds and protected birds would also be displaced from Heron's Head during construction. Mobile species would be expected to seek adjacent habitat during this period. Overall, construction of this feature is expected to have impacts that are ***less than significant with mitigation***.

Bay fill and construction of new seawall would have permanent impacts to aquatic protected species by removing habitat. The measures would remove 4 and 5 acres, respectively, of pelagic and benthic habitat, which is also EFH, HAPC, and designated critical habitat for green sturgeon and chinook salmon. The adverse impacts would be the same as those described for these actions in Alternative F, but on a smaller scale. Because of the loss of habitat, these measures are expected to have ***significant and unavoidable*** impacts to protected aquatic species and habitat. These unavoidable impacts would be offset with compensatory mitigation as described in Appendix K. Addition of the NNBF coarse beach would have beneficial impacts long-term by increasing foraging habitat and possibly prey availability locally for shorebirds.

Moderate to high impacts are expected during replacement of wharf structures like those described in Alternative F and G. Impacts are expected to be on the same scale as Alternative F, given the acreage of wharf being replaced similar. Overall, wharf replacement is expected to have adverse impacts that are ***less than significant with mitigation***.

The vertical shoreline would require the use of cofferdams to install textured panels on new or existing seawall. As described in Alternative F, dewatering would be needed which would have adverse impacts to protected fish, particularly juvenile and young

adult green sturgeon. Installation of cofferdams would also have temporary adverse impacts to protected fish, habitat, and marine mammals through generation of noise, vibration, physical restrictions to movement, turbidity, and sediment suspension. This is expected to be ***less than significant with mitigation***. In the long-term, the increased intertidal habitat with the vertical shoreline is expected to have ***beneficial*** impacts to protected aquatic species by increased prey availability, particularly for species that feed on small fish, invertebrates, and sessile organisms. Additionally, longfin smelt eggs can adhere to the textured surface providing additional nesting and rearing habitat.

4.16.4 Alternative B

Adverse impacts from floodproofing, building demolition, and relocation are anticipated to be like those described in the Construction Impact Summary for Terrestrial Impacts. Construction activities would occur sparsely over time, directed by threats from RSLC induced flooding, and be limited to those areas that require action. Habitat would be available in adjacent areas during construction activities that protected species would be able to utilize. Impacts overall are expected to be low and ***less than significant***.

Areas of retreat would expand available habitat in some areas for protected species including birds, terrestrial mammals, and plants as infrastructure and impervious surfaces are converted to green space. Temporary adverse impacts such as noise, vibration, presence of heavy equipment, and land disturbance would occur to conversion of grey space to green, but this is anticipated to be ***less than significant*** as other habitat spaces would be available in adjacent areas. Under Alternative B, Heron's Head Park is likely to be lost or greatly reduced spatially as relative sea level changes. This could have a ***significant and unavoidable*** impact on terrestrial protected species (e.g., California clapper rail, Ridgeway's rail, salt marsh harvest mouse) as it is the only suitable habitat available in the study area. Losing this habitat to RSLC would displace local populations and likely result in loss of species that are less likely to be able to move to surrounding areas (i.e., salt marsh harvest mouse).

Pier removal would result in localized, temporary impacts to aquatic protected species, like marine mammals and fish, from noise, turbidity, vibrations, sediment suspension, and physical disturbance. These impacts would be limited in spatial extent through implementation of BMPs described in the Water Quality mitigation section (e.g., use of silt curtains). Pier removal could temporarily disrupt foraging behavior of fish and marine mammals in the vicinity of the construction area, but given the high motility of these species, additional foraging areas would be available during that time. Piers offer artificial intertidal habitat in the San Francisco Bay that support benthic invertebrates, sessile organisms, and larvae. Removal would eliminate this habitat structure and thus, remove foraging, refuge, and nursery habitat for special status fish and animals that rely on prey that congregate around structures. This would result in permanent removal of any organisms directly attached to the piers and displace those around the structure to other areas. Given the limited extent of piers (n = 2) being removed, this adverse impact would be ***less than significant***. In the long-term, water quality is likely to be improved with removal of contaminated pier pilings, and thus, ***beneficial*** impacts would be realized to special status marine mammals and fish that forage or refuge around this area.

4.16.5 Alternative F

The adverse impacts for constructing Alternative F range from low to moderate to high impacts (**Table D.1-36**).

Table D.1-36: Summary of Special Status Species' Impacts Associated with Alternative F

Alternative F Special Status Species' Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	4	2	4	2	3	2	2	4	2+	2+	2+
O&M Assumptions	1	2	1	1	2	2	2	2	2+	2+	2+
Mitigated Rating	*4*	*2*	*4*	*2*	*2*	*2*	*2*	*3*	*1*	*1*	*1*

Shore-based measures such as levees, walls, t-walls, and roadway construction are expected to have low impacts to special status species. Most impacts are synonymous with those described in the Construction Impact Summary for Terrestrial Impacts. Impacts would be temporary and localized to the construction site. It is anticipated that protected species are mobile and would transit to adjacent habitat during construction. Thus, these actions would have ***less than significant*** impacts to protected species. Additionally, building relocations and demolition are anticipated to have the same impacts as those described in Alternative B.

The construction of NNBFs would have temporary, localized, adverse impacts to protected resources such as through generation of noise, turbidity, sediment suspension, vibrations, and physical disturbance. This is anticipated to be ***less than significant*** overall as adjacent habitat would be available during construction, and in the long-term, NNBF measures would be increasing available habitat in the area. NNBFs such as ecotone levees and marsh enhancement are planned at Heron's Head Park and Pier 94 wetlands. This creation and augmentation of habitat would have long-term ***beneficial*** impacts to protected species of birds, terrestrial mammals, and plants. The ecotone levee at Heron's Head offers a transition from salt marsh to upland that could provide suitable areas for California seablite, as well as refuge for salt marsh harvest mouse that may be present. The expansion of habitat would provide beneficial foraging, roosting, and potentially nesting grounds for protected birds. Ecological armoring, along with marsh enhancement, would offer long-term ***beneficial*** impacts to

protected fish by providing habitat and refuge for prey species. Fish would benefit from improved water quality and habitat with enhancement and addition of marsh area.

Protected fish, particularly green sturgeon, are susceptible to entrainment, entrapment, and mortality during dewatering activities and construction of associated enclosure structures, such as cofferdams. Early life stage sturgeon, such as eggs and larvae, are not anticipated in the study area; however, young adults and juveniles are assumed to be present. Dewatering activities are anticipated to be associated with construction of tidal gate foundations, seawall, and bay fill. BMPs as described in the Aquatic Resources mitigation section would be used to minimize entrapment of special status fish in areas set to be dewatered. During removal techniques, fish could become stressed, though this would be minimized to the greatest extent practicable. Removal from dewatered areas is not anticipated to have any long-term or permanent impacts to protected fish species. Dewatering would not directly impact marine mammal or pelagic birds' species; however, indirect effects would be expected by the loss of forage area during construction. Mammals and birds are expected to forage elsewhere in adjacent areas until construction is completed. Impacts from dewatering are anticipated to be ***less than significant with mitigation***, temporary, and localized to the construction area.

Construction of the new seawall and bay fill would permanently remove designated critical habitat for green sturgeon and chinook salmon, HAPC, and EFH from the study area. Approximately 25 acres of bay fill is planned for Alternative F to move the seawall bayward of the existing one. This is anticipated to have permanent impacts to designated CH, HAPC, and EFH, as well as marine mammals, and protected fish and bird species that utilize the pelagic and benthic habitat. Bay fill and seawall would permanently remove forage, refuge, loafing, and nesting habitat used by protected species. Additional habitat is available within the study area that can be utilized during and after construction. Construction of the seawall would also cause physical disturbance, turbidity, sediment suspension, noise, vibration, and potential release of contaminants from sediments that would adversely impact marine protected species. Permanent impacts from habitat loss are expected to be ***significant and unavoidable***.

Wharf construction is anticipated to have moderate to high impacts and be like those described for pier removal in Alternative B, but on a larger scale. Temporary, localized impacts would be recognized in the construction area such as noise, vibration, turbidity, sediment suspension, and physical disturbance. This would occur during removal of pilings, as well as during replacement. Pile driving is anticipated to occur during the day and cease at night, thus, turbidity and sediment suspension would be expected to lessen in the construction area periodically. Overall, the wharf being replaced would exist in the same footprint as before, so no increase to shade structure would be expected. A temporary loss of potential prey sources would occur when pilings are removed but is expected to return once pilings are replaced. Wharf replacement is expected to have adverse impacts that are ***less than significant with mitigation*** to protected aquatic species, EFH, HAPC, and designed CH for chinook salmon and green sturgeon.

Tidal gate construction is expected to have low impacts to migratory birds, waterfowl, and pelagic bird species from construction noise, vibration, and physical disturbance.

Indirect impacts may occur during installation through increased turbidity which may lead to reduced foraging capabilities. Birds are expected to utilize adjacent areas in San Francisco Bay during construction. Operation of tidal gates could have temporary adverse impacts to protected birds through noise and vibration and increased turbidity. This would only last during opening and closing of the tidal gates, lasting short durations (hours). The frequency and duration of operation during storm events has not been assessed but would be required to determine overall effects to protected birds. In general, impacts are expected to be low given the temporary and infrequent nature of annual maintenance needs. Beneficial indirect impacts could occur to protected birds through management of flood risk and reducing erosion during large storm events of coastal and terrestrial habitats during barrier closure.

Construction of tidal gates, particularly the foundations, are anticipated to have moderate impacts on protected fish, HAPC, EFH, green sturgeon CH, and marine mammals. Cofferdams would be installed prior to construction of foundations that would require dewatering, which would have the same impacts to fish and marine mammals as previously described. Construction of the gates and support structure would create noise, vibrations, and physical disturbance during installation. The adverse impacts from construction would be temporary and localized; however, foundation installation would permanently remove HAPC, EFH, and green sturgeon designated CH within the direct footprint. This is anticipated to be small in comparison to the study area and San Francisco Bay; thus, impacts would be ***less than significant with mitigation***. Indirect impacts to fish and marine mammals would occur with the potential loss of prey in the construction area, but these species are expected to forage in adjacent areas.

Operation of tidal gates are expected to have low impacts to protected terrestrial species but could have temporary moderate adverse impacts to protected aquatic species. Terrestrial species are likely to be adversely impacted by noise; however, they are not expected to be within the direct vicinity of tidal gates to which this impact could be more severe. The protected species in the study area are highly mobile and would be expected to leave the area of disturbance if or when tidal gates were being closed for maintenance testing. Aquatic species, mammals and fish, could be temporarily impacted by gate closure such as through changes to water quality, increased turbidity and sediment suspension, and minor restriction of passage for the species and/or prey. Tidal gates would be closed primarily during a coastal storm or during annual maintenance procedures. Additional hydrodynamic analyses are necessary to assess closure frequency and duration, by which a more thorough analyses of impacts to special status species could be completed. Mammal and fish species are highly mobile and are anticipated to move away from the maintenance operations for more suitable habitat. It is not likely that marine mammals would become entrapped in the creek areas during operation; however, some fish species (e.g., green sturgeon, smelt) could become temporarily entrapped inside the creek during operation. This is not expected to have substantial consequences as the gate would be temporarily closed and re-opened within a few hours. However, during a storm event, if protected fish were to become entrapped in the creeks, they could experience degraded water quality conditions, be exposed to contaminants from runoff, and may be restricted from prey.

Indirect impacts from gate closure include temporary changes to hydrology and water quality, increased noise, and vibration. Noise and vibration would adversely impact marine mammals and protected fish during gate closure and opening operations but would cease once those actions are completed.

4.16.6 Alternative G

The adverse impacts for constructing Alternative G range from low to moderate to high impacts (**Table D.1-37**).

Table D.1-37: Summary of Special Status Species' Impacts Associated with Alternative G

Alternative G Special Status Species' Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	2	2	2	2	4	2+	2+	2+	2+	2+
O&M Assumptions	2	2	2	1	2	2	2	2+	2+	2+	2+	2+
Mitigated Rating	2	2	2	2	2	2	3	1	1	1	1	1

As described in Alternative F and the Construction Impact Summary for Terrestrial Impacts, shore-based measures are anticipated to have low impacts to special status species overall. The majority of shore-based measures are constructed in areas that would not be ideal or suitable habitat for protected birds, mammals, and plants. The species that could be impacted or present in the construction site would be mobile and have the ability to move to adjacent areas during the period of construction. Overall, impacts are expected to be ***less than significant***.

Wharf construction would have moderate to high impacts to aquatic protected species, as well as EFH, HAPC, and designated CH for Chinook salmon and green sturgeon. Adverse impacts from wharf replacement would be the same as those described in Alternative F, but on a larger scale as more wharf is planned for replacement in Alternative G (5 acres vs. 8 acres total, respectively). As with Alternative F, impacts are expected to be ***less than significant with mitigation***.

Alternative G proposes to convert the largest acreage of grey surface to NNBFs of any alternative (700+ acres) which would have temporary, localized, minor adverse impacts during construction to protected species, but long-term ***beneficial*** impacts. Construction is anticipated to impact protected species through generation of noise, vibration, physical and visual disturbance, presence of heavy machinery, placement of fill, and earthwork. Overall, these impacts are expected to be ***less than significant*** due to their temporary nature and that the long-term beneficial impacts would far outweigh the limited adverse impacts from construction. Addition and augmentation of marsh at Heron's Head Park would significantly improve suitable and preferred habitat for threatened and endangered federally listed and state-listed species, both terrestrial and aquatic, as well as provide new habitat areas for migratory birds. Heron's Head Park has supported Ridgway's rail breeding populations, with the first chicks discovered in 2011 and the last siting reported in CNDDB also occurring in 2011 (Mosur 2015, CNNDB 2023). Only a single Ridgway's rail remained by 2015 (Mosur 2015). With an increase in suitable habitat, nesting and breeding populations would have the space to potentially become re-established. Pier 94 wetlands also provides habitat for the rail but has not supported any breeding populations to date. Augmentation of these wetlands and addition of ecological armoring would also be beneficial to these species by creating new habitat and protecting it from erosion through wave attenuation.

California seablite is another endangered species known to be present along margins of coastal salt marshes in upper intertidal zones in California. The closest sitings reported in CNNDB occurred at Hunter's Point, approximately 1.5 miles southwest of Heron's Head Park in 2013 (CNNDB 2023). The shrub is endemic to the coastal zone of California, with natural populations limited to Morro Bay and estuarine creek mouths near Cauycos, California (Walgren 2006). However, the species has been re-introduced to other locations in the San Francisco Bay Area (USFWS 2010). California seablite was last observed in Heron's Head Park and Pier 94 wetlands in 2003 and 2008, respectively. The populations at Heron's Head were established in 1999 and maintained at least 20 extant individuals, while Pier 94 populations were extant individuals with seedling recruitment (USFWS 2010). The expansion of ideal habitat in Alternative G would afford California seablite the space to increase population sizes either through passive or active recruitment.

The salt marsh harvest mouth is generally restricted to saline and brackish marsh habitats around San Francisco Bay Estuary. Few major, isolated populations have been documented, though not in the study area (79 FR 10830). Heron's Head Park and Pier 94 wetlands provide suitable marsh habitat for the species, of which, the loss of habitat would reduce populations locally and further lead to overall population isolation. However, with the addition of NNBFs such as marsh enhancement, ecotone levees, and naturalized shorelines adjacent to Heron's Head Park, preferred habitat would be created and expanded such that salt marsh harvest mice could thrive if present.

Alternative G is anticipated to have the most beneficial impacts to protected species and habitat, while having the lowest adverse impacts.

4.17 Noise and Vibration

See Annex D.1.2 for a discussion of impacts of the alternatives on noise and vibration.

4.18 Cultural Resources

The features proposed for this project involve construction activities that have the potential to directly and indirectly affect cultural resources in both terrestrial and submerged environments. The sequencing and implementation of the alternatives include two broad sets of actions: 1) design, construction, and implementation of CFRMs and NNBFs, and 2) additional measures which may occur in response to the success of first measures and changing conditions. First actions identified for design and implementation by the USACE to reduce coastal flood risk include structural measures (seawalls, levees, closure structures, and interior drainage systems) and non-structural (floodproofing of piers, select buildings, and infrastructure, raising of the wharf/shoreline, removing or moving structures, floodproofing of historic waterfront buildings and wharves, defense/raising of the shoreline, and incorporations of nature-based features such as creek enhancements).

Construction of Project Components will begin when the undertaking receives authorization and funding, and once all compliance is achieved. USACE shall complete detailed analyses, including compliance with the NHPA and other cultural resources laws and regulations, in the Preconstruction, Engineering, and Design (PED) phase that will inform the final design and, ultimately, construction and implementation of the Project Components.

The USACE and the California State Historic Preservation Officer (SHPO) agree that because effects on historic properties cannot be fully determined or resolved prior to the approval of the undertaking and due to the phased nature of the project, a programmatic agreement (PA) for the purpose of identifying and evaluating historic properties, assessing adverse effects, and resolving adverse effects on them in accordance with 36 CFR § 800.6, 36 CFR § 800.14(b)(1)(ii), and 36 CFR § 800.14(b)(3) is necessary (Sub-appendix D.3). Efforts to identify and evaluate historic properties, determine effects of the undertaking, identify appropriate avoidance, minimization or mitigation, and related consultation shall occur during the design phase in accordance with a Programmatic Agreement (Annex D.3.1), as the design for each component of the undertaking is finalized and funded, which may occur over a period of multiple years.

Extensive research, outreach to potential consulting parties, and incorporation of San Francisco Planning Department data was undertaken to identify known historic properties located within the proposed project footprint for alternatives analysis.

The Area of Potential Effect (APE) shall be established by the USACE in consultation with the SHPO, Port, and consulting parties to include all areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE shall be reviewed, and if necessary, refined for each Project Component of the undertaking, in consultation, as designs are finalized. The National Park Service uses a threshold age of 50 years as a criterion for consideration as to NRHP eligibility (National Park Service 1995:20). For purposes of this report, as well as the flood resilience measures proposed for the 2040s, historic

property identification within the study area considers resources that would meet the 50-year threshold as of 2040. Thus, buildings constructed in 1990 and before are considered historic-age resources for the project. For each phase of the project implementation, new above-ground historic properties may have reached the 50-year historic-age threshold and therefore be considered potential historic resources.

Overall effects determinations consider the context, intensity, directionality (i.e., adverse or beneficial), and duration of the effects and provide the basis for impact-level determination by resource. When considering the magnitude of impacts, the analysis should identify if the impacts are geographically local, regional, or widespread.

The analysis of the effects of the alternatives includes an analysis of potential impacts on identified and yet-to-be-identified aboveground and archaeological resources and traditional cultural properties (TCPs). Minimization measures are proposed to address the identified potential impacts (see Mitigation).

4.18.1 Construction Impact Summary

The construction activities for all proposed alternatives (B, F, G, and the Total Net Benefits Plan) would result in ground disturbance from grading, adding fill material, earth-moving, excavating, drainage, and pile driving. For Alternatives B, F, G, and the TNBP, mitigation measures would be necessary. The EIS takes a conservative approach and discloses that these alternatives would likely have large-scale impacts on aboveground and archaeological historic properties, due to the size of the project and archaeological sensitivity of the San Francisco shoreline, leading to significant and unavoidable impacts.

The proposed alternatives have the potential to affect historic properties, including archeological and above ground resources, and TCPs. The types of construction activities that have the potential to affect cultural resources include:

- Ground-disturbing activities performed as part of construction, operations and maintenance, and field investigations, which could include geotechnical, hydrogeological, agronomic, and construction test projects (i.e., geotechnical investigations).
- Construction activities that create increased opportunities for vandalism or looting that would physically disturb or destroy archaeological resources.
- Physical damage to or direct demolition of character-defining features of aboveground historic properties.
- Physical damage to or direct demolition of contributing elements or character-defining features of multi-component historic built resources.
- Direct impacts on individual resources that create significant impacts on historic landscapes (where the individual resource is a constituent element of the historic landscape).

- Construction in the vicinity of a resource, including districts, that removes features of the surrounding setting (where the setting is an integral part of the resource).
- Construction in the vicinity of a resource, including districts, that introduces new physical features that are incongruent with the setting (where the setting is an integral part of the resource).
- Introduction of new permanent sources of sound or activity in the vicinity of a resource, including districts, that would exceed the existing ambient noise level and be inconsistent with the setting (where a quiet or peaceful setting is an integral part of the resource).
- Construction activities and techniques across all alternatives would include:
- Erection of cast-in-place concrete elements onsite using removable forms and steel for reinforcement,
- Construction of cofferdams,
- Implementation of a variety of ground improvements and techniques,
- Engineering-with-nature (EWN) considerations,
- Sourcing and transporting materials, heavy machinery, and various pieces of support equipment,
- Dry floodproofing,
- Property acquisition and demolition,
- Raising bridges,
- Sheet pile wall and T-wall construction,
- Building relocation, and
- EWN features.

Construction of facilities under all alternatives may require the alteration of above-ground historic properties. Construction may also result in material alterations to the integrity of feeling, setting, or association. Changes to the setting would be material alterations because they would either remove the resource or alter the resource's character, resulting in diminishment of the resource's ability to convey its significance. Therefore, this would have a significant impact. Mitigation measures may lessen these impacts but cannot guarantee they would be entirely avoided. The scale of the alternatives and the constraints imposed by other environmental variables make avoidance of all significant impacts unlikely. Mitigation could reduce the impacts to **less than significant**, but this is dependent upon the extent and severity of impacts, some of which are currently ***too speculative for meaningful consideration***.

All the alternatives have the potential to impact previously unidentified archaeological sites or unmarked burials, which may not be identified prior to construction. Although

cultural resource inventories would be completed during PED, no inventory can ensure that all resources would be identified prior to construction. Similarly, the scale of construction makes it technically and economically infeasible to perform the level of sampling necessary to identify all previously unidentified archaeological sites or buried human remains prior to construction.

Because the resources that may be encountered during construction may be eligible for listing in the NRHP, damage to these sites may diminish their integrity. Construction has the potential to disturb previously unidentified archaeological sites that qualify as historical resources, historic properties, or unique archaeological resources. Excavation, compaction, or other disturbances may disrupt spatial associations that contain scientifically useful information and alter the potential basis for eligibility, thereby materially altering the resource and resulting in an effect.

If there are known sites in the construction area, USACE will implement mitigation measures, follow stipulations of the PA, and develop plans in the Research Design that would set forth the means for protecting historic properties or specifying treatment measures to minimize or mitigate the adverse effects. USACE may implement mitigation or treatment measures described in the Research Design prior to construction, during construction, or after construction is completed, as appropriate.

If previously unidentified archaeological resources are found during construction, USACE would adhere to the stipulations of the PA to determine NRHP eligibility and effects findings. For properties eligible for NRHP listing, USACE will identify and implement mitigation measures in consultation with the parties to the PA. However, given the archaeological sensitivity of the area and the extent of proposed project components even with implementation of mitigation impacts on archaeological historic properties could be ***significant and unavoidable***. If unknown burials are encountered during inventory or construction, the procedures outlining work stoppage and respectful handling of the remains outlined in the PA and Research Design will be adhered to.

4.18.2 Operations and Maintenance Impact Summary

The alternatives (B, F, G, and TNBP) would not include meaningful operational impacts to cultural resources because they would consist primarily of the installation of fixed flood improvements, such as levees, seawalls, sheet pile walls, and related infrastructure. The maintenance of implemented measures in the alternatives has the potential to impact cultural resources in the short- to long-term because some alternatives require subsequent actions by 2090, while others (T-walls, rebuilt wharfs, etc.) may require repairs before the end of the period of consideration (2140) that would result in additional ground disturbance or impacts to aboveground historic properties. There would be no material change in long-term operational or maintenance impacts to cultural resources in Alternative A, the No Action Alternative, as a result of this project.

4.18.3 Recommended Plan

The TNBP combines seismic ground improvements with a series of first and subsequent actions. The TNBP also incorporates various aspects of the different

alternatives discussed earlier. This alternative is analyzed by the First Actions measures for all four reaches (**Figure D.1-20** and **Figure D.1-21)**, then by the Subsequent Actions measures for all four reaches (**Figure D.1-22**). The TNBP proposes measures that incorporate structural improvements and EWN measures and relies on ground improvements and new infrastructure to manage stormwater. Over time, the TNBP would require significant changes to existing transportation infrastructure and the built environment as developed areas are elevated, rebuilt, demolished, or abandoned. The Recommended Plan would have **localized, permanent impacts to archaeological and above-ground cultural resources.** During construction significant and unavoidable adverse impacts, both direct and indirect, would occur. Mitigation could reduce the impacts to **less than significant**, but this is dependent upon the extent and severity of impacts, some of which are currently **too speculative for meaningful consideration**.

The TNBP would also have beneficial impacts on cultural resources by limiting water intrusion in the first and subsequent actions by 2090 with the least amount of proposed retreat or demolition. **Table D.1-38** provides a summary of the cultural resource impacts associated with the TNBP.

Table D.1-38: Summary of Cultural Resource Impacts Associated with the TNBP

TNBP Cultural Resource Impact Rating by Measure	**Bay Fill**	**Levee**	**Bulkhead wall/Seawall**	**Deployable Flood Gate**	**Roadway Impact**	**Sheetpile Wall**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Embankment Shoreline***	**Naturalized Shoreline***	**Marsh Enhancement***
Construction/Footprint (First Actions)	1	3	5	4	5	1	4	3	4	2	2	2	3	1
Construction/Footprint (Subsequent Actions)	1	4	5	1	5	1	4	3	4	2	2	2	3	3
O&M Assumptions	1	3	3	3	5	1	3	2	2	1	1	1	2	2
Mitigated Rating	1	4	4	4	4	1	3	2	4	1	1	1	2	2

First Actions: Proposed measures in the First Actions address rising sea levels to 2040; in Reaches 1 and 2, measures include floodproofing, elevating select buildings, reconstructing and raising bulkhead walls, replacing existing wharves with ductile

concrete wharves, and removing select buildings. In Reach 3, proposed measures in the First Actions include elevating the creek and bay shorelines with levees, floodwalls, and rebuilt wharves and bulkhead walls. In Reach 4, proposed measures in the First Actions include raising the shoreline using levees, bulkhead walls, and rebuilt wharves; installing deployable closure structures; and tying into existing or planned high ground. The TNBP's first actions also rely on performing ground improvement actions, building infrastructure to manage stormwater, and utilizing EWN measures across all reaches.

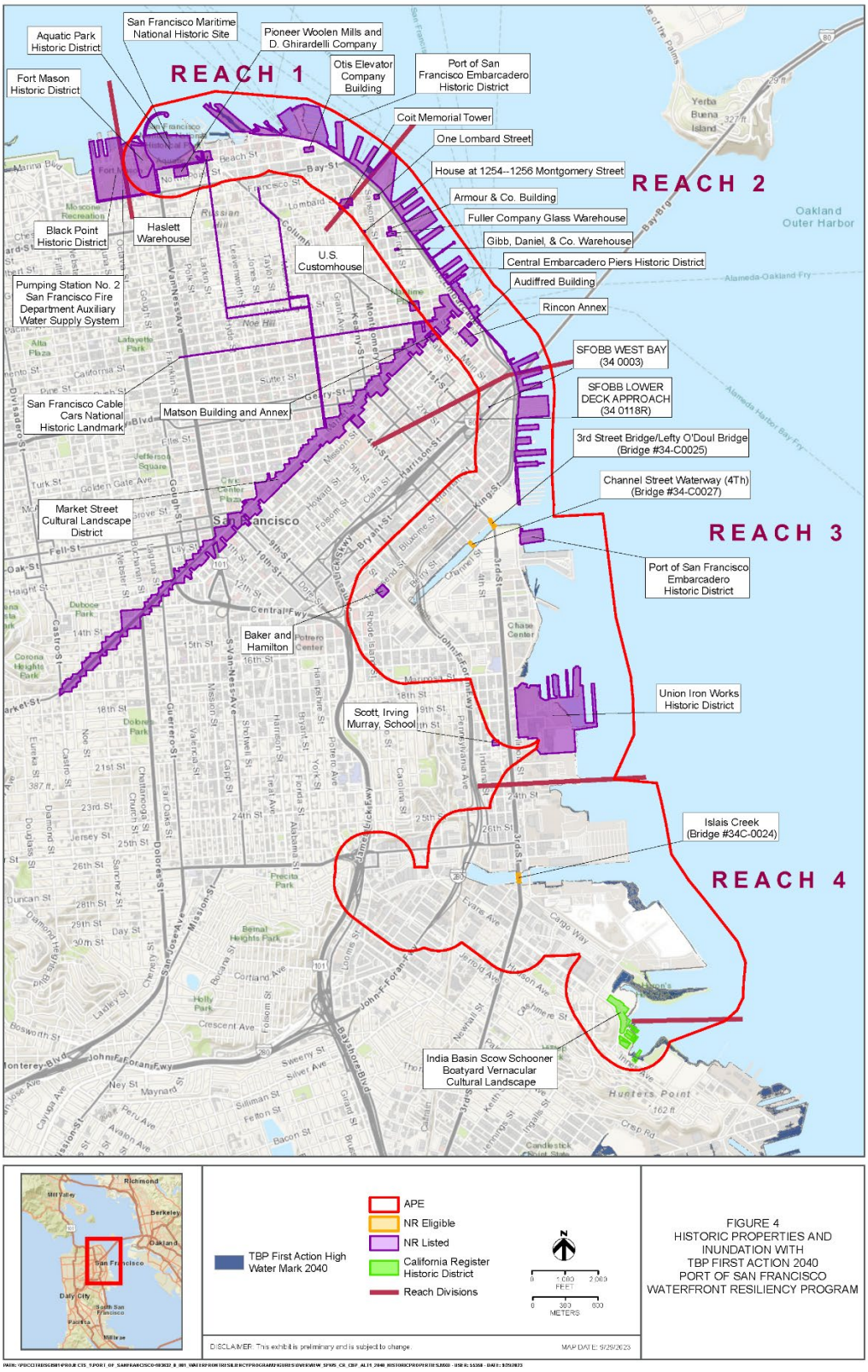


Figure D.1-20: Historic Properties and Inundation with the First Actions 2040

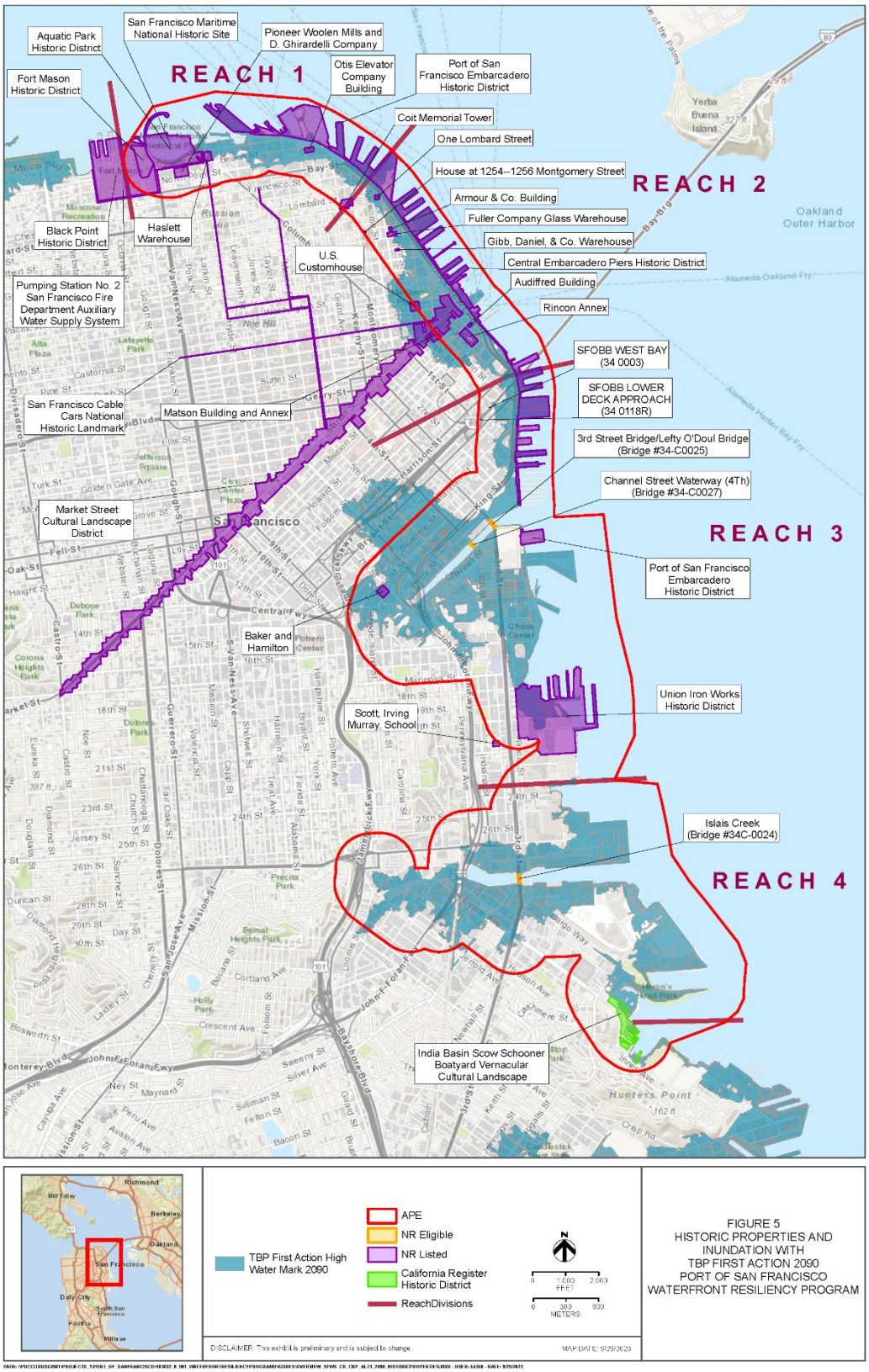


Figure D.1-21: Historic Properties and Inundation with the First Actions 2090

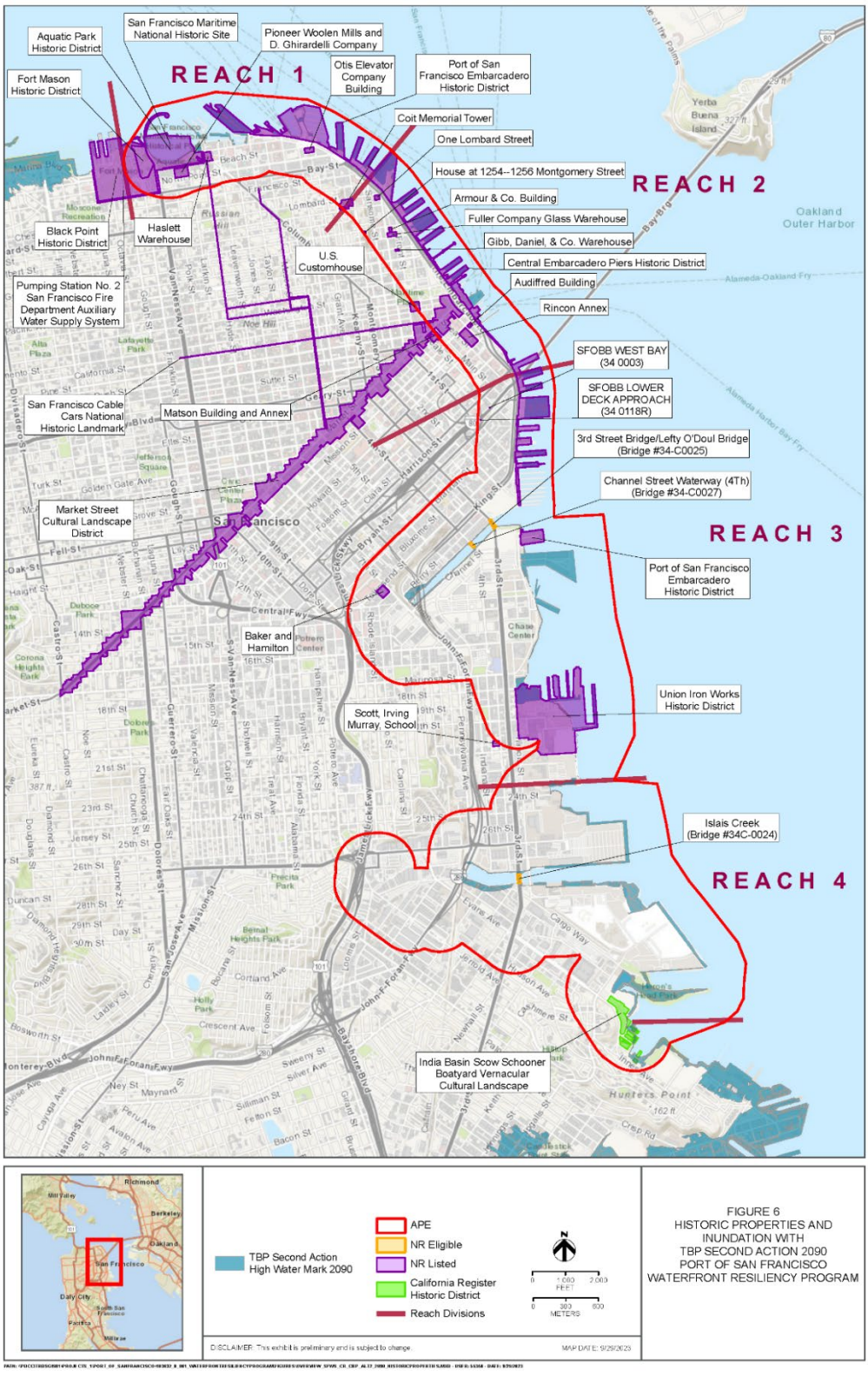


Figure D.1-22: Historic Properties and Inundation with the Subsequent Actions 2090

Subsequent Actions: The TNBP proposed measures in the subsequent actions include adaptation of first-action measures to respond to rising sea levels between 2040 and 2090. Reach 1 and 2 subsequent actions include potential elevation changes, floodproofing, or demolition of buildings bayside of TNBP first actions, along with raising the shoreline north of Piers 9 to 27 by 1.5 to 4.5 feet using floodwalls and rebuilt bulkhead walls and wharves. Proposed measures in the subsequent actions in Reach 3 include raising the shoreline 2 feet using levees, walls, and rebuilt bulkhead walls and wharves; reducing roadway capacity along Terry Francois Boulevard; potentially adding bay fill in some areas; and elevating bulkhead buildings from Pier 26 to 50. Proposed measures in the subsequent actions in Reach 4 include elevating the shoreline 2 feet using levees, floodwalls, bulkhead walls and wharves; constructing levees along Islais Creek west of the Illinois Street Bridge and from the Illinois Street Bridge to Pier 80; incorporating EWN features along Islais Creek and Pier 94; raising bulkhead walls and wharves; and potentially removing buildings along the new bulkhead wall. The TNBP Subsequent Actions also rely on performing ground improvement actions and building infrastructure to manage stormwater across all reaches.

4.18.4 Alternative B

The construction activities associated with Alternative B would result in a loss of use and access to physical property, resulting in a ***significant and unavoidable*** impact and mitigation measures would be necessary. Alternative B's construction activities (building demolition, pier demolition, and floodproofing measures) would significantly impact aboveground historic resources through demolition, as well as significantly impact archaeological and aboveground resources by taking no action to prevent extreme inundation. Although archaeological resources are underground, rising sea levels may result in intrusion of salt water which increases degradation, erosion, and intrusive activities from marine life.

Alternative B proposes nonstructural measures such as floodproofing to reduce risks rather than constructing traditional structural solutions. Actions under this alternative include dry floodproofing as well as property acquisition and demolition. Although buildings would be floodproofed and some relocation, this alternative would have the same sea-level rise inundation levels as Alternative A (**Figure D.1-23**). Construction and operational effects are described below. Likely water intrusion, based on the FWOP, would have residual impacts on historic properties but would be less than the FWOP based on decreased water intrusion into buildings due to floodproofing and relocation.

USACE flood map projections for Alternative B indicate that residual flooding would result in a loss of integrity for designated aboveground historic properties through physical damage or change as well as site removal or demolition. However, compared to the FWOP conditions, Alternative B would have result in less effects on historic properties due to the floodproofing of buildings. Therefore, the impact of Alternative B on above-ground historic properties relative to FWOP conditions would be ***less than significant***.

Although archaeological resources are underground, which affords a measure of protection, rising sea levels and inundation (which would be in the same areas as the FWOP) may have adverse effects. It is possible that archaeological sites could be researched and documented further before a loss due to encroaching sea-level rise, but the sites cannot be floodproofed or moved without severe damage as well as impacts on significance and integrity. Impacts on archaeological resources within the inundation areas would destroy or otherwise render resources unavailable. Low-lying areas such as the Mission, South of Market, and South Bayshore planning districts are most susceptible to damage. Building floodproofing or relocation would not avoid inundation effects which would be the same as the FWOP. Since Alternative B would not increase the level of adverse effects due to flooding to archaeological historical properties relative to FWOP conditions, the impact would be ***less than significant.***

Alternative B proposes nonstructural floodproofing measures for aboveground historic properties that cannot be moved out of high-risk areas. For aboveground historic properties, there is the potential for adverse effects. These include the potential loss of integrity from dry floodproofing measures, such as installing waterproof veneers or deployable gates at building openings. Other proposed measures in Alternative B include property acquisition and demolition, which may result in significant adverse effects on historic properties.

Alternative B also focuses on floodproofing and shifting resources away from the flood risks. This includes working with property owners to floodproof, modify, or remove buildings and infrastructure in areas that are at risk of flooding. Mitigation may lessen these effects but cannot guarantee they would be entirely avoided. The scale of Alternative B and the constraints imposed by other environmental variables would make avoidance of all significant impacts unlikely. As such, even with implementation of mitigation the impact on aboveground historic properties under Alternative B would be ***significant and unavoidable.*** During construction, significant and unavoidable adverse impacts, both direct and indirect, would occur to cultural resources. Mitigation could reduce the impacts to less than significant, but this is dependent upon the extent and severity of impacts, some of which are currently ***too speculative for meaningful consideration.***

For archaeological resources, the effects of Alternative B would occur due to any floodproofing or relocation activities that involve ground disturbance. This alternative has the potential to damage previously unidentified archaeological resources Because cultural resources within the project area damage to these sites may diminish their integrity. It is possible that archaeological sites could be researched and documented further before disturbance, but the sites cannot be floodproofed or moved without severe damage and impacts on significance and integrity. Impacts on potentially significant archaeological resources would destroy or otherwise render resources unavailable and the magnitude of the proposed project increases the likelihood of significant unavoidable impacts. Mitigation could reduce the impacts to less than significant, but this is dependent upon the extent and severity of impacts, some of which are currently ***too speculative for meaningful consideration.***

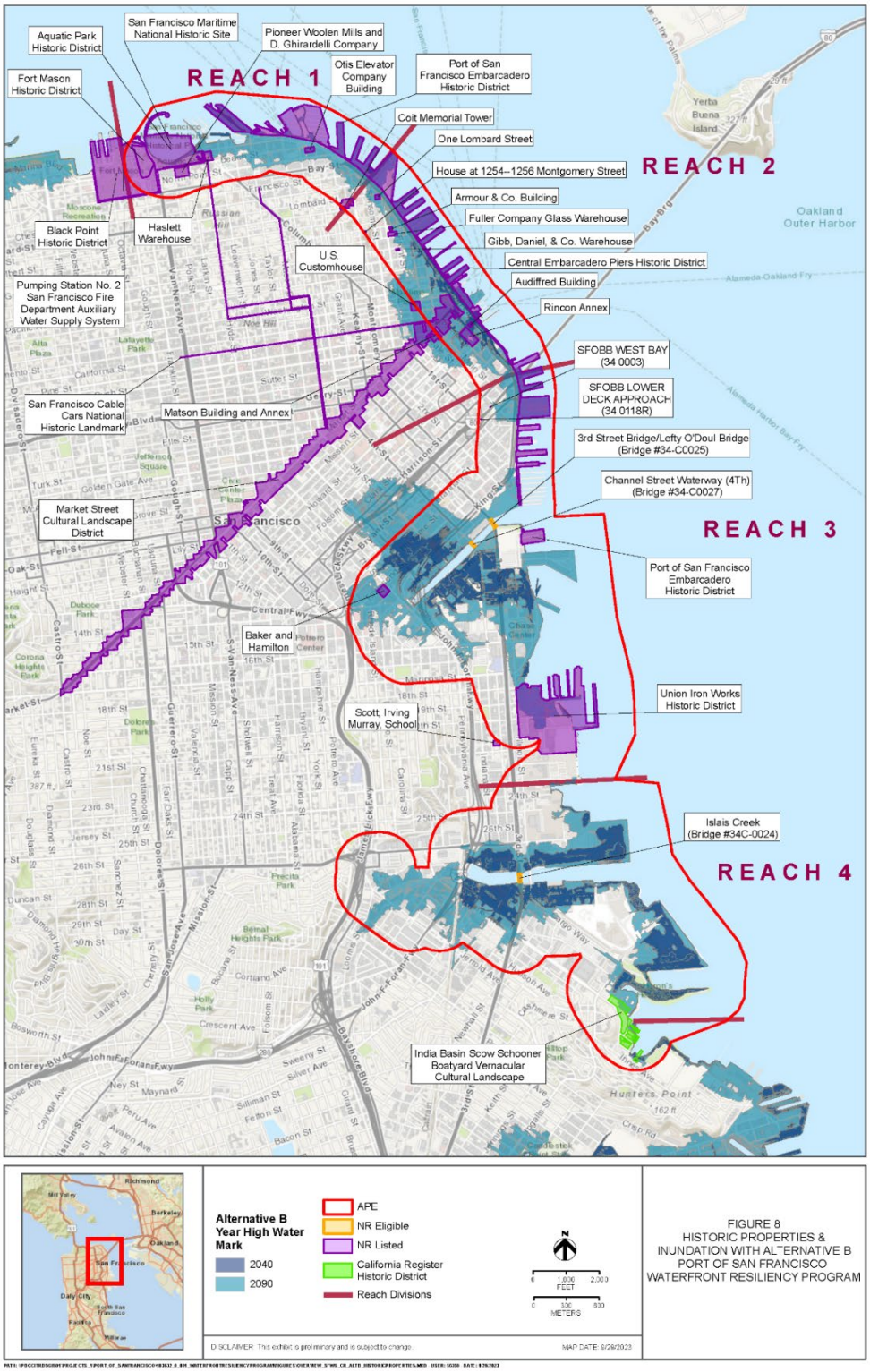


Figure D.1-23: Historic Properties and Inundation with Alternative B

4.18.5 Alternative F

The construction activities associated with Alternative F would result in ground disturbance from grading, adding fill material, earth-moving, excavating, drainage, and pile driving. Other construction impacts include building elevation or demolition, roadway impacts, and engineering with nature measures. Aboveground resources would be significantly impacted by construction activities, particularly from the proposed building demolition, which would not be fully mitigated even with implementation of mitigation measures. Due to the large scale of the project and high sensitivity of the San Francisco waterfront for archaeological resources, even with implementation of mitigation, the impact remains ***significant and unavoidable*** Mitigation could reduce the impacts to less than significant, but this is dependent upon the extent and severity of impacts, some of which are currently ***too speculative for meaningful consideration***. **Table D.1-39** provides a summary of the cultural resource impacts associated with Alternative F.

Table D.1-39: Summary of Cultural Resource Impacts Associated with Alternative F

Alternative F Cultural Resource Impact Rating by Measure	**Bay fill**	**Levee**	**Bulkhead wall/Seawall**	**Roadway Impact**	**Tide Gate**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Marsh Enhancement***
Construction Footprint	4	4	4	4	4	4	3	4	3	3	3
O&M Assumptions	3	2	3	3	3	3	3	3	1	1	2
Mitigated Rating	4	3	4	3	3	3	3	3	2	2	2

Alternative F proposes a combination of passive flood protection, managed retreat, and new water control structures to avoid reliance on a large-scale overhaul of existing inland drainage systems (**Figure D.1-24**). Proposed measures include levees, T-walls, cantilever walls, tide gates, and EWN features as well as elevation changes, relocation, or demolition for aboveground properties. These proposed measures were designed to be adaptable to the projected 2090 sea-level rise. Construction and operational effects are described below. Water intrusion with Alternative F would have residual impacts to historic properties but would be less than the FWOP based on decreased water

intrusion into buildings due to passive flood protection, retreat, and drainage improvements.

USACE flood map projections for Alternative F indicate that residual flooding would still result loss of integrity for designated aboveground historic properties through physical damage or change, as well as site removal or demolition. However, inundation in 2090 with Alternative F would only affect 403 acres compared to 1,337 acres under FWOP conditions and would result in less inundation of aboveground historic properties. Therefore, Alternative F would reduce adverse effects related to inundation of above-ground historic properties relative to FWOP conditions and thus this effect would be ***less than significant.***

Rising sea levels are managed through Alternative F's proposed measures in Reaches 1-3. Yet-to-be-identified archaeological resources would still be at risk from rising sea levels in Reach 4 (**Figure D.1-24**). Inundation overall in 2090 with Alternative F would only affect 403 acres compared to 1,337 acres under FWOP conditions and would result in less inundation of aboveground historic properties. Therefore, relative to the FWOP, Alternative F would reduce adverse effects related to inundation of archaeological historic properties and thus this effect would be ***less than significant.***

Alternative F proposes a combination of large structures to prevent water intrusion and control natural drainage. A cantilever wall would stretch from Plaza del California along the Embarcadero south to Pier 40, with the potential for adverse effects on aboveground historic properties within the Port of San Francisco Embarcadero Historic District and the Central Embarcadero Piers Historic District. The proposed cantilever wall would require ground improvements prior to construction. Ground disturbance could extend up to 100 feet below the ground surface. The width of disturbance may be 40 to 300 feet. Other measures that may cause adverse effects on historic properties include constructing vertical lift gates at the mouths of Mission Creek and Islais Creek.

Alternative F proposes ground-disturbing measures that have the potential to be significant and adverse. Archaeological resources along the waterfront could be affected by the proposed levees, walls, and EWN features, along with elevation, relocation, and demolition measures. Any construction into the floor of San Francisco Bay has the potential to encounter Native American archaeological historic properties, and the magnitude of the proposed project increases the likelihood of significant unavoidable impacts. Unknown archaeological resources within San Francisco Bay could be affected by levees, walls, and EWN features, along with relocation and demolition measures.

The cantilever wall could extend up to 100 feet below the ground surface, with the potential to affect deeply buried Native American archaeological resources, including burials. Some burials in San Francisco are among the oldest in California. Furthermore, Mission Creek and Islais Creek are sensitive for archaeological remains. Constructing vertical lift gates at the mouths of these creeks could have a significant and adverse effect on unknown archaeological resources. Archaeological resources within Alternative F's proposed bay fill areas would be destroyed or otherwise rendered unavailable.

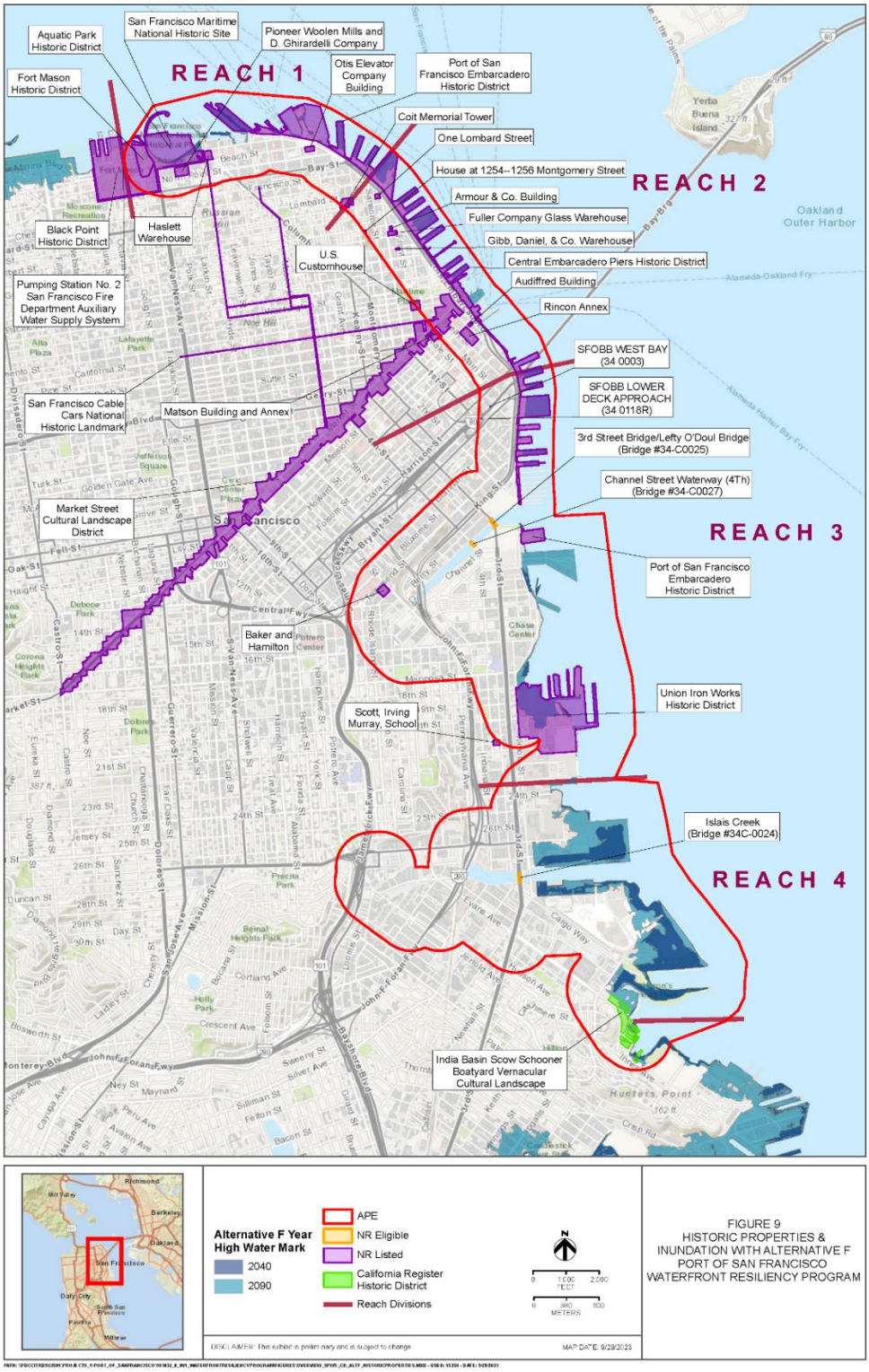


Figure D.1-24: Historic Properties and Inundation with Alternative F

4.18.6 Alternative G

The construction activities associated with Alternative G would result in ground disturbance from grading, adding fill material, earth-moving, excavating, drainage, and pile driving. Other construction impacts include building elevation or demolition, roadway impacts, and engineering with nature measures. Aboveground resources would be significantly impacted by construction activities, particularly from the proposed building demolition and engineering with nature measures, which would not be fully mitigated even with implementation of mitigation measures (see Mitigation). Due to the large scale of the project and high sensitivity of the San Francisco waterfront for archaeological resources, even with implementation of mitigation, the impacts may remain ***significant and unavoidable***. Mitigation could reduce the impacts to less than significant, but this is dependent upon the extent and severity of impacts, some of which are currently ***too speculative for meaningful consideration*****. Table D.1-40** provides a summary of the cultural resource impacts associated with Alternative G.

Table D.1-40: Summary of Cultural Resource Impacts Associated with Alternative G

Alternative G Cultural Resource Impact Rating by Measure	**Levee**	**Bridge raise**	**Bulkhead wall/Seawall**	**Roadway Impact**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Embankment Shoreline***	**Naturalized Shoreline***	**Marsh Enhancement***
Construction/Footprint	3	3	4	4	3	4	4	2	3	2	4	3
O&M Assumptions	2	2	4	3	2	3	2	1	1	1	2	2
Mitigated Rating	3	3	3	4	3	2	4	1	2	1	4	2

Alternative G proposes measures that rely on natural drainage rather than large pumping systems by retreating farther inland and leaving resources to flood that are within historic watersheds (**Figure D.1-25**). Proposed measures include raising bridges or incorporating levees, T-walls, walls, and EWN features. The EWN features involve ecotone levees, ecological armoring, and embankment shorelines. Like measures under Alternative F, these proposed measures were designed to be adaptable to projected 2090 sea-level rise. Unlike previous alternatives, Alternative G proposes significant changes to transportation infrastructure and land use, given the retreat away from

existing development, especially in the Mission Bay area and the Embarcadero. Construction and operations effects are described in this section.

USACE flood map projections under Alternative G would result in a loss of integrity for designated aboveground historic properties through inundation. However, in 2090, Alternative G would result in inundation of only 719 acres in the study area, compared to FWOP conditions of 1,337 acres, and thus less above-ground historic properties would be affected by inundation. Therefore, the impact on aboveground historic properties of Alternative G for inundation relative to FWOP conditions would be ***less than significant***.

Rising sea levels are managed through Alternative G's proposed measures in Reaches 1 and 2, but large areas in Reaches 3 and 4 would be inundated (**Figure D.1-25.**). Inundation overall in 2090 with Alternative F would only affect 719 acres compared to 1,337 acres under FWOP conditions and would result in less inundation of archaeology historic properties. Therefore, relative to the FWOP, Alternative g would reduce adverse effects related to inundation of archaeological historic properties and thus this effect would be ***less than significant.***

Alternative G proposes measures that rely on natural drainage rather than large pumping systems; such measures would be highly adaptable in the future but also most transformative to parts of the existing waterfront. Alternative G would establish new open spaces and wetlands but, over time, would require significant changes to existing transportation infrastructure and the built environment in response to retreating from some developed areas, with associated building demolition in areas of retreat. Demolition or abandonment could occur within 752 acres along the shoreline from the north side of Mission Creek to Heron's Head Park, including portions of two NRHP-listed historic districts, three NRHP-eligible bridges, and one NRHP-eligible historic district. For these reasons, this alternative would result in a ***significant*** impact.

Mitigation could reduce the impacts to less than significant, but this is dependent upon the extent and severity of impacts, some of which are currently ***too speculative for meaningful consideration***.

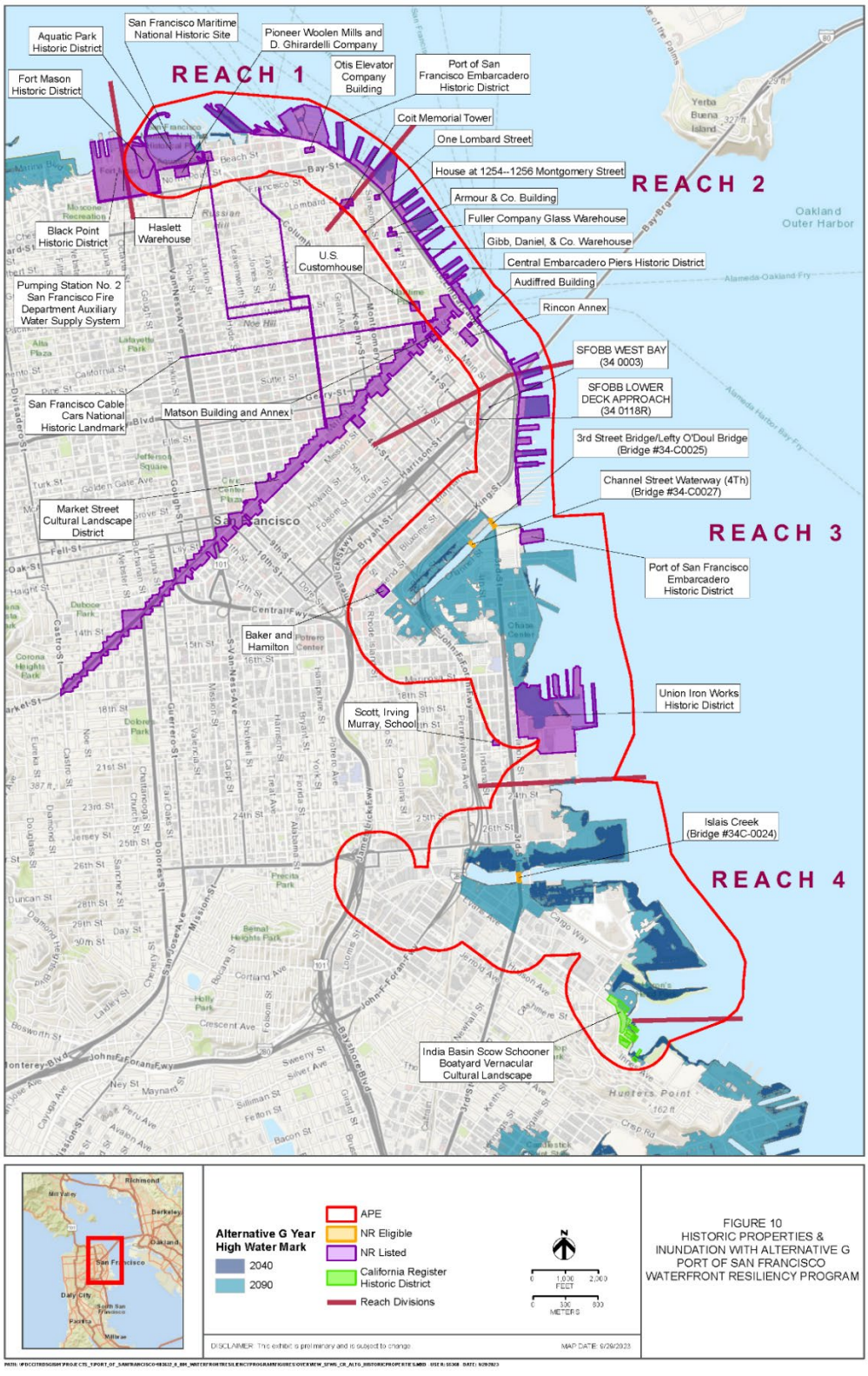


Figure D.1-25: Historic Properties and Inundation with Alternative G

4.18.7 Mitigation

The USACE is executing a Programmatic Agreement (PA) that outlines the procedures for the identification, discovery, evaluation, and mitigation of historic properties. The PA stipulates that after the initiation of the Preconstruction Engineering and Design (PED) Phase, and upon receipt of funding, the USACE will prepare a Research Design that would provide an overarching research framework for Section 106 compliance and agreement implementation undertaken for the project. The Research Design would be developed in consultation with the SHPO, the Tribes, and all consulting parties, and would provide implementation guidelines for developing historic property treatment plans, which would be used to address resource specific mitigation measures.

The USACE and the Port of San Francisco have conducted a preliminary inventory of known cultural resources, both aboveground and archaeological. Investigations to be conducted prior to construction may result in the identification of previously unrecorded historic properties. Furthermore, construction activities may result in the discovery of historic properties. The mitigation of historic properties may be necessary following an evaluation of impacts to determine if any historic properties would be adversely affected. Adverse effects may include direct physical impacts from construction, noise, changes to resource settings, degradation of resource integrity, and other impacts that may affect the character of historic properties. If there are known sites in the construction area, USACE would implement mitigation measures, follow stipulations of the PA, and develop plans in the Research Design that would set forth the means for protecting historic properties or specifying treatment measures to minimize or mitigate the adverse effects. USACE may implement mitigation or treatment measures described in the Research Design prior to construction, during construction, or after construction is completed, as appropriate. If previously unidentified archaeological sites are found during construction, USACE would adhere to the stipulations of the PA to determine NRHP eligibility and effects findings. For properties eligible for NRHP listing, USACE will identify and implement mitigation measures in consultation with the parties to the PA. If unmarked burials are encountered during construction, the stipulations in the PA for respectful treatment and steps for notifying authorities will be followed.

Because the project includes non-Federal lands, it must conform to State of California procedures for the treatment of human remains. Therefore, any human remains, or related items, discovered during implementation of this project would be treated in accordance with the requirements of Section 7050.5(b) of the California Health and Safety Code. If, pursuant to Section 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are or may be of Native American origin, then the discovery would be treated in accordance with the provisions of Section 5097.98(a)–(d) of the Public Resources Code. USACE shall ensure that the remains are not damaged or disturbed further until all stipulations in Section 7050.5 and Section 5097.98 have been met.

If USACE determines that there are no viable plans that would avoid an adverse effect finding, the USACE shall work with Consulting Parties to identify possible mitigation measures to resolve adverse effects. Creative mitigation measures shall be considered when possible in order to provide meaningful mitigation for the stakeholders and the

public. Plans for mitigation will be detailed in a Historic Properties Treatment Plan (HPTP). The HPTP will outline the minimization and mitigation measures necessary to resolve the adverse effects to historic properties. Development of appropriate measures shall include consideration of historic property types and provisions for avoidance or protection of historic properties where possible.

Possible mitigation measures may include, but are not limited to, data recovery; HABS/HAER/HALS documentation; preservation of selected eligible archaeological sites and incorporating them into heritage tourism plans while allowing others to be lost; burying sites under fill or incorporating them into the undertaking; syntheses of existing information of similar archaeological properties, periods, or types in a region or area; educational programs; virtual or web-based reports or educational media that otherwise would not be produced; preservation plans; public education and outreach, including signage and museum exhibits; interpretive documents; the use of digital and other media technologies including films and scanning of resources and artifacts; inclusion of cultural landscape perspectives; use of paleoenvironmental data to develop landscape evolution models for both scientific and public information and/or to inform native planting or landscape plans as part of the undertaking; new historical contexts, including indigenous perspectives, of areas or regions; combinations of any of these or other mitigations as agreed upon by the Signatories and Consulting Parties.

HPTPs may be developed for individual or multiple historic properties and will include the agreed-upon methods for mitigating adverse effects.

4.19 Socioeconomics and Community

See Annex D.1.3 for a discussion of the impacts of the alternatives on socioeconomics and community.

4.20 Transportation

See Annex D.1.4 for a discussion of the impacts of the alternatives on transportation.

4.21 Utilities

This section qualitatively describes the impacts expected to utilities in the study area.

Significance Criteria

An alternative is considered significant if:

- UT-01: interferes with operations of, cause damage to, or otherwise disrupt the use of any buried underwater cable, buried underwater pipeline, or overhead power transmission lines.

4.21.1 Construction Impact Summary

Temporary adverse impacts to utilities would occur during shore-based and in-water construction activities. Utilities would likely require modification and/or relocation during

construction activities within the construction area. This could result in temporary loss or intermittent availability of some utilities (such as telecommunications, water) during immediate relocation. Temporary services would be provided within the construction area if a utility were to be expected to be compromised for any longer than a few hours. No area of impact would be expected to be without access to sewer, water, or electricity for any length of time (e.g., more than a few hours) as a result of construction. After relocation, all utility access would be restored upon construction completion.

In the long-term, features are likely to have ***beneficial*** impacts to utilities by protecting them from repeated inundation during storm events that could result in damage or loss of the infrastructure. This would have far greater beneficial impacts to the study area than the temporary adverse impacts expected to occur during construction.

Wastewater generation would occur periodically throughout the construction period as a result of dewatering and demand from onsite construction workers. This demand would be temporary and nominal. Construction dewatering discharges would result in short-term increases in demand on existing wastewater or storm drainage facilities, but proposing dewatering discharge methods would include options for direct discharge to the bay under a NPDES general permit if certain criteria were met. This would ensure that any discharges to the combined sewer system would be within the capacity of existing facilities and would not require the construction or expansion of existing facilities. All wastewater flows would be treated at the Southeast Treatment Plan or the North Point Wet-Weather Facility prior to discharge through an existing outfall or overflow structure to the bay. The volume of wastewater flow would be directly related to the amount of water used for construction purposes.

Pacific Gas and Electric Company and SPFUC provide electricity and natural gas to the project site, and various private companies provide telecommunications facilities. Construction of features would result in an incremental increase in the demand for electricity, natural gas, and telecommunications. This increase in demand is not expected to result in loss or failure of electricity or telecommunications facilities and would be temporary, only lasting as long as construction.

4.21.2 Operations and Maintenance Impact Summary

Wastewater associated with operations and maintenance of features in the study area would flow to the city's combined stormwater and sewer system and be treated to the standards of the city's NPDES permit for the Southeast Treatment Plant. Temporary adverse impacts like those described in the construction impact summary could occur but are expected to be on a much smaller scale. The most likely impacts to utilities during O&M is increased usage of water, wastewater, and electricity during the activities; however, these increased demands would cease when the activity is complete. Impacts from operations and maintenance of any action alternative are likely to be minimal.

4.21.3 Recommended Plan

Adverse impacts are anticipated to be low for construction of features (**Table D.1-41**).

Table D.1-41: Summary of Utilities Impacts Associated with the TNBP

TNBP Utilities Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Roadway Impact	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	1	2	2	2	2	2	2	2	2	2	2	2	2	1
Construction/Footprint (Subsequent Actions)	2	2	2	1	2	1	2	1	2	2	2	2	2	2
O&M Assumptions	1	2	2	2	1	2	2	2	2	2	2	2	2	2
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

Impacts are not expected to differ from those described in the Construction Impact Summary and the Operations and Maintenance Impact Summary. No additional impacts to utilities are expected under the Recommended Plan and are expected to be ***less than significant***.

4.21.4 Alternative B

Impacts during construction activities are not expected to differ from those described in the Construction Impact Summary and the Operations and Maintenance Impact Summary and are expected to be ***less than significant***. No additional impacts to utilities are expected under Alternative B; however, it would be anticipated that utilities would be relocated as RSLC increases flooding into the study area. Utilities would be moved to reduce impacts from repeated inundation to limit loss and potential damage during storm events.

4.21.5 Alternative F

Adverse impacts are anticipated to be low for construction of features (**Table D.1-42**).

Table D.1-42: Summary of Utilities Impacts Associated with Alternative F

Alternative F Utilities Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	2	2	2	2	2	2	2	2	2	2	2
O&M Assumptions	1	2	2	1	2	2	2	2	2	2	2
Mitigated Rating	2	2	2	2	2	2	2	2	2	2	2

Impacts are not expected to differ from those described in the Construction Impact Summary and the Operations and Maintenance Impact Summary. No additional impacts to utilities are expected under Alternative F and are expected to be ***less than significant***.

4.21.6 Alternative G

Adverse impacts are anticipated to be low for construction of features (**Table D.1-43**).

Table D.1-43: Summary of Utilities Impacts Associated with Alternative G

Alternative G Utilities Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	2	2	2	2	2	2	2	2	2	2
O&M Assumptions	2	2	2	1	2	2	2	2	2	2	2	2

Alternative G Utilities Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Mitigated Rating	2	2	2	2	2	2	2	2	2	2	2	2

Impacts are not expected to differ from those described in the Construction Impact Summary and the Operations and Maintenance Impact Summary. No additional impacts to utilities are expected under Alternative G and are expected to be ***less than significant***.

4.21.7 Mitigation

No mitigation for utilities would be needed for implementation of this project.

4.22 Recreation and Access

This section describes the adverse and beneficial impacts expected to recreation and access in the study area.

Significance Criteria

Adverse effects on recreation were considered significant if implementation of an alternative plan would result in any of the following:

- **REC-01:** Substantially disrupt any institutionally recognized recreational facility or activity.
- **REC-02:** Substantially reduce availability of and access to recreational or open space areas.

4.22.1 Construction Impact Summary

Temporary adverse impacts on recreational value from construction and ground disturbance are certain under any of the action alternatives; however, the significance of such impacts is subjective by nature and difficult to quantify. Short-term impacts are likely to occur in the immediate vicinity of the project area where construction related equipment, activities, and dust could be visible and audible to observers. During the construction period, recreationists would experience an increase in noise from operation

of equipment that could impact their ability to seek solitude or may reduce the success of wildlife-dependent recreation activities. However, similar recreation opportunities would remain available on adjacent lands and elsewhere in the study area that could be accessed during times of construction. Public access to public lands would be maintained during construction with temporary access routes. Detours around construction areas would be included where appropriate. Recreation would resume in a manner like the existing condition after construction is complete.

4.22.2 Operations and Maintenance Impact Summary

Operations and maintenance activities may generate dust, and visible or audible disturbances that may be unpleasant in the vicinity of the action area. Overall, these would be minimal and be on a much smaller scale than the construction impacts. Recreation and access should not be readily disturbed during these actions, but it is likely that detours may be set where appropriate or restricted access during activities may be instilled for public safety. Once maintenance is complete, recreational activities would resume normally.

4.22.3 Recommended Plan

Adverse impacts to recreation and access are anticipated to be low for construction of features in the Recommended Plan (**Table D.1-44)**.

Table D.1-44: Summary of Recreation and Access Impacts Associated with the TNBP

TNBP Recreation and Access Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Roadway Impact	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	1	2	2	2	2	2	2	2	2	2+	2+	2+	2+	1
Construction/Footprint (Subsequent Actions)	2	2	2	1	2	1	2	1	2	2+	2+	2+	2+	2+
O&M Assumptions	1	2	2	2	1	2	2	2	2	2	2	2	2	2
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

Impacts are anticipated to be the same as those described in the Construction Impact Summary and the Operations and Maintenance Impact Summary. Adverse impacts would be temporary and localized to construction sites, in which other recreation spaces would be available for use. No feature is proposed to be constructed over or through a large park (e.g., Mission Bay Park System, Sue Bierman Park) which occupy several acres in the study area. The most recreational impacts would be realized at the waterfront during wharf replacement, seawall construction, and roadway impacts. During this time, the wharfs and areas of the waterfront that are undergoing construction may be inaccessible, depending on the type of construction activity, for public safety concerns. If required, temporary access would be granted to some of these areas where active construction was not being undertaken. Once construction is complete, recreationists would have access to the waterfront and wharfs normally. Adverse impacts from the construction of features are anticipated to be ***less than significant***.

This alternative would likely have a long-term ***beneficial*** impacts to recreation and access by protecting recreational features from erosion, damage, and loss by repeated storm events and RSLC. Additionally, NNBFs would increase the acreage of available space for recreational activities.

4.22.4 Alternative B

Recreation resources may experience temporary, adverse impacts during building demolition, relocation, pier removal, and floodproofing, though these are anticipated to be low overall. Impacts during relocation, demolition, and floodproofing are expected to be the same as those described in the Construction Impact Summary.

During pier removal, private boats would not be allowed to enter the immediate area due to public safety concerns. The permanent removal of this pier would eliminate access for recreational purposes; however, other piers would remain accessible during and after construction that could be utilized by recreational boaters. Access restrictions would temporarily reduce recreation opportunities during the construction phase. Recreational resources near the construction area, such as boat landings, private marinas, etc. would continue their operations during construction.

Long-term recreational opportunities near the piers are not expected to change. By removing the piers, shade structure and potentially contaminated pilings would be removed, which may improve fish habitat locally. This could allow for improved recreational fishing opportunities or would sustain the baseline condition.

In the long-term, some recreational spaces may be lost or relocated in Alternative B. For those being relocated, access to these would be temporarily disrupted while infrastructure was being moved elsewhere. For areas requiring demolition, these areas would increase the recreation space available as they are de-paved and converted to green space upon removal of infrastructure. These areas would be subject to flooding during storm events and may sustain damage as a result of that, but most of the time would be available for recreational opportunities. Overall, Alternative B is expected to have ***less than significant*** short-term and long-term impacts to recreation and access.

4.22.5 Alternative F

Adverse impacts to recreation and access are anticipated to be low for construction of features in Alternative F (**Table D.1-45**).

Table D.1-45: Summary of Recreation and Access Impacts Associated with Alternative F

Alternative F Recreation and Access Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	2	2	2	2	2	2	2	2	2	2	2
O&M Assumptions	1	2	2	1	2	2	2	2	2	2	2
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

Impacts are anticipated to be the same as those described in the Construction Impact Summary and the Operations and Maintenance Impact Summary. Adverse impacts would be temporary and localized to construction sites, in which other recreation spaces would be available for use. No feature is proposed to be constructed over or through a large park (e.g., Mission Bay Park System, Sue Bierman Park) which occupy several acres in the study area. The most recreational impacts would be realized at the waterfront during wharf replacement, seawall construction, and roadway impacts. During this time, the wharfs and areas of the waterfront that are undergoing construction may be inaccessible, depending on the type of construction activity, for public safety concerns. If required, temporary access would be granted to some of these areas where active construction was not being undertaken. Once construction is complete, recreationists would have access to the waterfront and wharfs normally. Adverse impacts from the construction of features are anticipated to be ***less than significant***.

Operation of the tidal gates would likely provide the greatest impact during operations and maintenance of any feature. It is assumed it would undergo annual operation to ensure proper functioning of the mechanisms. During this time, increased noise and visual disruption would occur while the gates are operating (a few hours). Recreationists in the vicinity of the gate structure would experience temporary, adverse disturbances

during this operation. Once gates were re-opened and maintenance was complete, any adverse impacts would cease.

This alternative would likely have a long-term ***beneficial*** impacts to recreation and access by protecting recreational features from erosion, damage, and loss by repeated storm events and RSLC. Additionally, NNBFs would increase the acreage of available space for recreational activities.

4.22.6 Alternative G

Adverse impacts to recreation and access are anticipated to be low for construction of features in Alternative G (**Table D.1-46**).

Table D.1-46: Summary of Recreation and Access Impacts Associated with Alternative G

Alternative G Recreation and Access Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	2	2	2	2	2	2+	2+	2+	2+	2+
O&M Assumptions	2	2	2	1	2	2	2	2	2	2	2	2
Mitigated Rating	2	2	2	2	2	2	2	2	2	2	2	2

Impacts are anticipated to be the same as those described in the Construction Impact Summary and the Operations and Maintenance Impact Summary. Adverse impacts would be temporary and localized to construction sites, in which other recreation spaces would be available for use. No feature is proposed to be constructed over or through a large park (e.g., Mission Bay Park System, Sue Bierman Park) which occupy several acres in the study area. The most recreational impacts would be realized at the waterfront during wharf replacement, seawall construction, and roadway impacts. During this time, the wharfs and areas of the waterfront that are undergoing construction may be inaccessible, depending on the type of construction activity, for public safety concerns. If required, temporary access would be granted to some of these areas where active construction was not being undertaken. Once construction is complete,

recreationists would have access to the waterfront and wharfs normally. Adverse impacts from the construction of features are anticipated to be ***less than significant***.

Any direct impacts to recreational opportunities during construction of NNBFs would be temporary and only last during construction. Recreationists that frequent Heron's Head Park or Pier 94 wetlands for wildlife viewing, may have to circumvent the action area when traveling due to construction limiting or delaying access. During sediment delivery to construction units (i.e., marsh enhancement, naturalized shorelines, ecotone levees), increased turbidity (e.g., marsh) and disturbance (e.g., ecotone levees) from construction equipment may deter fish and wildlife from the action area and neighboring areas, which may result in a temporary degradation of recreational opportunities outside the action area.

In general, construction of NNBFs would have long-term ***beneficial*** impacts to recreation opportunities by providing 700+ additional acres of habitat over the total life of the project that are suitable for waterfowl and other birds, fish, and mammals which would enhance opportunities for wildlife observing. Enhanced marsh habitat could also improve fishing in areas as marshes are productive nursery habitat for fish.

4.22.7 Mitigation

No mitigation for recreation and access would be needed for the implementation of the project.

4.23 Aesthetics

This section describes the impacts of the alternatives on visual resources in and around the project area. Landscape changes are difficult to quantify and subjective in terms of impact significance, being influenced by individual perceptions, uses, familiarities, and expectations for viewsheds.

Aesthetic resources can briefly be defined as those natural and man-made features of the environment that can be perceived by all the senses, not just sight. Aesthetic resources include the unified combination of water resources, landforms, vegetation, and user characteristics at a site. An aesthetic resource may be a particular landscape, viewshed, or view as perceived with all the senses. Visual resources are defined as those natural and cultural features of the environment that can be potentially viewed.

Significance Criteria

The factors used to analyze the potential impacts of the alternative must consider a wide variety of perspectives to determine significance of impacts to aesthetic values. The alternative would pose a significant impact to aesthetic resources if it would:

- **AES-01:** Substantial changes to views of any creek, bayou, or open space area from existing viewpoints including trails, over crossings, buildings, and residences

- **AES-02:** Substantial changes to views of other significant environmental resources such as mid-ground and background views of the overall landscape
- **AES-03:** Substantial changes to significant landmarks or defining features
- **AES-04:** Substantial obstruction of significant public views or view corridors
- **AES-05:** Development that is not harmonious with the surrounding visual setting (i.e. introducing a form, line, color, or texture that contrasts with the visual setting)

4.23.1 Construction Impact Summary

The construction activity view would be visually and audibly intrusive to the surrounding viewscape and have ***significant and unavoidable*** impacts during construction (multi-year) for Alternatives F, G, and the TNBP. In general, the adverse impacts during construction would come from the presence of heavy machinery, construction-related debris, temporary fencing used to restrict access, increase in noise from equipment use, etc. This would be visually and audibly disturbing near the construction zones, but also outside of the construction zones from areas that would have the construction within the viewshed. The experience of land use and general user activity would also be disturbed near the construction zone from noise and the visual disturbance of the presence of equipment. Areas may be inaccessible during times of construction for safety purposes that would also disrupt access to visual resources; however, this is anticipated to be temporary, only lasting until construction is completed.

The study area is urban in character and includes a diverse and intermixed combination of modern and historic buildings and structures, maritime and industrial facilities, vehicular streets, recreational trails, parks and public spaces, and natural areas along its shoreline. The linear stretch of the study area extends through several San Francisco districts and neighborhoods, contributing to its diverse visual character. The study area has and continues to experience physical and visual transformation in the form of redevelopment and infill development. This process of transformation has created a visual environment that includes a wide variety of architectural styles. As a result of this ongoing evolution, the massing, scale, materials, and architectural character (with respect to age and style) of the buildings and structures do not conform to any strongly discernible overall pattern. Open spaces in the Plan area also vary in character and are largely related to the physical form of the waterfront edge.

Measures would limit some existing views of visual resources from specific locations, but not to an extent that would be substantially adverse. Abundant views of scenic and visual resources that are currently available from different vantage points within the study area would remain with the new features being proposed with this study. Design elements of each feature incorporate the use of materials and architecture that blends with the surrounding landscape and with what was historically present, where appropriate (e.g., historic districts, along the Embarcadero). Some coastal views may be impacted or diminished but would still be available from other vantage points along the

LOD. With the design elements, the impacts are anticipated to be ***less than significant*** over the long-term.

4.23.2 Operations and Maintenance Summary

O&M is anticipated to have minor and temporary impacts to visual resources. Given maintenance operations would be very localized for project features and are likely to occur infrequently, over short periods of time, it is anticipated this would have ***less than significant*** impacts. Temporary adverse impacts would be realized while work crews are present, and depending on the maintenance needed, noise and visual disturbances or reduced access to visual resources in a concentrated area may occur; however, this would not raise to the same level as impacts incurred during construction.

4.23.3 Recommended Plan

Adverse impacts to aesthetic resources are anticipated to be moderate to high for construction of features in the Recommended Plan (**Table D.1-47**).

Table D.1-47: Summary of Aesthetic Impacts Associated with the TNBP

TNBP Recreation and Access Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*	Vertical Shoreline*
Construction/Footprint (First Actions)	4	4	4	4	4	4	4	4	4	4	4	4	1	4
Construction/Footprint (Subsequent Actions)	1	4	4	1	1	4	1	4	4	4	4	4	4	4
O&M Assumptions	1	2	2	2	2	2	2	2	2	2	2	2	2	2
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

Construction of the TNBP would have similar impacts to those described in the construction impact summary. Changes to vegetation cover and diversity would be similar to those described for Alternative F.

Access to views of natural features such as marshes and large waterbodies (i.e., San Francisco Bay) would remain accessible during construction, as well as after

construction completes. No protection is proposed for Heron's Head Marsh, thus it would be expected that overtime, depending on severity of RSLC, this resource would be degraded and may eventually be lost. Pier 94 wetlands are proposed to be augmented in 2090 with marsh restoration and enhancement that would reliably improve the aesthetic experience of that coastal landform. In general, aesthetic resources of the San Francisco Bay would remain mostly unchanged in the long-term. Areas visited for views of the water would be more persistent and reliably accessible due to the protection provided by the features upon construction completion, but the aesthetic experience of the water may be different. The differences would vary by location but may include: the Bay may be similarly visible, visible but more screened, and/or no longer visible. Note that more than one of these may simultaneously be true in the same location, dependent upon the viewer's vantage point. Overall, the impacts are expected to be ***less than significant*** once construction is completed, as views of natural features would remain available from multiple vantage points.

Construction of the NNBFs would have similar impacts to those described in the construction impact summary, particularly for the grey features being proposed. The coarse beach that overlays bayfill, which would change the views of natural features in reach 2 of the waterfront. The addition of ecological features could be considered beneficial for some viewers, but adverse to others. Similarly, NNBF measures in reach 4 would permanently change vegetation cover and the viewscape of natural features by including new green space.

Access to views of natural features such as marshes and large waterbodies (i.e., San Francisco Bay) would remain accessible during construction, as well as after construction completes. No protection is proposed for Heron's Head Marsh, thus it would be expected that overtime, depending on the severity of RSLC, this resource would be degraded and may eventually be lost.

4.23.4 Alternative B

There would be a temporary increase in construction equipment and support vehicles in the immediate area of the floodproofing or demolition sites that would likely last only a couple of months resulting in ***less than significant*** impacts. Over the long-term, floodproofing would not change the viewscape of the structure or the surrounding environment as the materials would blend with the structure's original form, color, and texture. Pier and building demolition would create a viewscape change that could be perceived as beneficial by some and adverse by others depending on their bias towards the quality and historic value of the site. Coastal views in general would be unaffected except for the demolition which may open new visual pathways. Long-term impacts are anticipated to be ***less than significant***.

4.23.5 Alternative F

Adverse impacts to aesthetics are anticipated to be moderate to high for construction of features in Alternative F (**Table D.1-48**).

Table D.1-48: Summary of Aesthetic Impacts Associated with Alternative F

Alternative F Recreation and Access Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	4	4	4	4	4	4	4	4	4	4	4
O&M Assumptions	1	2	2	1	2	2	2	2	2	2	2
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

Construction of Alternative F would have similar impacts to those described in the construction impact summary.

Vegetation cover and diversity varies but is mostly landscaping amongst infrastructure. Natural vegetation occurs at coastal landforms such as Heron's Head Park. Vegetation that exists outside of the LOD would remain exposed to coastal flood risks that could change presence or condition over time, but vegetation behind the LOD would remain unchanged or could have improved condition due to the reduction of damage from coastal flooding events and RSLC. The aesthetic experience of vegetation may be different after construction is completed such that it may be similar, may be partially changed, or may be lost. During construction, it is assumed vegetation within the direct construction footprint of features would be lost; however, this would be returned upon construction completion. Overall, impacts would be ***less than significant*** once construction is completed.

Implementation of tidal gates would result in a permanent landscape feature, that is likely to be interpreted by many to be significant and obtrusive. Tidal gates are typically dominant and often only somewhat compatible with the view scape, if at all. The gates, intended to close during operations, would block views of the Bay and creeks depending on the vantage point, and would become the dominant feature in the enclosed landscape. When not in operation, the tidal gates could be considered an "eye sore" feature that may obstruct views of the bay partially or completely depending on final design and view vantage point. The gates are characterized as somewhat compatible because it is likely to disrupt the harmony of the existing landform, causing the broad and open experience at the mouth of the creeks currently available to be lost. Some coastal views may be impacted or diminished by the gates but would still be available from other vantage points along the LOD. With design elements, the impacts are anticipated to be ***less than significant*** over the long-term.

4.23.6 Alternative G

Adverse impacts to aesthetics are anticipated to be moderate to high for construction of features in Alternative G (**Table D.1-49**).

Table D.1-49: Summary of Aesthetic Impacts Associated with Alternative G

Alternative G Recreation and Access Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	4	4	4	4	4	4	4	4	4	4	4	4
O&M Assumptions	2	2	2	1	2	2	2	2	2	2	2	2
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

Construction of Alternative G would have similar impacts to those described in the construction impact summary.

Changes to vegetation cover in reaches 2 and 3 would be similar to that described for Alternative F. In Reaches 3 and 4, incorporation of NNBFs and retreat of the LOD would convert existing pavement and grey infrastructure to green space, improving the vegetation viewshed. Incorporation of important ecological habitat and open space would create new visual pathways for coastal views, as well as incorporate new vegetation views, that may be perceived as beneficial by some, but adverse to others. Overall, the impacts are anticipated to be ***less than significant*** over the long-term.

Access to views of natural features such as marshes and large waterbodies (i.e., San Francisco Bay) would remain accessible during construction, as well as after construction completes. Similar to vegetation cover, views of natural features would be enhanced with the addition of NNBFs, particularly in reaches 3 and 4. The expansion of natural features, by augmentation of existing wetlands, and creation of new habitat (e.g., ecotone levees, naturalized shorelines) would improve visual resources within the reach as well as for other parts of the study area that may have the features within the viewshed. For some, it would be considered beneficial while others may consider it adverse. Overall, the impacts are expected to be ***less than significant*** once

construction is completed, as views of natural features would remain available from multiple vantage points.

4.23.7 Mitigation

No mitigation measures were identified for aesthetic resources. Elements were considered during the design of the features that would mitigate overall aesthetic impacts.

4.24 Hazardous, Toxic, and Radioactive Waste

Annex D.1.6 details the environmental consequences anticipated with HTRW.

4.25 Land Use Planning

See Annex D.1.7 for a discussion of impacts of the alternatives on land use planning.

4.26 Public Health and Safety

This section describes the adverse and beneficial impacts expected to public health and safety in the study area.

Significance Criteria

The alternative would pose a significant impact to public health and safety if:

- PH-01: create a significant hazard to the public or the environment by disrupting the routine transport, use, or placement or storage of hazardous materials or wastes.
- PH-02: Impair implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan.

4.26.1 Construction Impact Summary

It is not expected that measures would directly impact public facilities or services; however, public facilities could have temporarily interrupted services during construction activities. Increased vehicular congestion along roads, highways, and streets during construction could temporarily impede access of public services; however, detours and alternative access routes would be established to minimize these impacts. Site security (e.g., fencing) would be included around all construction areas to deter the public from accessing active construction sites for safety and health concerns.

Features such as new or relocated driveways, transit corridors, on-street loading zones, etc. would not impede emergency vehicles. None of the plans are anticipated to result in inadequate emergency access. No access would be cut off to emergency service infrastructure (e.g., hospitals, police stations), nor would emergency services be cut off from accessing areas to perform regular or emergency duties.

The police department evaluates performance, based on response times and, when appropriate, reallocate resources to meet the need for services in specific parts of the city, if and when conditions warrant. Although routes may change temporarily during construction, none of the alternatives would necessitate the construction of new or expanded police department facilities to maintain acceptable service ratios, response times, or other performance objectives.

The study area is serviced by several fire stations. The fire department conducts ongoing assessments of its service capacity and response times and would continue to do so in response to construction related impacts and changes following construction completion. None of the alternatives would necessitate the construction of new or expanded fire department facilities to maintain acceptable service ratios, response times, or other performance objectives.

Construction is not expected to increase demand for emergency response and emergency medical services. Instead, construction of an action alternative is expected to have long-term ***beneficial*** impacts to emergency services by reducing flooding risks and damages that would occur during a storm event. This is expected to benefit emergency response time for these services, as well as reduce damages or loss that may occur to emergency response facilities following a storm event.

4.26.2 Operations and Maintenance Impact Summary

Operations and maintenance activities are not anticipated to have adverse impacts to emergency or public health services, response, or infrastructure.

4.26.3 Recommended Plan

Adverse impacts to public health and safety are anticipated to range from no to low for construction of the Recommended Plan (**Table D.1-50**).

Table D.1-50: Summary of Public Health and Safety Impacts Associated with the TNBP

TNBP Public Health and Safety Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Roadway Impact	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	1	2	2	2	2	2	2	2	2	1	1	1	1	1
Construction/Footprint (Subsequent Actions)	2	2	2	1	2	1	2	1	2	1	1	1	1	1
O&M Assumptions	1	2	2	2	1	2	2	2	2	1	1	1	1	1
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*1*	*1*	*1*	*1*

Measures that would be constructed along the waterfront such as levees, t-walls, wharfs, vertical walls, seawall, roadway, and bay fill are anticipated to have low adverse impacts to public health and safety. The majority of adverse impacts would be realized with the need for traffic detours and reduced access during construction in localized areas that may increase response times in some instances. The actual construction of these features should not impose a public health and safety concern as active construction zones would be fenced off to prevent public access. In the long-term, these features would have ***beneficial*** impacts to public health and safety by reducing the likelihood of damage, loss, or injury from coastal and combined flooding events. The increased protection from features would improve public health and safety overall.

Construction of NNBFs is anticipated to have ***no impacts*** to public health and safety, rather would be beneficial in the long-term. NNBFs features are not proposed to be constructed in locations that would impede access or response of emergency services and do not occur near public safety infrastructure. As such, it is not likely that construction would have adverse impacts to the operability of these services. Long-term benefits can be realized with the improved and expanded access to natural spaces that improve overall well-being of individuals.

Construction of any measures or NNBFs would have ***less than significant*** impacts to public health and safety.

4.26.4 Alternative B

Alternative B is not anticipated to have impacts beyond those described in the Construction Impact Summary. Any emergency service infrastructure that required relocation would be temporarily unavailable from the previous operating location; however, services would still be provided from neighboring facilities. This may increase volume of operations to other facilities temporarily, but it is assumed these facilities would be provided with the necessary support to complete tasks without causing significant delays or issues with response to emergency services.

4.26.5 Alternative F

Adverse impacts to public health and safety are anticipated to range from no to low for construction of Alternative F (**Table D.1-51**).

Table D.1-51: Summary of Public Health and Safety Impacts Associated with Alternative G

Alternative F Public Health and Safety Impact Rating by Measure	**Bay fill**	**Levee**	**Bulkhead wall/Seawall**	**Roadway Impact**	**Tide Gate**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Marsh Enhancement***
Construction Footprint	2	2	2	2	2	2	2	2	1	1	1
O&M Assumptions	1	2	2	2	2	2	2	2	1	1	1
Mitigated Rating	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*1*	*1*

Measures that would be constructed along the waterfront such as levees, t-walls, wharfs, vertical walls, seawall, roadway, and bay fill are anticipated to have low adverse impacts to public health and safety. The majority of adverse impacts would be realized with the need for traffic detours and reduced access during construction in localized areas that may increase response times in some instances. The actual construction of these features should not impose a public health and safety concern as active construction zones would be fenced off to prevent public access. In the long-term, these features would have ***beneficial*** impacts to public health and safety by reducing the likelihood of damage, loss, or injury from coastal and combined flooding events. The increased protection from features would improve public health and safety overall.

Construction of NNBFs is anticipated to have no impacts to public health and safety, rather would be beneficial in the long-term. NNBFs are not proposed to be constructed in locations that would impede access or response of emergency services and do not occur near public safety infrastructure. As such, it is not likely that construction would have adverse impacts to the operability of these services. Long-term benefits can be realized with the improved and expanded access to natural spaces that improve overall well-being of individuals.

Construction of any measure or NNBF would have ***less than significant*** impacts to public health and safety.

4.26.6 Alternative G

Adverse impacts to public health and safety are anticipated to range from no to low for construction of Alternative G (**Table D.1-52**).

Table D.1-52: Summary of Public Health and Safety Impacts Associated with Alternative G

Alternative G Recreation and Access Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	2	2	2	2	2	2	2	1	2	3	3	1
O&M Assumptions	2	2	2	1	2	2	2	1	1	2	2	1
Mitigated Rating	2	2	2	2	2	2	2	1	1	2	2	1

Measures that would be constructed along the waterfront such as levees, t-walls, wharfs, vertical walls, seawall, roadway, and bay fill are anticipated to have low adverse impacts to public health and safety. The majority of adverse impacts would be realized with the need for traffic detours and reduced access during construction in localized areas that may increase response times in some instances. The actual construction of these features should not impose a public health and safety concern as active construction zones would be fenced off to prevent public access. In the long-term, these features would have ***beneficial*** impacts to public health and safety by reducing the likelihood of damage, loss, or injury from coastal and combined flooding events. The increased protection from features would improve public health and safety overall.

For the construction of most NNBFs, impacts are anticipated to range from no to low impacts to public health and safety. In 2040, most NNBFs are not proposed to be constructed in locations that would impede access or response of emergency services and do not occur near public safety infrastructure. As such, it is not likely that construction would have adverse impacts to the operability of these services. In 2090, NNBFs are expected to cover an expansive area (700+ acres) that would eliminate some roadways and areas that were previously serviced by emergency response. The NNBFs that are anticipated to have greater adverse impacts during construction include those that would occur inland (i.e., ecotone levees, naturalized shorelines), while shore-based features (i.e., ecological armoring, marsh) would occur outside of areas that would impact emergency services.

Moderate impacts during the construction of embankment and naturalized shorelines are anticipated during the 2090 construction phase. In 2090, UCSF Medical Center at Mission Bay (hospital) and Kaiser Permanente San Francisco Mission Bay Medical Offices would be demolished when the land it occupies is converted to NNBFs. Another two hospitals, UCSF Benioff Children's Hospital and Maternidad UCSF, are located approximately 1,200 feet to the southeast of these buildings, that would be available to accommodate emergency medical services when the hospital and medical offices are lost. This may temporarily increase the volume of patients attending the available hospitals; however, the population within this area is expected to lower given the conversion of large acres of grey infrastructure to natural spaces.

Construction of any or NNBFs would have ***less than significant*** impacts to public health and safety. In general, long-term benefits can be realized with the improved and expanded access to natural spaces that improve overall well-being of individuals.

4.26.7 Mitigation

No mitigation for public health and safety would be needed for implementation of the project.

4.27 Cumulative Effects

NEPA regulations require that cumulative impacts or effects of a proposed action be assessed and disclosed in an EIS or Environmental Assessment (EA). The CEQ regulations define cumulative impacts or effects as:

> …effects on the environment that result from the incremental effects of the action [project] when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.1(g)).

For purposes of this analysis, cumulative impacts are evaluated if the indirect and direct impacts of the Federal action have substantial temporary adverse or positive impacts to the resource, when considering past, present, and reasonably foreseeable future actions. Potential impacts of the past, present, and reasonably foreseeable future

actions include both potential direct effects (caused by the action sand occurring at the same time and place as the Recommended Plan), and indirect effects (caused by the action but removed in distance and later in time, and reasonably foreseeable).

The cumulative effects analysis considers the magnitude of the cumulative effect on the resource health, which refers to the overall condition, stability, or vitality of the resource and the trend of that condition. Laws, regulations, policies, or other factors that may change or sustain the resource trend were considered to determine if stress on the resource is likely in the foreseeable future. Cumulative impacts may also occur when the occurrence of disturbances is so close that the effects of one are not dissipated before the next occurs, or when the timings of disturbances are so close that their effects overlap. The general approach provided in the CEQ's Considering Cumulative Effects Under the NEPA was used to conduct the analysis (CEQ 1997).

This cumulative impact analysis was scoped with a temporal boundary approximately 100 years in the past (1920), from the beginning of the study, and approximately 50 years into the future (2190), from construction completion. This period of analysis captures a timeframe when a significant number of environmental laws were enacted in which resource protection became a priority (past). Additionally, the period of analysis tracks the H&H modelling for RSLC threats, as well as future RSLC trajectories.

For a spatial boundary to scope this cumulative impact analysis, projects or actions considered were mostly within the same county and/or in San Francisco Bay.

This study is one of many ongoing efforts to improve coastal and combined flood damages and disaster resilience along the San Francisco waterfront. The San Francisco Waterfront Plan and the Waterfront Resilience Program are led by the Port and include the study area, as well as areas both north and south of this study boundary.

4.27.1 Past or Present Actions

San Francisco Harbor Project. San Francisco Bay is one of the critical maritime thoroughfares in the nation, supporting international trade, commercial and recreational fishing, and recreation. 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. Successfully accomplishing this mission, which requires maintaining the Federal channels to their regulatory depths, is critical to the region's maritime trade and to the regional and national economies. Over 60 million tons of waterborne commerce traverse the San Francisco Bar entrance channel annually. Regular dredging the region's channels, ports and associated docking, and berthing and other facilities is needed to maintain adequate depths for vessels to maneuver in a safe and efficient manner.

The San Francisco Harbor project consists of a deep-draft navigation channel (the Main Ship Channel) immediately offshore San Francisco Bay on the San Francisco Bar and in-Bay components. The original project was adopted by various Congressional Acts from 1868 to 1922 and provided for channel dredging and rock removal. The project was modified to existing dimensions by the Rivers and Harbors Acts of 1927, 1935,

1937,1939, and 1965. The San Francisco Bar entrance is located approximately five miles west of the Golden Gate Bridge in the waters leading into San Francisco Bay and was last deepened in 1974 to a 55-foot project depth at Mean Lower Low Water (MLLW). This high use, deep draft channel requires annual maintenance dredging to be performed to maintain the 55-foot project depth. This critical channel, which is the gateway to San Francisco Bay, is 2,000 feet wide by 16,000 feet long (USACE and RWQCB, 2015). In addition to the San Francisco Bar entrance channel, there are eleven in-Bay components. These components are dredged infrequently.

The Islais Creek entrance channel is located 2.5 miles south of the Bay Bridge. The original channel was adopted by the Rivers and Harbors Act of 1927 and modified by the Rivers and Harbors Act of 1935 and consists of a flared channel approaching the mouth of Islais Creek, 3,300 feet wide at the Bay end and 500 feet wide at the U.S. Pipehead Line end, and 35 feet deep. The primary users of the channel were commercial shipping firms operating out of Piers 80, 84, 86, 88, 90, 92, and 96 (USACE, 1975). Dredging of the channel was very infrequent. Enlargement of the entrance channel was considered, and a draft environmental impact statement issued in October 1973.

Fisherman's Wharf. This project provides protection to the existing fishing fleet and the federally owned historic fleet (National Park Service) at Fisherman's Wharf, San Francisco, California. Originally constructed in 1988, the project includes a 1,509-foot - long solid concrete sheet-pile breakwater, which is located along the west side of Pier 45, and a segmented concrete sheet-pile breakwater, which is located on the northeastern side of Pier 45. The latter has one 252-foot-long segment and one 150-foot-long segment. A Section 216 study was conducted in FY 07 to identify relationships and impacts between the Corps' project and the National Park Service's San Francisco Municipal Pier.

Final Environmental Assessment/Environmental Impact Report for Maintenance Dredging of the Federal Navigation Channels in San Francisco Bay, 2015-2024. Sediment accumulation in these channels can impede navigability. Maintenance dredging removes this sediment and returns the channels to regulatory depths to provide safe, reliable, and efficient waterborne transportation systems (channels, harbors, and waterways) for the movement of commerce, national security needs, and recreation. Therefore, USACE's purpose in this project is to continue maintenance dredging of the Federal navigation channels in San Francisco Bay consistent with the goals and adopted plans of the LTMS, while adequately protecting the environment, including listed species.

San Francisco Waterfront Seawall Section 103 Study. This study was initiated in 2013 under the continuing authority of Section 103 of the River and Harbor Act of 1962, as amended. The study included a portion of the Embarcadero area of the San Francisco waterfront. The study focused on two areas of concern – a low point approximately 40 feet wide between two buildings near Pier 5 and a half-mile low section of seawall between the Agricultural Building and Pier 22 1/2. The study was put on hold in 2018 due to the funding and initiation of this Congressionally authorized feasibility study under the Investigations account that includes the entire 7.5-mile waterfront.

Pier Repair/Removal Program. Section 5051 of WRDA 2007 provides discretionary authority to the Secretary of the Army, in cooperation with POSF, to carry out a project for repair and removal, as appropriate, of Piers 30-32, 35, 36, 70 (including Wharves 7 and 8) and 80 in San Francisco, California, substantially in accordance with the Port's Redevelopment Plan. The first phase of the project consisted of removing the deteriorated and partially collapsed Pier 36 using funding provided in FY 2010. Built in 1909 of both reinforced concrete and wood elements, Pier 36 was originally 721 feet long and 201 feet wide. Removal of Pier 36 made way for construction of the Brannan Street Wharf public park, the centerpiece of the South Beach Waterfront neighborhood redevelopment plan. A letter report on the removal of Pier 70 was completed in 2016, but the work was not undertaken due to the redevelopment of Pier 70.

Pier 70 Central Basin Section 107 Study. This study was conducted under the continuing authority of Section 107 of the Rivers and Harbors Act of 1960, as amended. The purpose of the study was to determine the feasibility of dredging the central basin at Pier 70 to an increased depth to reduce the impacts of shoaling to allow vessels to access the Pier 70 shipyard safely and efficiently without the use of high tide. A draft integrated Detailed Project Report and EA was completed in 2017, but the study was terminated after the dry dock closed.

Pier 48/Seawall Lot 337/Mission Rock Special Use District Project is a 3.6-million-square-foot mixed-use development project that would include retail, commercial, residential, and parking uses as well as eight acres of parks and open space and historic rehabilitation of Pier 48. The project would include a parking structure with 2,300 spaces, 1.7 million square feet of commercial, 150,000 to 250,000 square feet of retail, and between 650 and 1,500 residential units. Phase 1 of this project currently is under construction.

Pier 70 Mixed-Use District Project is a multi-phase 28-acre mixed-use development including parking spaces, parks, roads, public access, shoreline improvement and utility infrastructure. Mixed uses include residential (1,712,000 to 903,000 gross square feet), commercial (1.8 million gross square feet), retail and arts spaces (400,000 gross square feet) and research/development space. Phase 1 of this project is currently under construction.

Potrero Power Station Mixed-Use Development Project is a 5.4-million-square-foot mixed-use development that would include hotel, commercial, entertainment, residential, and parking uses as well as seven acres of open space. The project would include 2,600 residential units, 250 hotel rooms, 1.6 million square feet of commercial (office, research and development, PDR, and retail), 50,000 square feet of community facilities, 25,000 square feet of entertainment/assembly, and 2,700 parking spaces. The buildings would range in height between 65 and 240 feet. Phase 1 of this project is currently under construction.

The Better Market Street Project would revitalize Market Street from Octavia Boulevard to the Embarcadero by optimizing sustainable mobility modes (transit, walking, rolling, and cycling) so that Market Street would be pleasant, reliable, efficient, and safe for all users. The first phase of the project, between Fifth and Eighth streets, began in October 2023.

The Embarcadero Enhancement Program, Central Embarcadero Phase 1 would improve safety, mobility, connectivity, and accessibility for all users of the Embarcadero, which serves as a major transit corridor, tourist destination, marine-oriented commercial district, and public recreation area. The first phase of the project was completed in 2022.

4.27.2 Reasonably Foreseeable Actions

TZK Broadway and Teatro ZinZanni Project includes a boutique hotel with approximately 192 rooms with ancillary retail and commercial spaces and a new theater to serve as the permanent home for Teatro ZinZanni and its historic “Spiegeltent”; and an approximately 14,000-square-foot privately financed park at the northern end of the site. Construction has not yet begun.

The Port of San Francisco’s Waterfront Resilience Program would include developing a series of coordinated projects working to ensure a resilient waterfront in the face of seismic and sea-level rise, climate change-related hazards, and includes an U.S. Army Corps of Engineers Flood Study for the entire Port waterfront and a program to strengthen the three-mile-long Embarcadero seawall. A project application has not yet been submitted.

The San Francisco Housing Element 2022 Update42 would modify the policies of the general plan’s housing element. The goals, policies, and actions are required to plan for the regional housing targets allocated to San Francisco by regional agencies for the 2023–2031 cycle and meet future housing demand in San Francisco. The housing element update includes policies designed to improve housing affordability and would shift an increased share of the city’s future housing growth to transit corridors and low-density residential districts within certain areas of the city. It would not include specific changes to existing land use controls (e.g., zoning) or approve any physical development, but the Environmental Impact Report would evaluate the potential physical environmental impacts that could result from future actions regarding implementation of the policies proposed under the housing element. The Draft Environmental Impact Report was published in 2022, and the plan was adopted in January 2023.

The Mission Bay Ferry Landing project (Phase 2) would provide regional ferry service to and from the Mission Bay neighborhood, as well as the Dogpatch, Potrero Hill, Pier 70, and the Central Waterfront neighborhoods. The Mission Bay Ferry Landing would provide capability to berth two ferry boats simultaneously. Cumulative Impact Analysis

The measures included in the Recommended Plan would continue the trend of projects designed to make the region more resilient to coastal hazards and climate change, and to protect infrastructure. The majority of measures in the Recommended Plan would have temporary adverse impacts that are anticipated during construction; however, permanent impacts are also expected with limited resources. Temporary impacts would end soon after the construction phase is over and be minimized with the use of BMP’s, while permanent impacts would be offset with compensatory mitigation. The cumulative impact analysis is presented by resources grouped into the natural, physical, built, and

human environment. Cumulative impacts of past projects and actions are captured in the Affected Environment (Section 3.0) as these would have contributed to the present state of resources in the project area.

4.27.2.1 Natural Environment

Temporary impacts are expected to natural resources as a result of construction activities for this project, present actions, and reasonable and foreseeable actions. Temporary impacts include turbidity, water quality disturbance, physical impacts from construction equipment, and the potential injury or harassment of organisms by construction activities. All of these impacts would be minimized with the use of BMP's and avoidance and minimization measures to the greatest extent practicable. The cumulative impacts could be heightened at any given time if more than one project is occurring within the same area at the same time. The majority of adverse impacts to the natural environment would be realized with in-water construction activities which are planned with this project, the Mission Bay Ferry landing, and as components of the Waterfront Resiliency Program. It is unlikely that all of these projects would have construction activities occurring at the same time, but in the event this occurred, impacts to natural resources would be elevated.

Permanent impacts are also expected to the natural environment from this project and future actions, such as the Mission Bay Ferry Landing with the addition of hardened structures in San Francisco Bay and bay fill. These permanent impacts are not expected to result in net loss as compensatory mitigation would be used to fully account for this impact of construction. However, cumulatively, these projects would result in the permanent modification of bay habitat that is within the direct construction footprint.

There are also beneficial cumulative impacts anticipated as a result of this project and several of the present and reasonably foreseeable actions with the inclusion of NNBFs and increase in open space. This project proposes construction of NNBFs that would benefit state and federally protected species, while the Potrero Power Station and Embarcadero Enhancement projects would provide additional recreation and open spaces that could be frequented by local fauna. The increase in naturalized spaces would provide new areas for fauna in an otherwise highly urbanized location.

4.27.2.2 Physical Environment

The San Francisco Bay Area Air Basin is the cumulative study area for air quality, while global atmosphere is the cumulative study area for GHGs. Consequently, there are numerous past, present and reasonably foreseeable projects within these study areas. Implementation of avoidance and minimization measures would reduce criteria pollutant emissions generated by this project but would not avoid the exposure of sensitive receptors to substantial pollutant concentrations in localized areas. Other projects in the cumulative impacts area may implement comparable mitigation measures, such as using water or dust control chemicals to reduce fugitive dust or complying with relevant air quality regulations. Other cumulative projects may also contribute pollutant concentrations in the same localized areas affected by project construction. Thus, construction of the project would cumulatively contribute to existing localized air quality

impacts in the study area but would not cumulatively contribute to regional air quality impacts.

Construction activities under this project could coincide with construction activities associated with reasonably foreseeable projects, resulting in a combined increase in construction noise. In general, the potential for projects to overlap, resulting in combined or prolonged increases in ambient noise, is more likely when the construction noise of two or more projects overlaps. As such, the cumulative noise from simultaneous construction activity in proximity to one another could result in higher noise levels than would otherwise occur with one project under construction. Construction of multiple projects consecutively could increase the duration of construction noise levels that would be 10 dBA above the ambient noise level or 90 dBA at sensitive receptors. Given that the adaptations constructed under the Recommended Plan would occur along the shoreline in the vicinity of Embarcadero Early Projects and other ongoing construction, this would make a considerable contribution to the significant cumulative construction noise impact. Implementation of avoidance and minimization measures would help to alleviate the level of noise impact if multiple construction projects were underway at the same time and area. Alternatively, construction phases between projects could be coordinated to occur at different times to spatially spread noise disturbance; however, this could result in prolonged noise disturbance for a longer period. It is unlikely that multiple projects generating vibration disturbances would occur at the same time in the same locations, thus it is not expected to contribute to cumulative impacts.

This project is considering seismic hazards for design and construction, as such, long-term beneficial impacts to geologic resources would be anticipated. It is assumed the reasonable and foreseeable actions would be designing features with seismic loading factored to ensure construction of a stable building or other infrastructure. With that, projects would be expected to be beneficially impacting geologic resources by creating more stable subsurface conditions.

Some cultural resources would be permanently impacted during construction of the Recommended Plan as many are proposed to be elevated to remain in place while being protected from coastal flood hazards. Additionally, many others would be protected with addition of floodwalls or other features in close proximity that would likely change the visible characteristics of many cultural resources. Many of these impacts would be minimized to the greatest extent practicable; however, it is also understood these impacts would remain in perpetuity. This project in combination with the reasonable and foreseeable actions would cumulatively impact cultural resources, either temporarily or permanently, but overall have a goal of protecting the resources with improvements to infrastructure to combat threats of coastal flooding exacerbated by climate change. In this respect, many cultural resources would also have beneficial impacts with the protection from flooding and future damages.

This project is proposed to occur in a historically, heavily industrialized area that has resulted in a relatively extensive distribution of contamination throughout the study area. USACE regulations require sites to be free of contamination prior to construction begins. In this regard, construction would be expected to have a long-term beneficial impact to HTRW by potentially reducing the levels of contamination and thereby risks of future exposure. For this analysis, it was assumed the reasonable and foreseeable

actions would be working with a clean site or would not be disturbing HTRW areas, thus would not contribute to any cumulative adverse impacts associated with contamination.

4.27.2.3 Built Environment

Temporary adverse impacts would occur during construction to infrastructure, both with this project and other current and future proposed projects and actions. Construction impacts are anticipated to cease with construction completion and minimized with the use of mitigation and BMP's. In the long-term beneficial impacts would be realized for infrastructure that is being protected from coastal flooding with the addition of measures. Other projects proposed for the study area would contribute to the benefit of infrastructure such as housing, recreation and access, maritime facilities, and hospitality. It is assumed utilities would be adjusted for this project and others to continue provision of important services, and thereby, often improve the service availability and access. Aesthetics would result in a permanent change to waterfront views, particularly in areas where new infrastructure is proposed or modified. These are assumed to be mostly beneficial as consideration would be given to visual impacts and designs would be modified to minimize those impacts.

Cumulative impacts of other construction projects that could be taking place when construction starts, and cumulative effects to transit or transportation users, would be considered as part of the construction and traffic management plans to be prepared for elements of the project as work progresses to limit overall impacts.

4.27.2.4 Human Environment

The cumulative impacts from this project and the present and reasonably foreseeable actions were assumed to overall improve the human environment by enhancing protection from coastal and combined flooding risks. Temporary impacts during construction would be realized from any of the projects, which would be assumed to be heightened if more than one project was occurring in the same area(s) at the same time. However, generally the plans are designed to enhance the human environment either by improving safety, living standards, recreation, and/or housing and transit availability in the project area.

4.28 Probable Adverse Environmental Effects That Cannot Be Avoided

This section describes the TNBP's long-term adverse impacts that may be unavoidable and the rationale for proceeding notwithstanding the unavoidable effects.

Air Quality: During construction, there will be unavoidable air quality impacts associated with construction activities, operation of heavy equipment, and transport of personnel and materials into and out of the project area. Operation of heavy equipment would result in the release of exhaust emissions. Additionally, dust could be generated during grading and excavation activities. Mitigation measures have been incorporated and are fully described in Annex D.1.1 Section 2.3.4. Mitigation would include: implementation of BAAQMD's Basic and Enhanced BMPs for Construction, utilizing the

highest tier equipment available at the time of construction where practicable, and creating barriers between the construction site and sensitive receptors. As of now, no compensatory mitigation is necessary. However, if modeling indicates emissions are greater than *de minimus* levels once the designs have been refined, compensatory mitigation will need to be considered and would likely include funding an off-site local emission reduction project, when available.

Aquatic Resources: Wharf raising/rebuilding and construction of a coarse beach will result in approximately 9.0 acres of bay fill that will require compensatory mitigation in the form of old pile and pier removal from the bay. Loss of fringe wetlands and inter-tidal habitat is expected during construction of the ecotone levee and marsh enhancements; however, these habitats would be restored as a feature of the design that would over the long-term enhance the aquatic habitats at these locations, resulting in no net loss. Additional mitigation measures have been incorporated to minimize unavoidable impacts and are described in section 4.14.7 of this sub-appendix.

Noise: During construction, there will likely be unavoidable noise impacts associated with construction activities, operation of heavy equipment, and movement of personnel and material into and out of the project area. Mitigation measures have been incorporated to minimize construction-related noise impacts, such as limiting heavy equipment use to daytime hours not regulated by the City the greatest extent practicable, conducting noise and vibration monitoring, employing common construction BMPs, and complying with all Federal and State noise control regulations. Mitigation measures are described in Annex D.1.2 Section 2.3.

Transportation: The project will disrupt traffic patterns, result in transportation corridor closures, loss of access and parking, detours and increased construction traffic and congestion near staging and construction areas. These impacts are expected to be temporary but long-term lasting until construction is complete. Permanent unavoidable impacts resulting from changed traffic patterns would be realized with roadway, bike path, sidewalk, and transit redesign, and re-routing in areas of raised elevation or narrowing of roadways to accommodate the levees and floodwalls. Mitigation has been incorporated to minimize the impacts and have been described in Annex D.1.4 Section 2.2.4 and include but are not limited to preparing construction traffic management plans to minimize cumulative effects from other projects, maintaining or providing pedestrian and bicycle access to the waterfront to the greatest extent practicable, and providing alternative transit access and stops where necessary.

4.29 Irreversible or Irretrievable Commitments of Resources

NEPA, as amended by the FRA of 2023 (42 U.S.C. § 4332(2)(C)(v)), requires that the environmental analysis include identification of “any irreversible and irretrievable commitments of resources which would be involved in the proposal should it be implemented.” Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g. energy and minerals) that cannot be replaced within a reasonable time frame. If a wetland is filled to build a parking lot, that habitat is

irretrievable as long as the parking lot remains. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g. extinction of a threatened or endangered species).

Should the proposed action be implemented, there would be some irreversible or irretrievable commitments of natural and built resources that would be expended in the construction and operation of any of the action alternatives. These resources include:

- Materials used to construct new flood risk management structures, meet seismic design requirements, and modifications to the existing stormwater and transportation systems (e.g. concrete, stone, steel, pavement, etc.);
- Energy in the form of fossil fuels and electricity consumed during operation of heavy equipment, production of construction materials, and transport of equipment, materials, and personnel to and from the project site; and,
- Capital and labor resources required to develop, construction and operate various components of the flood risk management system.

Some components, such as existing structures, pavements, utility lines, or other features requiring removal to construct the new structures, may be recycled upon removal which would offset some of the material consumed and introduce a minor amount of material that would be available to others. Similarly, any new materials and components placed as part of the new structure may be recycled upon decommissioning, but in the near team, these materials would not be available to others.

Land and aquatic habitats (e.g. intertidal and subtidal habitats) that would be physically altered by construction would be committed to the new use for the foreseeable future and would represent an irreversible commitment of those areas for the life of the project. Should, however, a greater need arise for the use of the land, or should the proposed project no longer be needed, the land and aquatic habitats could be restored to the original condition or be committed to for another use. However, there is no indication that such a need for conversion could develop or would be desirable.

4.30 Relationship Between Short-Term Uses of Environment and the Maintenance and Enhancement of Long-Term Productivity

NEPA also requires that an EIS include a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. This section describes how the proposed action would affect the short-term use and the long-term productivity of the environment.

For this analysis, “short-term” refers to the temporary phase of construction of the proposed project while “long-term” refers to the operational life of the proposed project and beyond. The preceding sections evaluate the short- and long-term impacts of implementing each of the alternatives in more detail for each resource.

Construction of any of the alternatives would result in short-term construction related impacts within the project areas and would include increased air emissions and ambient

noise; disturbances to fisheries and wildlife; loss of public access, recreational opportunities, and aesthetic value; interruptions and delays in transportation and access in and around the project area; and decreased water quality such as higher turbidity levels and lower dissolved oxygen. These impacts would be temporary and would occur only during construction and are not expected to alter the long-term productivity of the natural or built environment.

Over the long-term, adverse impacts including encroachment/fragmentation of aquatic habitats; changes in hydrologic flows, land use, aesthetic qualities of the iconic landscape, recreation opportunities, public access, and the transportation system; and potential loss or degradation of historic resources or other culturally or socially significant resources. However, most of these adverse impacts can, and have been, avoided or minimized through the design of the structures or incorporation of compensatory mitigation. The alternatives themselves present trade-offs between the long-term productivity impacts on different resource categories.

The long-term benefits of each of the alternatives include an overall enhancement of the quality of life and reduction in damages caused by coastal and combined flooding, RSLC, and seismic events throughout the 7.5-mile San Francisco Waterfront.

5.0 Avoidance and Minimization Measures

The TNBP avoids a significant amount of adverse impacts to ecological habitats by placing the line of defense at or landward of the existing shoreline and designing the project to avoid bayfill to the greatest extent practicable and integrating NNBFs where feasible. The following is a brief assessment of the avoidance and minimization measures by reach and action. The avoidance and minimization measures for the project are described in this section separated by first and subsequent actions. Table D.1-53 provides a high-level overview of first and subsequent actions based on RSLC scenarios by reach.

Table D.1-53: First and Potential Subsequent Actions, Recommended Plan

Reach	*First Action*		*Subsequent Action*			
	Crest Elevation[1]	*Description[2]*	*Crest Elevation[1]*			*Description[2]*
			Low	*Intermediate*	*High*	
1	*--*	*Floodproofing buildings, phased over time (Alternative B)*	*--*	*Only nonstructural action*	*New defense structure: 19.0 ft NAVD88*	*Intermediate: Floodproof more buildings, phased over time (Alternative B)* *High:* Defend at existing shoreline (Alternative G)
2	*15.5 feet NAVD88*		*--*	*--*	*19.0 ft NAVD88*	*High: Increase crest elevation of defense structure along existing shoreline (Alternative G)*
3	*13.5 feet NAVD88*		*--*	*15.5 feet NAVD88*	*19.0 ft NAVD88*	*Increase crest elevation of defense structure along existing shoreline (Intermediate: Alternative D; High: Alternative E)*
4	*13.5 feet NAVD88*		*--*	*15.5 feet NAVD88*	*19.0 ft NAVD88*	*Increase crest elevation of defense structure along existing shoreline (Intermediate: Alternative D; High: Alternative E)*

NAVD88 = North America Vertical Datum of 1988

[1]Crest elevation columns indicate the assumed structural measures crest elevation for purposes of alternatives evaluation. Actual crest elevations would vary along the waterfront based on local wave conditions, pending further analysis in PED.

[2]First and Subsequent Actions include a mix of structural and nonstructural measures, and NNBFs. The brief description here is intended to highlight key differences by reach.

5.1.1 Reach 1

5.1.1.1 First Actions

All measures are considered nonstructural, meaning the measure attempts to reduce the flood risk and the damages associated with flooding rather than focusing on reducing or modifying how the water moves through the area. By design, the nonstructural measures realize impacts at the immediate site of the measure which is often isolated to the structure itself (e.g. floodproofing, building demolition) and do not involve disturbance of ecological habitats. Construction of the concrete curbs around the piers involves minimal construction efforts that would be completed from the pier and would not involve any in-water work which avoids impacts to any aquatic habitats.

Additionally, demolition of two piers would remove approximately 1.0 acre of piles, bayfill, and decking and allow the area to restore to higher quality open water and subtidal habitat.

5.1.1.2 Subsequent Actions

Under the intermediate relative sea level change (RSLC) scenario, the subsequent actions would include additional non-structural components. Nonstructural measures would not impact any location except at the immediate structure. One acre of building demolition would be completed that would allow the area to be flooded and taken over by RSLC. Here, it is anticipated that intertidal habitat would be naturally created.

For the Subsequent Actions measures under a high RSLC scenario, the seawall alignment and associated seismic ground improvements are landward of the existing shoreline and behind the existing seawall where one currently exists. This design would not require any bayfill or in-water work to construct the features. To maintain the aesthetic quality and accessibility of the waterfront, a gradual slope has been incorporated into the design that will promote unity throughout waterfront that would generally be unnoticeable to the average visitor when the pre-construction and post-construction conditions are compared. The design allows accessibility to all (i.e. fewer steps and gentle slopes) and incorporates and maintains the historic features unique to the waterfront buy ensuring the architectural design and materials are consistent with the surrounding environment. This design creates more transportation impacts to achieve the target slope and seawall elevation but fully avoids any impact to aquatic habitats.

With the increase in ground elevation, approximately 3.25 acres of existing wharf would need to be rebuilt to the higher elevation resulting in temporary localized impacts to the aquatic environment during construction. Because of the design, there would be no increase in the footprint of the wharf, all existing wharf material would need to be removed and replaced with new, more eco-friendly materials, and fewer piles would be necessary per square foot than currently exists. Overall long-term benefits to the aquatic environment are expected from the net decrease in bay fill and removal of old materials (e.g. creosote piles) that contribute to poor water quality.

5.1.2 Reach 2

5.1.2.1 First Actions

Similar to the subsequent actions in reach 1, the First Actions in reach 2 involves constructing a seawall landward of the existing seawall and rebuilding approximately 6.3 acres of wharf. The design and construction methodology would be identical to reach 1 Subsequent Actions and all the same avoidance and minimization efforts and long-term benefits described above would be applicable here. The difference here is that the action would be completed as a First Action and not a subsequent action.

All NNBFs minimize the long-term adverse impacts of the engineered structure despite some temporary aquatic impacts during construction. By incorporating NNBF into the design, natural processes and materials are used to reduce wave hazards, support nearshore ecology, and provide public water access in lieu of more traditional engineered designs and materials such as concrete, rip rap, or monoculture turf grass, which do not provide any long-term ecological or recreational benefits and are generally less visually desirable. Additionally, implementation of the NNBF avoids conversion of existing habitats into impervious surfaces.

5.1.2.2 Subsequent Actions

The Recommended Plan does not include Subsequent Actions in this reach under the intermediate RSLC scenario since the First Action is being constructed at a higher initial scale, unlike the other three reaches. By completing the 3.5-foot target elevation in the First Actions, the significant disturbance to the Embarcadero including transportation, recreation and cultural resource impacts and costs associated with reworking the same area twice are avoided. Under the high RSLC scenario, the Recommended Plan includes increasing the elevation of structures by an additional 3.5-feet in this reach. The First Actions measures have each been designed to be adaptable to future design modifications to address RSLC conditions. Based on the designs at this time, the high RSLC Subsequent Actions would not abandon the First Actions structures and thereby avoids the need for construction or conversion of lands to impervious surfaces outside the First Actions construction footprint. As with the other measures, the designs and construction methodology avoid all aquatic impacts.

5.1.3 Reach 3

5.1.3.1 First Actions

In reach 3, measures constructed landward of the existing shoreline would not require any in-water work, thus avoiding the need for bay fill and adverse impacts to aquatic habitats. Additionally, all impacts from construction have been avoided on approximately 7,500 linear feet of shoreline because the design was aligned to take advantage of existing high ground to avoid unnecessary construction of additional features. Instead of raising the bridges, deployables are proposed which avoids a significant amount of in-water work and disturbance associated with replacing two bridges.

Approximately 4.5 acres of wharf would need to be rebuilt which would involve some temporary impacts, but overall result in long-term benefits from removal of old construction materials and a reduction in bay fill as described for reach 1 Subsequent Actions. The footprint would not be increased and therefore long-term changes from a footprint increase have been avoided. Also, the modified design in this location avoids disruptions and reconfiguration of the light rail system.

5.1.3.2 Subsequent Actions

The First Actions measures have each been designed to be adaptable to future design modifications to address RSLC conditions. Based on the designs at this time, the Subsequent Actions would not abandon the First Actions structures and thereby avoids the need for construction or conversion of lands to impervious surfaces outside the First Actions construction footprint. As with the other measures, the designs and construction methodology avoid all aquatic impacts.

5.1.4 Reach 4

5.1.4.1 First Actions

Like the other reaches, all measures are constructed landward of the existing shoreline and would not require any in-water work, thus avoiding the need for bay fill and adverse impacts to aquatic habitats. Additionally, all impacts from construction have been avoided on approximately 6,500 linear feet of shoreline because the design was aligned to take advantage of existing high ground to avoid unnecessary construction of additional features. Similar to reach 3, the impacts of raising of existing bridges would be avoided by relying on deployables for flood defense. Similar to reach 1 first action, approximately 0.75 acres of building demolition would occur allowing these areas to convert to intertidal or sub-tidal habitat, while an additional 2.0 acres of building demolition would occur and be converted to open space.

A small area of gradual retreat along the creek in incorporated, resulting in long-term ecological benefits and avoidance of engineered structures and permanent impacts at or near the existing shoreline. These areas would be allowed to flood and be overtaken by RSLC, which is expected to convert to marsh, intertidal or sub-tidal habitat. Long-term conversion of existing habitats into impervious surfaces would be avoided. As well, this conversion of some industrial lands and public facilities would provide public water access and additional open space.

5.1.4.2 Subsequent Actions

The subsequent actions avoidance and minimization measures described for reach 3 also apply in reach 4. Additionally, NNBF features have been incorporated into the designs that allow for ecological enhancements while supporting and enhancing the performance of the flood defense structures.

6.0 Environmental Compliance

The final IFR/EIS has been prepared to satisfy the requirements of all applicable environmental laws and regulations, where possible, and has been prepared using the NEPA regulations (42 U.S.C §§ 4321 et seq.) and the USACE's regulation Environmental Quality: Procedures for Implementing NEPA, 33 CFR Part 230. In implementing the Recommended Plan, any compliance that could not be completed during the feasibility phase will be secured during the design phase and the USACE would continue to follow the provisions of all applicable laws, regulations, and policies related to the proposed actions.

Based on agency feedback, demonstration of full compliance of the First Actions measures during feasibility is likely for the following laws and executive orders (EOs): Fish and Wildlife Coordination Act (FWCA), Endangered Species Act (ESA), Clean Water Act (CWA) Section 404, National Historic Preservation Act (NHPA), E.O. 11988 (Floodplain Management), and E.O. 11990 (Protection of Wetlands). Full compliance may not be possible for the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and CWA Section 401. There are a few measures in the project that may preclude full compliance if the agencies determine there is not sufficient level of design detail for them to make a determination. Since the TNBP is a system, the agencies will not likely make a determination on only parts of the project because their policies require considering the whole project and would not allow a multi-part review. Full compliance cannot be achieved and must be addressed during the design phase for the following laws: Marine Mammal Protection Act (MMPA), Clean Air Act (CAA), and Coastal Zone Management Act (CZMA) due to lack of detailed design required to complete the analysis.

The following data gaps have been identified by the agencies as being needed to secure full compliance for actionable measures:

- Field verification of bay habitats to confirm the assumptions made and data used during feasibility is an accurate reflection of site-specific conditions to correctly quantify and mitigate impacts (CWA-401, CZMA).
    - Bay-wide modeling is needed to better understand how engineered structures like seawalls affect hydrodynamics in the bay. The modeling will need to assess changes in tidal amplitude and how that affects erosion and the magnitude and spatial distribution of peak water levels and inundation around the bay (CZMA).
    - Water quality and chemistry modeling, including interior drainage and outflow paths, demonstrating the recommended plan would not contribute to temporary or permanent degradation of biological habitats (CWA-401, CZMA).
    - Impervious surface modeling based on measure specific design details such as surface area and material used (CWA-401).

- Air quality modeling to quantify criteria pollutant and greenhouse gas emission based on site-specific details for construction timing, duration, equipment used, modes of transport, etc. (CAA).
- Determination of final detailed footprint, designs, and construction methods that will inform short- and long-term impacts, including:
    - Duration, timing, and methodology of all construction actions but of particular interest in water work, pile driving actions, and temporary relocation of structures (CWA-401, CZMA, MMPA);
    - Source of construction material (e.g. dredged material or commercial) (CWA-401, CZMA);
    - Extent and methodology of completing ground improvements for seismic-related issues (CWA-401, CZMA, MMPA);
    - Confirmation of assumptions regarding pier retention or abandonment (CWA-401, CZMA); and
    - Location of public access points including configuration of transportation, bike lanes, and walk paths (CZMA).

For the Subsequent Actions/adaptive measures, full compliance cannot be demonstrated for any law or E.O. during feasibility. In addition to the above data gaps, to secure compliance for the subsequent action/adaptive measures, there must be more certainty in the timing of the action as well as the construction methodology, alignment and design of the features, the affected environment at the time of the action, and the regulatory rules in place at that time.

Where compliance cannot be achieved, the compliance documentation in the final IFR/EIS provides commitment for how compliance will be achieved during the design phase.

6.1 National Environmental Policy Act

NEPA requires that all Federal agencies use a systematic, interdisciplinary approach to protect the human environment. This approach promotes the integrated use of natural and social sciences in planning and decision-making that could have an impact on the environment.

NEPA requires the preparation of an EIS for any major Federal action that could have a significant impact on the environment (42 U.S.C. §§ 4321–4347). The EIS must address any adverse environmental effects that cannot be avoided or mitigated, alternatives to the proposed action, the relationship between short-term resources and long-term productivity, and irreversible and irretrievable commitments of resources. According to 33 CFR Part 230, a supplement to either a DEIS or FEIS must be prepared if an agency makes substantial changes in the proposed action that are relevant to environmental concerns, or there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.

The NEPA regulations provide for the use of the NEPA process to identify and assess reasonable alternatives to proposed actions that avoid or minimize adverse effects of these actions upon the quality of the human environment. “Scoping” is used to identify the range and significance of environmental issues associated with a proposed Federal action through coordination with Federal, State, and local agencies; the general public; and any interested individuals and organizations prior to the development of an EIS. The process also identifies and eliminates, from further detailed study, issues that are not significant or have been addressed by prior environmental review.

Scoping began with the publication of a Notice of Early Scoping in the Federal Register (FR) on August 20, 2020 and a Notice of Intent to Prepare an EIS published in the FR on July 27, 2023. Thirty-day comment periods were opened for both of these sessions and multiple public meetings and other engagements were held to solicit feedback on the study purpose, alternatives that should be considered, potential impacts and analyses that should be completed and any resources of significance or concern. This draft IFR/EIS was released to the public on January 26, 2024 for review and comment. A 60-day comment and review period commenced with publication of a Notice of Availability in the FR. During the comment period, multiple public meetings and additional public engagement were completed to solicit feedback on the EIS and Recommended Plan. All comments received during the comment period were incorporated into the final IFR/EIS and include a matrix with agency response to each substantial comment (*Appendix H: Public Involvement*).

An Integrated Feasibility Report and EIS (IFR/EIS) was prepared to provide the basis for a decision to recommend to Congress for authorization of the recommended plan as described in the Chief’s Report, which would include only the First Actions measures. The IFR/EIS provides a site-specific NEPA review of the First Actions measures and general overview of the impacts anticipated for the subsequent actions if the conditions, construction methodologies, timing, etc. that exist today continue to exist at the time of construction (50+ years in the future). The IFR/EIS includes disclosure of all direct, indirect, and cumulative effects to the human and natural environment. It documents the

ways that impacts have been avoided and minimized throughout feasibility because of design considerations, inclusion of conservation measures and BMPs, and agency and public input, so that these commitments are carried forward to the design phase. For unavoidable adverse impacts that require compensatory mitigation, the mitigation need was identified based on the best available information and resource agency coordination (*Appendix K: Mitigation*).

The IFR/EIS includes an analysis of both the First and Subsequent Actions even though only the First Actions are being recommended for authorization and funding. The purpose of including both actions was to present sufficient information regarding overall impacts of the subsequent actions so that decision-makers can make a reasoned judgment on the merits of the overall potential flood defense system being considered (e.g., “hard look requirement”) and make a reasoned choice among alternatives in consideration of potential adaptation in the future. This follows the NEPA guidance to consider connected actions or reasonably foreseeable actions even though the subsequent actions is expected to occur more than 50 years in the future. Since the authorization would not include a subsequent action, the ROD would only describe the first actions. Once the triggers for adaptation are reached, USACE will begin subsequent NEPA reviews of any proposed subsequent actions, which involves preparation of one or more additional NEPA documents (either an EIS or Environmental Assessment) prepared in accordance with ENPA regulations in place at that time, which would include providing for additional public review periods and resource agency coordination.

If during the design phase any project changes are found to be outside the scope of the recommended plan and the Chief’s Discretionary Authority, a re-review of the original decision and authority will need to be completed following USACE policies at the time the change is identified. If design changes induce impacts greater than those described in the final IFR/EIS, supplementation of the IFR/EIS may be required following the NEPA regulations at the time the change is identified, and a new ROD signed.

Sequencing Strategy

Step 1. Prepare Draft IFR-EIS – A draft IFR-EIS was prepared for public release. The draft IFR-EIS underwent district quality control and legal review before public release. The draft IFR-EIS was used as the vehicle to elicit comments from resource agencies, the public and stakeholders. Acknowledging that the impact analysis on a study scope of this size is constrained by budget, timing and available information and level of design, the impact analysis approach will be geared towards the most significant resources and issues, and towards that which is necessary to recommend a TSP. In the draft IFR/EIS, all reasonable alternatives were discussed at comparable levels of detail. The draft IFR/EIS included the array of alternatives with sufficient detail for USACE to be able to make a decision. The information included locations, direct, indirect, and cumulative impacts and benefits, and potential compliance issues.

- The draft IFR-EIS was released for a 60-day public and agency review to solicit input which will be used to inform the refinement of the TSP. Comments will also be used to better address information for resource agencies and identify all needed compliance for the TSP in the final IFR-EIS.

Step 2. Prepare Final IFR-EIS – Subsequent to the ADM, the PDT, specifically Engineering optimized the TSP to develop the Recommended Plan. USACE updated the IFR-EIS with details and refinements from optimization, as well as responded to and incorporated comments in order to finalize the final IFR-EIS. The final IFR-EIS presents sufficient information regarding overall impacts of the proposed action so that the decision-makers can make a reasoned judgment on the merits of the action at the present stage of planning or development.

- The detailed engineering information available at the conclusion of the final IFR-EIS was utilized for finalizing the Mitigation and Adaptive Management Plan(s).
- The draft Record of Decision (ROD) and final IFR-EIS will be published for a 30-day waiting period in which no comments will be accepted. The ROD language for a final IFR-EIS asserts that the USACE finds that the report adequately defends that the Recommended Plan, is engineeringly feasible, economically justified, and environmentally acceptable and approves it for construction. It also summarizes the major components of the plan, asserts that all efforts with existing information and commensurate to the level of design have been made to avoid, minimize or mitigate environmental consequences, and describes that a compensatory mitigation plan would address all unavoidable impacts.

Step 3. Sign the Chief's Report and ROD – The Chief of Engineers will sign the Chief's Report and submit the final IFR-EIS to Congress for Authorization. The ROD would be signed by the Assistance Secretary of the Army (Civil Works).

Step 4. Congress Authorizes the Project

Step 5. Congress Funds PED for First Actions – What gets funded by Congress will dictate the timing of and how many times subsequent steps occur. This begins the design phase. A review of the final IFR-EIS will be completed to ensure the First Actions and affected environment has not changed substantially from what was described and supplemental NEPA is not required. Additionally, as designs are developed, environmental compliance for any laws not secured during feasibility will be completed.

Step 6. Congress Funds Construction of First Actions.

Step 7. Begin Construction of First Actions – Any mitigation needs identified must be completed before the unavoidable impact can be realized.

Step 8. Operations and Maintenance of the Measure(s) and Long-term Monitoring of RSLC.

Step 9. RSLC Triggers Adaptive Actions – The need for the adaptive action is expected to be approximately 50 years after the First Actions was constructed, but the timing is uncertain and could be further in the future or sooner than 50 years.

Subsequent NEPA Review(s)

Step 10. Congress Funds Preparation of Project Adaptation Report for Subsequent Actions (assumes Federal involvement)

Step 10a. Scoping – Scoping, following the NEPA, Army and USACE regulations in effect at the time of completing this step, will be completed to seek public and agency feedback on the scope of the supplemental NEPA review and concerns that should be addressed beyond those not identified previously.

Step 10b. Release of Draft NEPA Document – Complete draft supplemental NEPA review using the appropriate level NEPA document to disclose the site-specific impacts and mitigation needs based on detailed design refinements.

- A public comment period will be held to seek feedback on the supplemental NEPA review.

Step 10c. Release of Final NEPA Document – Similar to Step 2, the supplemental NEPA review will incorporate any refinements made to the design since the draft NEPA document was released including addressing public and agency comments. Final compliance documentation, including all necessary permits and authorizations, must be secured and included with the final document.

Step 11. Congress Authorizes the Subsequent Actions

Step 12. Congress Funds PED for Subsequent Actions – Congress will dictate the timing of and how many times subsequent steps occur based on input from the Project Adaptation Report for Subsequent Actions (Step 10). This begins the design phase for subsequent actions.

Step 13. Congress Funds Construction of Subsequent Actions.

Step 14. Begin Construction of the Subsequent Actions – Any mitigation needs identified during the supplemental NEPA review(s) must be complete before the unavoidable impact can be realized.

Step 15. Operations and Maintenance of the Subsequent Actions

6.2 Clean Water Act

The Federal Water Pollution Control Act of 1972, as amended in 1977 via the Clean Water Act (CWA), authorizes the EPA to regulate activities resulting in a discharge of pollutants into waters of the U.S. This section discusses compliance requirements for water quality policies embodied in Sections 401 and 404 of the Federal Water Pollution Control Act.

The feasibility analysis for the SFWCFS was conducted using the formulation process for Civil Works projects to identify the TNBP. The TNBP reasonably maximizes net benefits in all four planning accounts (national and regional economics, environmental quality, and other social effects) compared to costs.

6.2.1 Compliance with the 404(b)(1) Guidelines (40 CFR 230)

The goal of the 404(b)(1) Guidelines is “to restore and maintain, the chemical, physical, and biological integrity of waters of the United States (waters of the US) through the control of discharges of dredged or fill material.” The regulations set forth in 40 CFR Part 230 are the substantive criteria issued by the US Environment Protection Agency (USEPA), used in evaluating discharges of dredged or fill material into waters of the US. The Guidelines provide regulations outlining measures to avoid, minimize and compensate for impacts.

Only one structural measure (wharf raise/rebuild) and three NNBFs (ecotone levees, marsh enhancements, coarse beach and living seawall) in the Recommended Plan include the discharge of dredged or fill material into waters of the U.S. All other measures were designed and would be constructed landward of the existing shoreline to avoid discharge of fill materials and impacts to waters of the U.S. The TNBP have been developed in accordance with the Guidelines.

For the wharf raise/rebuild measures old pier pilings (creosote covered wood or concrete and rebar) and decking (wood, concrete, and rebar) would be removed and replaced with new pilings (concrete) and decking (rebar, concrete, grates, etc.) that would facilitate a higher elevation wharf. There would be no increase in the footprint of the wharf and fewer piles would be necessary per square foot than currently exists resulting in a net decrease in bay fill and overall benefit from removal of old materials (e.g. creosote piles) that contribute to poor water quality and are toxic to marine life. Since the decking footprint would not change, it is anticipated that at a minimum the current light and temperature of the intertidal and subtidal habitat would remain the same. During PED, the designs will be refined to incorporate features that allow more light and air flow, where appropriate, than the current wharf allows, which would also be a long-term benefit to the marine environment.

For the ecotone levees, marsh enhancements, and coarse beach NNBFs, fill materials would primarily involve natural materials free of any contaminants or eco-friendly concrete that supports vegetative growth. Fill material would be placed between the MLLW and MHHW water line to achieve the target elevation that would support the desired community, such as tidal marsh or beach. Any existing fringe wetland or intertidal habitat would be filled with material and then restored. The length between loss and restoration is dependent on how long construction takes at the immediate site, type of plants used, and growing conditions, but is anticipated to reach pre-construction conditions or better within one to three growing seasons after a one-year period of construction or two to five years. At each of these NNBF locations, the purpose of the measure is to support the overall performance of the flood defense feature using natural processes. As a result, these features also provide habitat enhancements that result in a net increase in quantity and quality of intertidal, beach, and marsh habitats and overall benefit to the waters of the U.S. over the life of the project.

For the living seawall NNBF, the fill material (most likely concrete) would be placed directly onto the existing seawall by bolting on or building into the design of another feature (e.g. new seawall) to create surface complexity (for example, surface texture, grooves, crevices, and nooks) to traditionally smooth surfaces. The living seawall is a

relatively flat form of fill that would be placed from the bay bottom elevation to MHHW. This NNBF will increase habitat diversity to the intertidal and sub-tidal environments where only open water currently exists resulting in an overall net benefit.

One measure (pier demolition) will remove approximately 1.0 acre of fill previously placed in waters of the U.S. including historic piles, bay fill, and pier decking and allow the area to restore to higher quality open water and subtidal habitat.

There is no anticipated long-term loss of wetlands that would require compensatory mitigation. Approximately 9.0 acres of bay fill will require compensatory mitigation in the form of old and unused pier and piling removal. A compensatory mitigation plan was developed and will continue to be refined through the design phase as additional details become available (*Appendix K: Mitigation*).

The placement of any of these fill materials will not violate any applicable State or Federal water quality criteria or toxic effluent standards of Section 307 of the Clean Water Act. The proposed discharge will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values will not occur. For most measures, the aquatic ecosystem, recreation, and aesthetics would be enhanced over the existing condition.

The complete analysis, consistent with the 404(b)(1) guidelines, can be found in Annex D.4.1 (Clean Water Act Compliance). No significant adaptations of the guidelines were made with respect to the evaluation completed for this project.

6.2.2 Section 401 of the CWA

Section 401 of the CWA sets forth requirements and procedures for obtaining State water quality certification (WQC) for activities which result in any discharge into navigable waters. The USACE plans to seek State water quality certification for this project during the design phase when more details are available. Coordination has been ongoing with the Water Board in which they have identified impact analyses that need to be completed to meet their requirements for issuing a WQC. Some of these analyses include impervious surface analysis, a complete 404(b)(1), baywide modeling, and groundwater and discharge modeling. The Water Board has also identified several criteria that they will want to see to issue a WQC including mitigation for all unavoidable adverse impacts to aquatic habitats that replace the quality and quantity of habitat lost, incorporation of runoff and surface water management measures for all new or modified impervious surfaces, and water quality management features. The Water Board has provided a letter of confirmation committing to coordinating during PED to attain a WQC prior to construction (Annex D.4.2).

6.2.3 Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem (LEPDA Discussion)

Detailed documentation of the plan formulation process and alternatives analysis can be found in Chapter 3 of the main report and in Appendix A (Plan Formulation). As stated earlier in this Section, this feasibility analysis was conducted using the formulation process for Civil Works projects to identify the TNBP. The analysis was also performed on a regional basis to aid with the identification and comparison of project measures across the project area. The following section documents the analysis which resulted in the identification of the LEDPA.

The alternatives identified as the final array all performed well in terms of costs and benefits and meeting the study goals and objectives and the purpose and need. Each are considered practicable and reasonable. From these alternatives, the PDT determined that the LEDPA is Alternative B- Nonstructural Plan. This plan avoids any beneficial or adverse impacts to aquatic habitats and waters of the U.S. since there would be no in-water work. Alternative B was not selected for recommendation because while reasonable and practicable, there are life safety risks and disruptions to the daily use of the waterfront (e.g., impacts to the transportation system, movement of people and goods, availability of services, tourism, and recreational opportunities; ability of emergency services to render aid) from allowing floodwaters to enter the study area and defense happens on a structure by structure basis. The remaining three final array alternatives (TNBP, Alternative F, and Alternative G) all minimize life safety risks but each have varying levels of aquatic environmental impact.

The PDT reviewed the next least environmentally damaging plan, which was identified as the TNBP. The TNBP has the least amount of aquatic impacts of the plans that defend the waterfront from floodwaters and minimize life safety risks. This alternative avoids and minimizes aquatic impacts to the greatest extent possible by aligning the flood defenses landward of the existing shoreline. The TNBP has approximately 9 acres of unavoidable adverse impacts as described above; however, the other two practicable alternatives that minimize life safety risk each have greater unavoidable impacts. Additionally, the TNBP incorporates NNBFs into the designs which would improve the quality and increase the quantity of aquatic habitats in the study area over the long-term.

6.3 Clean Air Act of 1970

The Federal CAA of 1970 authorized the establishment of national health-based air quality standards and also set deadlines for their attainment. The Federal CAA Amendments of 1990 (1990 CAAA) made major changes in deadlines for attaining National Ambient Air Quality Standards (NAAQS) and in the actions required of areas of the nation that exceeded these standards. Under the CAA, state and local agencies in areas that exceed the NAAQS are required to develop State Implementation Plans (SIPs) to show how they will achieve the NAAQS for nonattainment criteria air pollutants by specific dates. SIPs are not single documents; rather, they are a compilation of new

and previously submitted plans, programs (such as monitoring, modeling, permitting, etc.), district rules, state regulations and Federal controls. The United States Environmental Protection Agency (USEPA) is responsible for enforcing the NAAQS primarily through reviewing SIPs that are prepared by each state.

Pursuant to CAA Section 176(c) requirements, USEPA promulgated the General Conformity Rule (GCR), which applies to most Federal actions, including the TNBP. The GCR is used to determine if Federal actions meet the requirements of the CAA and the applicable SIP by ensuring that pollutant emissions related to the action do not cause or contribute to new violations of a NAAQS, increase the frequency or severity of any existing violation of a NAAQS, or delay timely attainment of a NAAQS or interim emissions reduction.

The TNBP falls within San Francisco County, which has been designated as a nonattainment area for three NAAQS: 8-hour ozone (2008 standard), 8-hour ozone (2015 standard), and 24-hour fine particulate matter (PM2.5) (2006 standard). These designations vary in severity, with the classifications being “marginal” nonattainment for the 2008 and 2015 8-hour ozone standards, and moderate nonattainment for the 24-hour PM2.5 standard. Because the action is in a nonattainment area, general conformity applies to the project.

The quantitative and qualitative analyses for the first and subsequent actions of the TNBP indicate that construction emissions may not exceed the *de minimis* levels that currently apply to the action area indicating that as of now a GCD may not be necessary. However, given that construction would not begin until 2030 for the first actions and more than 50 years in the future for the subsequent actions, the information currently available to support the emissions analysis lacks the necessary precision to make a reliable and defensible conclusion with respect to CAA consistency. As a result, compliance with the CAA has been delayed until PED, when a comprehensive emissions analysis will be conducted with more accurate information and data are available to define expected construction activities and project conditions. Based on the results of that analysis, a GCD may be required to satisfy general conformity at that time. In any case, it is reasonable to assume that compliance with the CAA is achievable with minimal to no mitigation needs.

6.4 National Historic Preservation Act of 1966

Compliance with the National Historic Preservation Act of 1966, as amended (54 U.S.C. § 306108), requires the consideration of effects of the undertaking on all historic properties in the project area and development of mitigation measures for those adversely affected properties in coordination with the State Historic Preservation Officer (SHPO), Tribal Nations, and the Advisory Council on Historic Preservation (ACHP). It has been determined that there is a potential for new construction, improvements to existing facilities, and maintenance of existing facilities to cause effects to historic properties. Therefore, in accordance with 36 CFR 800.14, the USACE has developed a Programmatic Agreement among the USACE and the California SHPO to address the identification and discovery of cultural resources that may occur during the construction and maintenance of proposed or existing facilities (Sub-Appendix D.3). The USACE

also invited the ACHP and Tribal Nations to participate as signatories to the Programmatic Agreement. It is anticipated that the PA will be executed by finalization of the IFR/EIS.

6.5 Endangered Species Act

The ESA, as amended, establishes a national policy designed to protect and conserve threatened and endangered species and the ecosystems upon which they depend (16 U.S.C. 1531–1543). The ESA is administered by the Department of the Interior, through the USFWS, which oversees protection of non-marine species or marine species when not in the marine environment, and by the Department of Commerce, through the NMFS, which oversees marine species in the marine environment, collectively referred to as the Services. The ESA ensures that Federal agencies and departments use their authorities to protect and conserve endangered and threatened species. Section 7 of ESA requires Federal agencies prevent or modify any projects authorized, funded, or carried out by the agencies that are "likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of critical habitat of such species."

The procedures for Section 7 consultation are defined in regulations issued by the Services (50 CFR Part 402). A draft BA is prepared to analyze the potential impact(s) a measure(s) would have on listed species and critical habitat. If the analysis determines that all effects of the measure or action are insignificant (i.e., so small they cannot be meaningfully measured, detected, or evaluated), discountable (i.e., extremely unlikely to occur), or wholly beneficial (positive effects with no associated negative effects), a may affect but is not likely to adversely affect (NLAA) determination can be made and informal consultation can be initiated. If the action is reasonably expected to result in measurable adverse effects, then a "likely to adversely affect" (LAA) determination is made for the affected species and formal consultation is initiated.

For USFWS managed species, the Recommended Plan is NLAA six listed species due to their proximity to construction activities, but with their presence outside the construction footprint. The remaining species were found to be outside the known range or no suitable habitat exists and therefore there would be no effect to those species. Informal consultation with the USFWS was initiated on 8 July 2025 with submission of the BA (Annex D.6.1). USFWS agreed with the USACE determinations and provided a concurrence letter on 24 September 2025.

For NMFS managed species, the nature of the work required in and near the water is expected to have adverse effects on listed species leading to a LAA determination. A request for technical assistance was submitted to NMFS with transmittal of the BA and EFH assessment on 15 July 2025. NMFS requested this process to provide initial review and update to the BA and EFH assessment prior to initiating formal consultation in a meeting between USACE and USFWS on 1 July 2025. NMFS responded to USACE's request for technical assistance on 12 December 2025 with recommendations for consideration as conservation measures for the assessment. Additionally, NMFS indicated they would produce a Condensed Biological Opinion (CBO), which is a streamlined approach that allows NMFS to adopt significant portions of the initiation

package directly into the CBO, reducing drafting time and focusing efforts on the analysis of effects and conservation measures. Providing a CBO allows NMFS to meet their statutory requirement under the ESA. Formal consultation was requested on 29 December 2025. NMFS responded to USACE's request on 12 January 2026 with recommendations to change the effects determinations for all listed species to LAA, including Central Valley Spring-run Chinook salmon, California Central Valley Steelhead, and Central California Coast Steelhead; update the determination for critical habitat to LAA; and make an official "may adversely affect" determination for EFH. The USACE agreed to these recommendations on 14 January 2026. Accordingly, the effects determination in the EFH/BA in Annex D.6.2 were amended. NMFS responded that the BA was complete and consultation was initiated on 13 January 2026. A CBO was received on 8 July 2026. The CBO included an Incidental Take Statement (ITS) in accordance with ESA Section 7(b)(4) and section 7(o)(2) for Central Valley spring-run Chinook salmon, California Central Valley steelhead, Central California Coast steelhead, and Sacramento River winter-run Chinook salmon. To minimize incidental take, NMFS provided four reasonable and prudent measures, as well as terms and conditions to be followed during project implementation. The CBO is included in Annex D.6.4.

Even with concurrence letters and BOs, Section 7 consultation may need to be reinitiated if the project changes or a new species or critical habitat is designated that could be affected by the action. During the design or construction phase, the Recommended Plan First Actions measures may need to be modified depending on any unforeseen changes to the designs. On actions of this scale, some alterations in the design and construction phases are expected and normal. Each change to the action would be reviewed against the most recent consultation compliance document to confirm the change does not rise beyond the level and/or type of effects that that were previously considered in the consultation. If species or critical habitat are designated after the most recent consultation, the USACE must demonstrate how the action would affect the species or critical habitat. If changes are greater than previously described or a new species or critical habitat is designated, the USACE would request reinitiation of Section 7 consultation. Whether the consultation is formal or informal will depend on the original consultation method and the extent of change in impacts. After consultation is initiated, the process described above for informal and formal consultation would be followed depending on the consultation type requested.

6.6 Migratory Bird Treaty Act and Migratory Bird Conservation Act and Executive Order 13186

The MBTA of 1918 (as amended) extends Federal protection to migratory bird species; among other activities non-regulated "take" of migratory birds is prohibited under this MBTA in a manner similar to the ESA prohibition of "take" of threatened and endangered species. Additionally, EO 13186 "Responsibility of Federal Agencies to Protect Migratory Birds" requires Federal activities to assess and consider potential effects of their actions on migratory birds (including, but not limited to, cranes, ducks, geese, shorebirds, hawks, and songbirds).

The effect of the Recommended Plan on migratory bird species has been assessed. Impacts to migratory birds are expected to be temporary and limited to migratory bird species near the immediate construction area. Minimal nesting trees are present in the project area; however, the trees that are present may be removed during construction and would remove nesting locations over the long-term. Any trees removed would be replaced after construction, however, the planted trees will not be mature enough for several years, thus creating a long-term impact. All tree removal will be completed outside the nesting season where possible and if not a survey of the tree will be completed to ensure no active nests are present before removal. For migratory birds more sensitive to disturbances, in particular those in wetland environments at Heron's Head or Pier 94, construction noise may disrupt their foraging and nesting ability forcing them to avoid the area until construction is complete. For migratory birds used to the noise and disturbance of an urbanized environment, individuals may temporarily avoid the area until they become familiar or used to the disturbance, at which time it is expected they would resume pre-construction behaviors and use of the area.

Over the long-term, new flood defenses should not create impediments to migratory bird movements or result in increases in bird strikes. City-required bird-safe building design standards would be implemented for any required lighting, building modifications, or structure raising measures, as appropriate. Migratory birds would benefit from the NNBF measures by protecting and creating foraging, nesting, and roosting habitat. Improved coastal resiliency is expected to improve bird habitat and increase productivity in the project area.

Compliance with the MBTA and EO 13186 are complete and at this time, no compensatory mitigation is anticipated; however, coordination with USFWS on migratory birds will continue into the design phase for the First Actions to aid in refinement of designs to avoid and minimize the potential for bird-strikes, loss of nesting, roosting or foraging habitat, or construction disturbance. Designs may also be refined to protect, restore, or create foraging, nesting, and roosting habitat.

6.7 Fish and Wildlife Coordination Act of 1958

The Fish and Wildlife Coordination Act (FWCA) provides for consultation with the USFWS, NMFS and, in California, with California Department of Fish and Wildlife (CDFW) whenever the waters or channel of a body of water are modified by a department or agency of the United States. The intent of this consultation is to help prevent the loss of and damage to wildlife resources from water development projects.

From the start of the study, multiple coordination meetings were held with the Services. For USFWS, their main concerns centered around any work or impacts that could occur within existing marsh lands near Pier 94 or at Heron's Head and indicated where possible, these areas should be avoided, or mitigation and conservation measures may be necessary. No structural features are proposed for construction in existing marsh areas for the first or subsequent actions. As part of the subsequent action, open water areas and degraded marsh would be improved or restored to function as a Natural and Nature-Based feature to aid in the performance of the flood defense system within this

reach. USFWS did not have other concerns due to the urbanized nature of San Francisco shoreline.

The NMFS had multiple recommendations in support of plan formulation and measure identification. They recommended wherever possible to avoid bay fill and in-water work. They also strongly encouraged incorporating NNBFs where possible in lieu of “gray” or engineered infrastructure that could also support enhancement opportunities for habitat diversity and conservation of trust species.

The agency recommended if USACE was going to consider tide gates, a thorough analysis of how the structure would operate and affect water quality and dissolved oxygen levels would be necessary. Additionally, the designs and operation of a structure should consider balancing fish passage, water quality, and the need for flood management.

The NMFS also identified a number of trust resources that should be considered when designing and analyzing the project including but not limited to: Chinook and Pacific salmon, Pacific herring, Pacific coast groundfish, and coastal pelagic species; marine mammals such as sea lions, harbor seals, harbor porpoises, and the occasional gray whale or humpback whale; and habitats including open water, wetlands, eelgrass, and shallow bay bottoms. Some of the analyses and conservation measures they would like to see to support any alternative and consultation include:

Analyses:

- Effects of any overwater structures for the life of the structure (e.g. seawalls, bulkheads, tide gates, etc.) including light penetration, current/wave motion, temperature changes, changes in bay bottom bathymetry, impediments to movement, etc.
- Effects of construction activities on aquatic species, marine mammals, and water quality including those from pile driving, dewatering, cofferdam construction, placement or removal of fill material, in-water work, etc.
- Effects of hardened shoreline (replacement or addition of seawalls) on the overall Bay function and quality of habitat for fisheries over the life of the structure.

Conservation Measures:

- Incorporate construction materials that facilitate light penetration for any overwater structures.
- Incorporate living seawalls or materials and designs that facilitate fish habitat (e.g. promote growth of aquatic vegetation, provides cover or forage areas).
- Remove contaminated creosote piling and replace with eco-friendly concrete or other materials.
- Consider seasonal timing restrictions for in-water work and pile driving.
- Integrate NNBFs where possible.

A Coordination Act Report (CAR) was received from USFWS on 27 August 2025 (Sub-Appendix D.7). USFWS supports implementation of the project assuming the USACE maximizes reasonable inclusion of EWNs wherever possible and further development and refinement of the compensatory mitigation plan occurs to offset the effect of bay fill. USFWS recommended the USACE conduct additional coordination with State and Federal resource agencies to evaluate the need, amount, and location(s) of any pier or pile removals to offset the effect of bay fill as part of the refinement of the compensatory mitigation plan during PED. The Services agreed with the modelling approach and draft mitigation plan, but assert insufficient details were available to fully evaluate the offset. The USACE acknowledges this lack of detail and commits to refine the compensatory mitigation plan in PED when design details become available, as well as to working with Federal and State agencies on this effort.

6.8 Marine Mammal Protection Act of 1972

The Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 et seq.) established a national policy to prevent marine mammal species and population stocks from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part. The Marine Mammal Protection Act prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. In the Marine Mammal Protection Act, “take” is defined “as harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect.” The Department of Commerce, through the NMFS, is charged with protecting species that are known to occur in the San Francisco Bay such as whales, dolphins, and porpoises. Manatees are protected by the Department of the Interior through the USFWS. The Animal and Plant Health Inspection Service, a part of the Department of Agriculture, is responsible for regulations managing marine mammals in captivity.

Under the law, responsible parties conducting any activities that would result in the incidental take of marine mammals are required to have an Incidental Take Authorization, in the form of an Incidental Harassment Authorization (IHA) or Letter of Authorization (LOA) issued by the NMFS. Incidental Take Authorization applications must include detailed information regarding each discreet project activity, projected environmental impact, potentially affected marine mammal populations, mitigation of negative impacts, and a comprehensive monitoring and reporting plan. Additionally, the IHAs are generally only valid for a maximum of 5 years.

It is expected that construction activities related to pile driving and in water work may result in the incidental take of marine mammals, as defined under the Marine Mammal Protection Act. The anticipated impacts include harassment, serious injury or mortality of marine mammals and would require a LOA to be issued. However, the design and construction details required to submit an application are unavailable during feasibility and must be delayed until the design phase. Additionally, construction is not anticipated to occur within the 5-year time limit even if a LOA could be issued now and would need to be reapplied for at the time of construction.

Coordination with NMFS has continued to occur between draft report release and the final report. Coordination will help to identify additional impacts and avoidance and minimization measures that can be built into the designs and construction methodologies and better understand potential compensatory mitigation needs.

A memorandum from HQUSACE was provided for the study approving delaying coordination under MMPA until PED (Sub-Appendix D.8).

6.9 Magnuson Stevens Fishery Conservation and Management Act

The MSFCMA (PL 94-265), as amended, provides for the conservation and management of the Nation's fishery resources through the preparation and implementation of Fishery Management Plans (FMPs) (16 U.S.C. 1801 et seq.). The MSFCMA calls for NOAA fisheries to work with regional Fishery Management Councils to develop FMPs for each fishery under their jurisdiction. The study area is within or near EFH designated habitats and could impact federally-managed species, as documented in section 3.11.2.6.

One of the required provisions of FMP specifies that essential fish habitat (EFH) be identified and described for the fishery, adverse fishing impacts on EFH be minimized to the extent practicable, and other actions to conserve and enhance EFH be identified. The MSFCMA also mandates that NMFS coordinate with and provide information to Federal agencies to further the conservation and enhancement of EFH. Federal agencies must consult with NMFS on any action that may adversely affect EFH. When NMFS finds that a Federal or State action would adversely affect EFH, it is required to provide conservation recommendations.

The USACE prepared a draft joint BA and EFH assessment to document the potential effects of implementing the Recommended Plan on EFH and Federally-managed fish species and their habitat (Annex D.6.2). The assessment concludes that Recommended Plan measures involving in-water work or bay fill would have temporary and long-term adverse direct and indirect impacts to EFH in the action area through the loss of habitat and changes in habitat quality. A request for technical assistance was submitted to NMFS with transmittal of the BA and EFH assessment on 15 July 2025. NMFS requested this process to provide initial review and update to the EFH assessment prior to initiating formal consultation in a meeting between USACE and USFWS on 1 July 2025. NMFS responded to USACE's request for technical assistance on 12 December 2025 with recommendations for consideration as conservation measures for the assessment. Consultations under the MSFCMA was initiated on 13 January 2026. EFH concurrence was provided on 8 July 2026. NMFS provided four conservation recommendations to avoid, minimize, or mitigate adverse effects to EFH:

- To minimize the adverse effects of hydroacoustic noise, shading, vessel scour, and physical habitat disturbance and alterations to EFH, the Corps should implement all terms and conditions associated with Reasonable and Prudent Measures 3 and 4 in the ITS of the preceding ESA BO.
- To further reduce the adverse effects of shoreline armoring on EFH and to enhance the ecological value of the estuarine corridor, the Corps should

maximize the implementation of living seawalls and other structurally complex, natured-based features throughout the project footprint. The Corps should evaluate all planned conventional seawall and bulkhead replacements and incorporate textured surfaces, intertidal rocky benches, or similar features beyond the baseline 27 acres of proposed EWN integration wherever engineering and flood risk management constraints allow.

- Incorporate setbacks on the order of 50 feet (approximately 15 meters) to 165 feet (approximately 50 meters) from eelgrass habitat where practical to allow for greater circulation and reduced impact from boat maneuvering, grounding, and propeller damage, and to address shading impacts. Any overwater structure construction – including in-kind replacement – that occurs within 65 feet (approximately 20 meters) of eelgrass (survey mapping buffer) should be required to follow the monitoring and mitigation requirements outlined in the California Eelgrass Mitigation Policy.
- To minimize the loss of biologically highly productive benthic invertebrate communities, the Corps should protect native Olympia oysters (*Ostrea lurida*) established on existing hard substrates slated for removal or burial. The Corps should implement the following protocols:
    a. Pre-Construction Surveys: A qualified marine biologist should conduct a targeted survey for native oysters on all seawalls, pilings, and riprap within the project footprint no more than 60 days prior to construction.
    b. Salvage and Relocation Plan: If native oysters are identified, the Corps should develop and implement an Oyster Relocation Plan submitted for NMFS review. To the maximum extent practicable, existing colonized substrates (e.g., loose riprap or manageable debris) should be carefully extracted and relocated to adjacent, ecologically suitable subtidal or low intertidal habitats. Relocation sites must be strictly confined to elevation at or below 0 ft mean lower low water (MLLW) (targeting -2.0 to -3.0 feet MLLW) to prevent settlement and competitive overgrowth by the invasive Pacific oyster (*Magallana gigas)*. Relocation sites must also avoid highly depositional mudflats to prevent lethal sedimentation overburden.
    c. Habitat Enhancement: Ensure that an applicable portion the 27 acres of EWN features (e.g., textured seawall panels and intertidal rocky benches) are specifically designed and placed strictly at or below the 0-ft MLLW tidal elevation to optimally recruit and support the re-establishment of native oyster populations while excluding non-native competitors.

In accordance with section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation Management Act, the USACE responded to NMFS on 20 July 2026 and agreed to implement all four EFH conservation recommendations.

Coordination with NMFS to date and their suggestions and concerns are documented in Section 6.7 of this sub-appendix. The EFH Concurrence letter and USACE response is included in Annex D.6.4.

6.10 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972, as amended, (16 U.S.C. § 1451 et seq.) provides for the management of the nation's coastal resources. The Act is administered by NOAA; however, regulating authorities have been delegated to the State of California. Due to the unique nature and needs of the San Francisco Bay, the State of California created the San Francisco Bay Conservation and Development Commission (BCDC) to regulate the CZMA in the San Francisco Bay Region. The BCDC developed a Coastal Zone Management Plan, the San Francisco Bay Plan to guide the protection and use of the bay and its shoreline. The Bay Plan provides policy direction for BCDC's permit authority regarding the placement of fill, extraction of materials, determining substantial changes in use of land, water, or structures within its jurisdiction, protection of the bay habitat and shoreline, and maximizing public access to the bay. The Study area is part of the Bay Plan Maps 4 and 5 identified as Central Bay North and Central Bay, respectively. The maps identify several Port Priority Use Areas at China Basin (Piers 48 and 50), Central Basin (Pier 68), and surrounding the Islais Creek Channel (Piers 80, 90, 92, 94, and 96).

Part IV of the Bay Plan contains findings and policies that pertain to development of the bay and shoreline. These findings and policies address the many facets that comprise the uses, needs, and design issues associated with balancing the environmental, ecological, economic, recreational and social objectives of development within or along the shoreline of the bay. They include: (1) Safety of Fills; (2) Protection of the Shoreline; (3) Dredging; (4) Water-Related Industry; (5) Ports; (6) Airports; (7) Transportation; (8) Commercial Fishing; (9) Recreation (including Marinas); (10) Public Access; (11) Appearance, Design and Scenic Views; (12) Salt Ponds and Other Managed Wetlands; and (13) Other Uses. All of these policies are applicable to the study except airports, salt ponds and other managed wetlands.

In addition to the Bay Plan, the BCDC developed and adopted the San Francisco Waterfront Special Area Plan (SAP) and the San Francisco Bay Seaport Plan. The SAP and Seaport Plan set forth specific policies for uses, fill, public access, and design for piers and shoreline areas between Hyde Street Pier in Fisherman's Wharf to India Basin, including all Port piers and pile-supported facilities. The Seaport Plan specifically sets policies for areas determined to be necessary for future port development and are designated as port priority use areas. These areas are reserved for port-related and other uses that will not impede development of the sites for port purposes. Both plans include general policies that apply to all areas covered by the Study, as well as geographic- or site-specific policies.

Under these regulations, USACE is responsible for managing its projects within the coastal zone jurisdiction in a manner that is consistent, to the maximum extent practicable, with the Bay Plan, Seaport Plan, and Special Area Management Plan. Overall, the Recommended Plan has been developed to avoid and minimize adverse impacts to aquatic resources, water quality, recreation, and public access, to the greatest extent practicable while improving the future conditions under climate change to preserve the current and future uses of the entire waterfront. Unavoidable adverse impacts are anticipated for transportation, bay fill, air quality, and water quality. For each

of these resources, mitigation has been incorporated into the plan to minimize the impacts, and where not possible, to compensatory mitigation has been incorporated, as is the case for the bay fill.

The BCDC, pursuant to the CZMA and the implementing Federal Regulations in 15 CFR Part 930, is required to review Federal projects within San Francisco Bay and agree or disagree with the Federal agency's determination that the project is consistent with the Commission's Amended Coastal Zone Management Program for San Francisco Bay. It is anticipated that the Recommended Plan will be consistent with the policies set forth in the Bay Plan, SAP, and Seaport Plan based on the consistency determination developed using the feasibility level design (Annex D.5.1). Coordination with the BCDC has continued since release of the draft IFR/EIS. The BCDC has indicated the project design details in the IFR/EIS are not sufficient to support a formal review and issuance of consistency during feasibility. As such, BCDC provided a letter of support committing to working with the USACE to meet the requirements of CZMA during the design phase as project designs are refined (Annex D.5.2). It is likely the project will undergo a phased consistency determination process, whereby phases of the project will reach consistency as design and construction advances.

6.11 Bald and Golden Eagle Act of 1940

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, as amended, prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” bald eagles, including their parts, nests, or eggs. The Act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.” Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Populations of bald and golden eagles are found in the less urbanized areas of San Francisco Bay and coastal range. While individual eagles may migrate through the area, the project area does not support nesting habitat for eagles as it generally lacks large mature trees. If nesting were to occur, the nest would need to be placed on man-made structures which would present its own set of challenges to survival, although not unheard of in other parts of the county. The chance of this occurring is relatively low since more suitable nesting habitat is available throughout the Bay or in more vegetated areas of the City. Following the MBTA protocols, surveys of trees would be completed prior to removal to ensure no active nests are present. During construction, increased noise may cause individuals to steer clear of the shoreline, roost in a different area or fly a different path. Construction and long-term operation of the Recommended Plan is not expected to cause adverse impacts that would rise to the level of take.

6.12 Rivers and Harbors Act of 1899

Section 10 of the Rivers and Harbors Act (33 U.S.C. § 403) prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. This section provides that

the construction of any structure in or over any navigable water of the U.S., or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army.

San Francisco Bay and the associated docks and shoreline in the project area are considered navigable waters of the U.S. Since the Recommended Plan involves bay fill, wharf raise/rebuild, pier demolition, and other permanent obstructions, this Act is applicable to the study. During plan formulation, maintaining navigability and maritime function was considered a constraint and as a result of the measures that were developed and being considered support a flood defense system that is largely landward of the existing shoreline and maintains the existing wharfs and piers in their current location and footprint even though they are being raised to a higher elevation. Approximately 9 acres of bay fill is necessary to accommodate one location of wharf rebuilding and construction of a coarse beach, in which both locations would not support any maritime function and would not be an obstruction to the movement of vessels.

The proposed action is subject to public notice and other evaluations normally conducted for activities subject to the Act. The Recommended Plan is compliant with the Act.

6.13 Federal Aviation Administration – Hazardous Wildlife Attractants on or Near Airports

In accordance with FAA AC 150/5200-33C and the Memorandum of Agreement among the FAA, the USACE, and other Federal agencies (July 2003), the Recommended Plan was evaluated to determine if proposed land uses could increase wildlife hazards to aircraft using public use airports in the study area. The nearest airport (San Francisco International Airport [SFO]) is approximately 8.0 miles south of the project area in San Mateo County. The infrastructure associated with the project is not expected to attract wildlife; however, the NNBF measures could have the potential to attract birds and increase the incidence of wildlife strikes. Since the NNBF would be implemented greater than five miles from the airport, the circular assumes there would be no impact from the project on the potential from bird strikes during approach, departure, or circling airspace. As a result, a wildlife hazard assessment and associated consultation is not necessary.

6.14 Executive Order 11988, Floodplain Management

EO 11988 requires Federal agencies avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities."

The Water Resources Council Floodplain Management Guidelines for implementation of EO 11988, as referenced in USACE ER 1165-2-26, requires an eight-step process that agencies should carry out as part of their decision making on projects that have potential impacts to, or are within the floodplain. The eight steps and project-specific responses to them are summarized below.

Step 1: Determine if a proposed action is in the base floodplain (that area which has a one percent or greater chance of flooding in any given year).

> The proposed action is within the base floodplain. The base floodplain is at the immediate shoreline in reaches 1, 2, and most of 3 due to existing sea walls, floodwalls, levees and berms and all areas landward of these features are outside the base floodplain. In reach 4, the base floodplain goes further inland but is still retained within the industrial properties directly connected to the shoreline. The project is designed to reduce damages to existing infrastructure located landward of the proposed project.

Step 2: If the action is in the base floodplain, identify and evaluate practicable alternatives to the action or to location of the action in the base flood plain. Section 5 of this document presents an analysis of potential alternatives.

> Practicable measures and alternatives were formulated and evaluated against the USACE guidance, including nonstructural measures such as retreat, demolition and land acquisition.

Step 3: If the action must be in the floodplain, advise the general public in the affected area and obtain their views and comments.

> There has been extensive coordination with pertinent Federal, State and local agencies, as well as the public. Two public commenting periods have already been completed on the study and included multiple public meetings, outreach events, and published media. See Appendix H for a complete description of public engagement completed to date. Once the draft report is released, public meetings will be scheduled in the study area during the public review period for additional coordination. During PED, the NFS intends to host a number of additional public engagement sessions to inform the public of the plans.

Step 4: Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial flood plain values. Where actions proposed to be located outside the base flood plain will affect the base flood plain, impacts resulting from these actions should also be identified.

> Currently, the San Francisco shoreline in reaches 1, 2 and partially in 3 do not currently contain any floodplain characteristics as the urbanized environment is built up to the existing wall and even extends onto wharves and piers. The area generally lacks any trees or vegetation that could function as a floodplain bench. In reach 3 and 4, areas with floodplain characteristics are present, albeit it many areas are altered by the presence of levees, berms, and constructed infrastructure already constructed. TNBP measures in these areas were designed to align with existing levees and berms or along existing property boundaries where the floodplain has already been altered and avoids intrusion

into areas that support natural floodplain characteristics such as at Pier 94 or Heron's Head. NNBF, such as eco-armoring will be added to the berms in these areas or restoration of wetlands, will be incorporated to facilitate a more natural functioning floodplain while also reducing the flood risk. The project would not alter or impact the natural or beneficial flood plain values and would enhance it where NNBF are incorporated.

Step 5: If the action is likely to induce development in the base flood plain, determine if a practicable non-flood plain alternative for the development exists.

The project enhances the function of the existing shoreline features to address risk as RSLC occurs over the long period of analysis and is not likely to induce development. The study area is already densely developed, and any additional development would likely be redevelopment of an existing area. Areas that might develop in response to growing workforce needs might expand southward and replace industrial areas if the need arises (as of now that is not believed to be the case and was not considered as part of the costs or benefits of the project, but could occur in the future decades). The developments would be required to comply with already stringent building standards that are currently in place or under revision by the City of San Francisco.

Step 6: As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impacts of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial flood plain values. This should include reevaluation of the "no-action" alternative.

There is no mitigation to be expected for the Selected Plan. The project would not induce development in the flood plain and the project will not impact the natural or beneficial floodplain values. Chapter 3 of the main report and Appendix A (Plan Formulation) provide significant detail alternative identification, screening and the selection process. The "no action" alternative was included in the plan formulation phase.

Step 7: If the final determination is made that no practicable alternative exists to locating the action in the flood plain, advise the general public in the affected area of the findings.

The draft IFR/EIS was provided for public review and a public hearing was scheduled during the public review period. Each comment received was addressed and, if appropriate, incorporated into the Final Report. A record of all comments received is included in *Appendix H: Public Involvement*.

Step 8: Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the EO.

The Recommended Plan is the most responsive to all of the study objectives and the most consistent with the EO.

6.15 Executive Order 11990, Protection of Wetlands

The purpose of EO 11990 is to “minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.” To meet these objectives, this EO requires Federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The EO applies to:

- Acquisition, management, and disposition of Federal lands and facilities construction and improvement projects which are undertaken, financed or assisted by Federal agencies; and
- Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

EO 11990 applies to this study. All practicable measures have been taken to avoid and minimize the loss of wetlands and further enhance existing wetlands through the implementation of NNBFs. No work would be completed within any wetland area for the structural flood defenses. Construction of berms and seismic ground improvements would occur near but outside the wetlands. BMPs would be incorporated to prevent movement of sediment into the wetlands from the construction site and no surface waters would be diverted from or into wetlands that were not there prior to construction. Additionally, there would be stipulations that no staging areas, access roads, construction footprints would be sited in the wetlands. As a result, there would be no direct or indirect loss of wetlands.

Incorporation of NNBFs at Pier 94 during the subsequent actions would result in a net gain in overall quality and quantity of wetlands in the project area. The NNBF are primarily intended to restore open water to wetlands and improve degraded wetlands at that time. During construction, there may be some inadvertent direct or indirect impacts to existing wetlands. Vegetation may be trampled, smothered, or temporarily degraded due to turbidity as a result of placing material to achieve the target platform grade or from movement of equipment and personnel. It is expected that any wetlands present that could be impacted would be already significantly degraded due to RSLC and natural conditions and may be temporarily lost until the restored vegetation reaches maturity and the wetland becomes fully functioning at which time the quality and quantity would be much higher than the pre-construction condition.

Additionally, fringe wetlands may be present along the NNBF berm construction footprint and, similar to the NNBF wetlands, existing wetlands may be temporarily lost while the berm is constructed. Fringe wetlands would be replaced as part of the NNBF berm design and the wetland loss would be considered temporary and the quality and quantity of fringe wetlands are expected to be much higher than the pre-construction conditions.

Based on current designs, there is no net loss of wetlands and therefore no compensatory mitigation is necessary. The Recommended Plan is compliant with EO 11990.

6.16 Executive Order 13112, Invasive Species

EO 13112 addresses the prevention of the introduction of invasive species and provides for their control and minimization of the economic, ecological, and human health impacts the invasive species causes. It establishes the Invasive Species Council, which is responsible for the preparation and issuance of the National Invasive Species Management Plan, which details and recommends performance-oriented goals and objectives and specific measures of success for Federal agencies. BMPs would be employed during construction activities to prevent the spread and introduction of invasive and non-native species. NNBF features of the Recommended Plan would help offset some habitat loss as a result of invasive species by restoring native habitats. The recommended plan is in compliance with EO 13112.

6.17 Executive Order 13045, Protection of Children

EO 13045 directs Federal agencies to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. Examples of risks to children include increased traffic volumes and industrial or production-oriented activities that would generate substances or pollutants that children may come into contact with or ingest.

The project area is regularly visited by adults and children alike, particularly in reaches 1, 2 and 3; however, no children live in the project area. Construction activities would temporarily disrupt the area through the temporary loss of access and recreation and increased noise and traffic. This impact would be experienced equally by anyone who visits the area. Post-construction, access would be restored, and pre-construction conditions would resume. Over the long-term, the flood defenses would minimize the risk of flooding and therefore also minimize the risk to anyone who visits the waterfront.

This report has evaluated the potential for the Recommended Plan to increase risks to children, and it has been determined that children visiting the project areas would not disproportionately experience any adverse effects from the proposed project.

7.0 References

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.1.1
AIR QUALITY AND GREENHOUSE GAS ANALYSIS

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Acronyms and Abbreviations

Acronym	Definition
ACMs	asbestos-containing materials
AMM	avoidance, minimization, and mitigation
BAAQMD	Bay Area Air Quality Management District
CAA	Clean Air Act
CAAQS	California ambient air quality standards
CARB	California Air Resources Board
CFR	Code of Federal Regulations
CH_4	methane
City	City and County of San Francisco
CO	carbon monoxide
CO2	Carbon dioxide
EIS	environmental impact statement
EO	executive order
EPA	U.S. Environmental Protection Agency
Foundation	Bay Area Clean Air Foundation
g/gal	grams per gallon
GCR	General Conformity Rule
GHG	greenhouse gas
HAP	hazardous air pollutant
HTRW	Hazardous, Toxic, and Radioactive Waste
I-280	Interstate 280

kg	kilograms
kg/gal	kilograms per gallon
mph	miles per hour
N_2O_2	nitrous oxide
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
O_3	ozone
Pb	lead
PM	particulate matter
PM10	particulates 10 microns in diameter or less
PM2.5	particulates 2.5 microns in diameter or less
Ppb	parts per billion
Ppm	Parts per million
ROG	reactive organic gas
SFBAAB	San Francisco Bay Area Air Basin
SIP	State Implementation Plan
SO_2	sulfur dioxide
State	State of California
TNBP	Total Net Benefits Plan
$\mu g/m^3$	micrograms per cubic meter
USACE	U.S. Army Corps of Engineers

VOC	volatile organic compound

1.0 Introduction

This section describes the affected environment for air quality and greenhouse gases (GHGs) and analyzes effects that could occur due to construction of the alternatives. The alternatives would result in temporary changes to air quality and GHG emissions through short-term construction activities. Although mitigation is available to avoid significant permanent impacts on global GHGs, implementation of the alternatives may result in significant and unavoidable impacts on localized air quality. Construction emissions and mitigation measures are discussed in Section 2.3.3.1 and Section 2.3.4, respectively.

2.0 Affected Environment

This section summarizes the federal, State of California (State), regional, and local regulations related to air quality and GHG emissions applicable to the alternatives. Relevant regulatory agencies include the U.S. Environmental Protection Agency (EPA), California Air Resources Board (CARB), and Bay Area Air Quality Management District (BAAQMD).

2.1 Regulatory Framework

2.1.1 Federal Regulations

2.1.1.1 Clean Air Act and General Conformity Rule

The EPA and CARB regulate and measure air quality through the Clean Air Act (CAA) and national ambient air quality standards (NAAQS), and California CAA and California ambient air quality standards (CAAQS), respectively. The NAAQS, presented in **Table D.1.1-1**, serve as benchmarks for maintaining air quality. Under the CAA, State and local agencies in areas that exceed the NAAQS are required to develop State Implementation Plans (SIPs) to show how they will achieve the NAAQS for non-attainment criteria air pollutants by specific dates. SIPs are not single documents; rather, they are a compilation of new and previously submitted plans, programs (e.g., monitoring, modeling, permitting programs), district rules, State regulations, and federal controls.

To support compliance with the CAA and attainment of the NAAQS, the EPA established the General Conformity Rule (GCR) under CAA Section 176(c). The GCR is a critical tool that assess whether federal actions, including various alternatives, meet the requirements outlined in the CAA and SIP.

Table D.1.1-1: National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Average Time	National Primary Standard	Violation Criteria
				National
CO	primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	

Pollutant	Primary/ Secondary	Average Time	National Primary Standard	Violation Criteria
				National
Pb	primary and secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
NO_2	primary	1 hour	100 ppb	The 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	primary and secondary	1 year	53 ppb	Annual mean
O_3	primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
$PM_{2.5}$	primary	1 year	9.0 µg/m^3	Annual mean, averaged over 3 years
	secondary	1 year	15.0 µg/m^3	Annual mean, averaged over 3 years
	primary and secondary	24 hours	35 µg/m^3	The 98th percentile, averaged over 3 years
PM_{10}	primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
SO_2	primary	1 hour	75 ppb	The 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: U.S. Environmental Protection Agency 2024

CO= carbon monoxide; Pb = lead; NO_2 = nitrogen dioxide; O_3 = ozone; $PM_{2.5}$ = particulate matter 2.5 microns in diameter or less; PM_{10} = particulate matter 10 microns in diameter or less; SO_2 = sulfur dioxide; µg/m^3 = micrograms per cubic meter; ppb = parts per billion; ppm = parts per million

2.1.2 State and Local Regulations

2.1.2.1 Local Air Quality Plans and Rules

The BAAQMD is responsible for developing the local elements of the SIP for the San Francisco Bay Area Air Basin (SFBAAB), which includes San Francisco. The BAAQMD is also responsible for implementing federal and State regulations at the local level and establishing local air quality regulations and permit obligations.

2.1.2.2 State and Local Regulation of Greenhouse Gas Emissions

At the State level, California has adopted statewide legislation for addressing GHG emissions. Notably, Assembly Bill 1279 outlines the State's GHG reduction goals for achieving a 40 percent reduction below 1990 emissions levels by 2030 and an 85 percent reduction in anthropogenic emissions below 1990 emissions levels, as well as net-zero GHG emissions, no later than 2045. The City and County of San Francisco (City) has also adopted a plan to achieve net-zero GHG emissions.

2.2 Existing Condition

Air quality and GHGs are important considerations for the alternatives because of current regional air quality conditions, which exceed certain federal and State ambient air quality standards, and because GHGs generated by the alternatives are regulated at the state and federal level.

The NAAQS and CAAQS were established by the EPA and CARB, respectively, to protect public health and welfare. Standards have been set for six criteria pollutants—ozone (O_3), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO2), sulfur dioxide (SO_2), and particulate matter (PM), which consists of particulates 10 microns in diameter or less (PM10) and 2.5 microns in diameter or less (PM2.5). O_3 is considered a regional pollutant because its precursors affect air quality on a regional scale; nitrogen oxides (NOX) and reactive organic gases (ROGs) react photochemically to form O_3; this reaction occurs at some distance downwind of the emissions source. Pollutants such as CO, NO2, SO2, and Pb are considered local pollutants that tend to accumulate in the air locally. PM is both a local and regional pollutant. Fossil-fueled vehicles and equipment used to construct the alternatives would generate exhaust emissions with O_3 precursors (NO_X and ROGs), CO, NO_2 (as a component of NO_X), SO_2, and PM. Earthmoving activities would generate fugitive dust, which would contribute to the presence of PM in the air.

Criteria pollutant concentrations in the SFBAAB are measured at several monitoring stations. The nearest station to the study area is the San Francisco-Arkansas Street station, which is adjacent to the area of construction at6th Street and Arkansas Street. Monitoring data for 2019 through 2021 show that the station experienced infrequent violations of the O_3 CAAQS and NAAQS, PM2.5 NAAQS, and PM10 CAAQS (CARB, 2023a). Data collected from monitoring stations throughout the SFBAAB are used to designate areas as non-attainment, maintenance, or attainment areas for the NAAQS and CAAQS. Nonattainment areas are regions where air quality does not meet the NAAQS, indicating higher levels of pollutants. Maintenance areas were previously non-attainment areas but have achieved and maintained compliance with the NAAQS. Attainment areas meet the air quality standards for all designated pollutants. According to the most recent local monitoring data, the area of construction is classified as being in non-attainment for O_3, attainment for CO, attainment/unclassified for PM10, and non-attainment for PM2.5 (CARB, 2023b; EPA, 2023a).

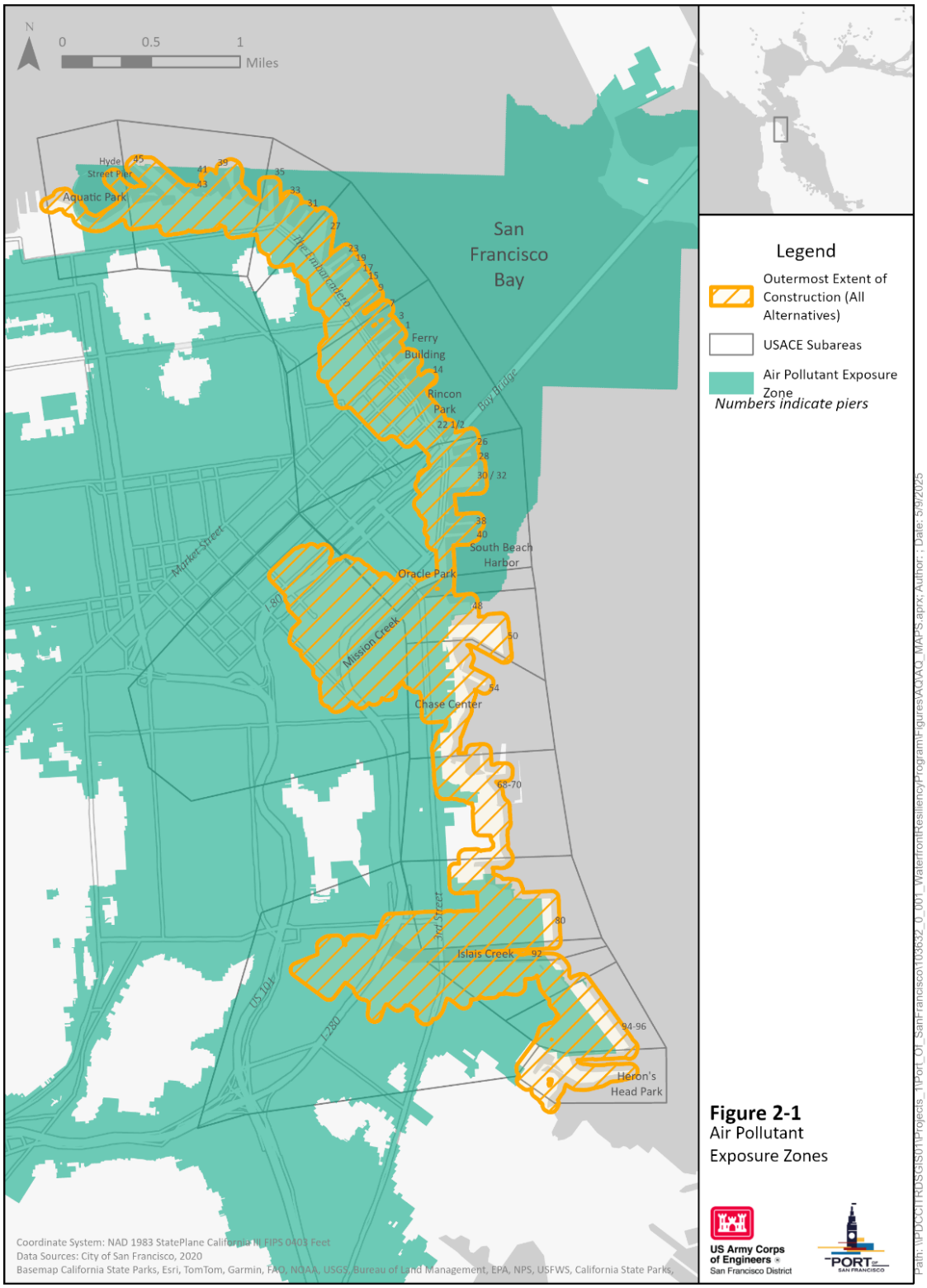
Regulators have not established separate standards for GHGs or hazardous air pollutants (HAPs). Gases that trap heat in the atmosphere are known as GHGs. The primary GHGs generated by the alternatives would be carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O_2). The EPA defines HAPs as pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects (EPA, 2022). In Section 2.2.3 Effects, for each alternative, HAPs are evaluated as substantial pollutant concentrations potentially affecting sensitive receptors. The area of construction overlaps several areas that have been identified by the San Francisco Department of Public Health (2020) as having elevated health vulnerabilities from existing HAP concentrations, as shown in **Figure D.1.1-1**. Sensitive land uses are particularly vulnerable to poor air quality

because they are locations where human populations, especially children, seniors, and sick persons, are located and where there is a reasonable expectation of continuous exposure. Residences within or adjacent to the area of construction are found within the Aquatic Park, Northeast Waterfront, Ferry Building, South Beach, and Mission Bay subareas. Mixed-use buildings with housing units line Beach Street in Aquatic Park, and there are multi-family dwellings at the intersection of Chestnut Street and Sansome Street in the NE Waterfront. Farther south, the Rincon Hill and South Beach residential districts are adjacent to the area of construction in the South Beach subarea. Figure D.1.2-1 in Annex D-1-2: *Noise and Vibration*, shows the sensitive receptors both in and within 1,000 feet of the area of construction. These same receptors are also considered sensitive for air quality purposes and could be exposed to substantial pollutant concentrations.

2.3 Environmental Consequences

2.3.1 Assessment Method

The alternatives differ in their implementation timelines, which range from 30 to 100 years. The alternatives propose structural and non-structural interventions to reduce coastal flood risks from the various targeted sea-level-rise trajectories. Construction activities would depend on factors such as the degree of sea-level rise, local economic conditions, market demand, and other financing considerations. The specific size, location, construction techniques, and scheduling for each individual construction action have not yet been determined. Thus, in the absence of the detailed location-specific construction information required to provide an informative and meaningful analysis, the evaluation of potential construction-related effects resulting from implementation of the alternatives is conducted qualitatively for criteria pollutants. Specifically, emission-generating activities and the types of emission sources are described; additional details regarding anticipated cut-and-fill volumes, where available, are provided to help characterize the expected intensity of air quality effects.



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Integrated Feasibility Report / Environmental Impact Statement

Figure D.1.1-1: Air Pollutant Exposure Zones

The GHG analysis, likewise, considers comparative construction data as well as quantitative metrics regarding construction costs and the change in land use. Specifically, fuel consumption is correlated to construction costs and converted to GHG emissions, based on the amount of CO_2, CH_4, and N_2O_2 emitted per gallon of diesel consumed (USEPA, 2023b). To determine the number of gallons of fuel used to implement the project alternatives, it was assumed that 10 percent of the construction costs would be associated with fuel consumption and that the average cost of diesel would be $6 per gallon.

2.3.2 Basis of Significance

The context for air quality considers ambient conditions within the SFBAAB, including regional attainment status, ambient air quality monitoring data, and applicable regulations, as established by the EPA and CARB. The air quality context also considers conditions along the alternatives' footprint and within 1,000 feet of construction work areas and permanent alternatives features, including the number and location of sensitive receptors. The context for GHG emissions includes the state and global atmosphere.

Impacts are determined by assessing the following conditions:

- Whether the alternative would conflict with implementation of applicable air quality plans or threaten to violate an ambient air quality standard (or additionally contribute to a non-attainment status),
- The degree to which the alternative would affect public health by exposing sensitive receptors to pollutant concentrations, and
- Whether the alternative would contribute to increases in GHG emissions.

The GCR, discussed in Section 2-1.1.1, *Clean Air Act and General Conformity Rule*, establishes emissions thresholds (known as *de minimis* levels) at 40 Code of Federal Regulations (CFR) 93.153(b) for use in evaluating the conformity of a project with applicable air quality plans. Given that the current evaluation is a planning study and that detailed emissions estimates will be prepared when the engineering design is further developed, the requirements of the GCR do not need to be met now, in accordance with 40 CFR 93.153(c), *Planning, Studies, and Provision of Technical Assistance.* GCR requirements would be met when the detailed emissions estimates can be prepared. However, for disclosure purposes only, a preliminary general conformity analysis has been completed for the Recommended Plan and is included as Sub-Appendix D-2: Clean Air Act Compliance. This preliminary analysis is not based on detailed construction assumptions suitable for an actual conformity analysis; thus, subsequent phases under the project would require their own project-level conformity evaluation and determination at a future date.

2.3.3 Effects

This section describes the adverse and beneficial impacts on air quality and GHG emissions in the study area.

2.3.3.1 Construction Impact Summary

Construction activities would result in the generation of dust and emissions from heavy machinery, including the use of emergency generators and maintenance. The specific intensity of air quality impacts through 2040 (first actions) and from 2070–2130 (subsequent actions) would depend on various factors, including the specific location of construction, the duration of construction or modification activities, and the type and number of pieces of equipment used. The intensity and magnitude of criteria pollutants from construction emission sources would be reduced during buildout by State and local regulations. Construction emissions generated may be offset, to some degree, by a reduced need for emergency action and response.

Given the information known at this time, the potential exists for construction emissions to conflict with implementation of air quality plans and violate ambient air quality standards for both the first and subsequent actions. Implementation of avoidance and minimization measures and mitigation measures described in Section 2.3.4, *Mitigation*, would be required to reduce construction emissions from individual phases of construction for both the first and subsequent actions.

While construction activities are generally not expected to be located near sensitive receptors, there may be instances of sensitive receptors within 1,000 feet of certain activities for both the first and subsequent actions. Implementation of avoidance and minimization measures and mitigation measures described in Section 2.3.4, *Mitigation*, would be required; however, construction activities would still be expected to expose sensitive receptors to substantial pollutant concentrations for both the first and subsequent actions.

Construction would also produce GHG emissions. Implementation of avoidance and minimization measures described in Section 2.3.4, would be necessary to reduce construction exhaust emissions and GHGs for both the first and subsequent actions.

2.3.3.2 Operations and Maintenance Impact Summary

Substantial operational emissions would not occur because the alternatives would consist primarily of the installation of fixed flood improvements, such as levees, seawalls, sheet pile walls, and related infrastructure for both the first and subsequent actions. However, electric pumps would be used to pump inland water associated with operations. California regulations support increases in the renewable portfolio standards over time, with a goal of 100 percent renewable energy, and electric pumps would not be a significant source of criteria pollutant or GHG emissions over the long run. There would be no material change in long-term operational emissions, compared to those that would be generated under the FWOP for both the first and subsequent actions. Consequently, operational air quality emissions would result in ***no impact***.

2.3.3.3 Future Without-Project (FWOP) (Alternative A)

Under the FWOP scenario, no actions would be taken to reduce flood risks beyond projects already approved along the San Francisco waterfront. The increased risk of coastal flooding increases the potential for damage to public and private properties, disruptions to utilities, interruptions to transportation services, and road closures.

The FWOP scenario has the potential to result in significant air quality and GHG emissions from increased maintenance, emergency response, and recovery activities to address coastal flooding including demolition and relocation of buildings within inundation areas. These activities would generate emissions, potentially exposing receptors to increased pollutant concentrations and contributing to GHG emissions. In addition, disruptions to the electrical grid could also generate emissions, especially if replacement power sources are fossil-fueled. The FWOP scenario also poses potential health risks to individuals displaced from their homes due to flooding if they are relocated to areas with higher ambient air pollution or if they become unhoused.

Identifying the specific emissions activities under the FWOP scenario involves a high degree of uncertainty. The timing, types, and magnitude of maintenance, construction, response, and relocation will be strongly influenced by the specific nature, timing, and severity of storm surges, which are unpredictable and cannot be known at this time. As such, it is not possible to produce an accurate and comprehensive cost estimate for the FWOP scenario. Because cost estimates would provide the required details to estimate emissions (e.g., equipment type, duration of use, quantities), a complete quantification of criteria pollutant and GHG emissions for the FWOP scenario cannot currently be performed.

While it is not possible to fully estimate all emissions under the FWOP scenario, a rough estimate of the fuel that will be expended for a portion of the activities, specifically the SFPUC anticipated storm and sewer upgrades can be made. The fuel estimate for this work is approximately 3,846,000 gallons. CO_2 emissions are highly correlated to fuel use. Approximately 99 percent of the carbon in diesel fuel is emitted in the form of CO_2 (EPA, 2023b). EPA published a CO_2 emission factor of 10,180 grams per gallon (g/gal), or 10.18 kilograms per gallon (kg/gal). Using these assumptions, CO_2 emissions from the SFPUC storm and sewer upgrades can be calculated from the expected fuel consumption. Over the entire construction period (120 months), approximately 39,150 metric tons (MT) CO_2 (43,160 tons CO_2) would be emitted for this activity. This translates into about 330 MT CO_2 per month (360 tons per month) or 3,920 MT CO_2 per year (4,320 tons per year CO_2).

While CO_2 emissions can be calculated from fuel use, the same is not true for criteria pollutants. While criteria pollutants are generated from fossil fuel combustion in construction equipment and vehicles, compared to GHGs the magnitude of criteria pollutants released is more strongly influenced by types and efficiency of equipment-specific control technologies. Because criteria pollutants cannot be reliably calculated

from fuel use alone, a criteria pollutant emissions inventory cannot be generated at this time for the FWOP scenario.

Another substantial source of emissions would be repairs, recovery, demolition and potential relocation of damaged and unusable buildings and facilities. While the exact extent of demolition and relocation cannot be estimated relative to future storm damage, the general scale of possible demolitions can be estimate for the FWOP condition based on areas of inundation. For the 2040, one percent storm condition under the FWOP scenario, 2,430 housing units, 38 LBE businesses, 25 city facilities, 4 miles of Muni routes, and 10 miles of streets would be inundated. For the 2090, one percent storm condition under the FWOP scenario, 13,248 housing units, 174 LBE businesses, 237 city facilities, 22 miles of Muni routes, and 42 miles of streets would be inundated. Repair, recovery, demolition, and potential relocation from such an event would require extensive construction activity and associated emissions. More details on how the areas of inundation were determined and the facilities referenced can be found in Appendix B: Engineering and Appendix E.2: Other Social Effects Report.

Table D.1.1-2 displays estimated fuel consumption and total MT CO_2 for the SFPUC scoped work for storm and sewer upgrades under the FWOP scenario. Results for the Recommended Plan and action alternatives, which are discussed further below, are also presented. It is critical to note that the values for the FWOP scenario are only for the SFPUC scoped work for storm and sewer upgrades. In other words, the fuel and emission estimates for the FWOP scenario shown in Table 2-2 are just for one component of the activity required in the FWOP scenario for a single infrastructure system. Additional fuel would be consumed by many other activities, including maintenance, sea wall repairs, demolition and relocation, and road reconstruction. For these reasons, the FWOP scenario estimates presented in **Table D.1.1-2** are not directly comparable to those for the action alternatives, which reflect expected fuel and emissions from full implementation.

Table D.1.1-2: Estimated Fuel Use and Total MT CO2 for SFPUC Storm and Sewer Upgrades for the FWOP Scenario and Fuel Use and Total MT CO_2 for Construction of the Action Alternatives [a]

Alternative	Million Gallons	MT CO_2
Sewer and Storm Upgrades Only under the FWOP [b]	4	39,150
Recommended Plan	158	1,604,964
Alt B	120	1,222,000
Alt F	290	2,952,000
Alt G	195	1,985,000

Notes:
[a] Results are for the entire construction duration and have been rounded. The following construction periods were assumed: Sewer and Storm Upgrades (FWOP) = 10 years; Alt F = 20 years; Recommended Plan = 20 years; Alt G = 20 years; Alt B = 50 years.
[b] Results are for SFPUC scoped work for storm and sewer upgrade, and thus reflect only one component of the construction required for the FWOP scenario. Thus, ***the FWOP scenario estimates are not directly comparable to those for the Recommended Plan and action alternatives***, which reflect expected fuel and emissions from full implementation.

Based on the above analysis, the FWOP scenario has the potential to result in significant air quality and GHG emissions due to increased maintenance, emergency response, and recovery activities (including demolition and relocation) as well as potential disruptions to the electrical grid. The lack of ability to precisely estimate storm event response precludes a comprehensive and accurate analysis of expected emissions. The fuel and GHG emissions estimates for the SFPUC storm and sewer upgrades highlight the substantial GHG output associated with a single component of the FWOP scenario. Substantial additional emissions would be generated by other activities under the FWOP scenario, including but not limited to maintenance, sea wall repairs, demolition, relocation, and road reconstruction. Given the damage expected under the FWOP scenario and the associated magnitude of likely repairs, it is likely total emissions for the FWOP scenario would match or exceed those of the Recommended Plan and action alternatives. Recommended Plan

Table D.1.1-3 shows a summary of the air quality impacts associated with the Recommended Plan.

Table D.1.1-3: Summary of Air Quality Impacts Associated with the Recommended Plan

Recommended Plan Air Quality Impact Rating by Measure	**Bay Fill**	**Levee**	**Bulkhead wall/Seawall**	**Closure Structure**	**Roadway Impact**	**Sheetpile Wall**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Embankment Shoreline***	**Naturalized Shoreline***	**Marsh Enhancement***
Construction/Footprint (1st Action)	4	4	5	4	4	4	4	4	5	3	3	3	3	1
Construction/Footprint (2nd Action)	5	4	5	1	4	1	4	1	5	3	3	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	4	3	4	3	3	3	3	3	4	2	2	2	2	2

* Denotes Engineering with Nature (EWN) measure.

2.3.3.3.1 Regional Air Quality Effects

Implementation of the Recommended Plan would require the use of diverse construction equipment and machinery across specific geographic areas, which would have an impact on air quality.

In Fisherman's Wharf (Reach 1), key first actions include floodproofing buildings and infrastructure, and constructing concrete curbs around piers. Reach 1 subsequent actions include additional floodproofing or elevation of the shoreline with bulkhead seawalls and floodwalls. These activities could include the use of excavators for digging and preparing the ground for floodproofing measures and shoreline elevation, concrete mixers for mixing and pouring concrete for curbs and other structural elements, cranes for lifting and placing heavy materials such as bulkhead seawalls and floodwalls, pile drivers for driving piles into the ground to support structures like seawalls and piers, and compactors to ensure soil stability.

For the Embarcadero (Reach 2), key first actions include raising the shoreline, performing ground improvement for seismic performance, floodproofing buildings, and constructing concrete curbs around piers. Subsequent actions for Reach 2 continue raising the shoreline, considering building adaptations based on risk profiles, and addressing stormwater management. These activities could include use of excavators and backhoes for excavation and earthmoving, cranes for heavy lifting during the installation of floodwalls and bulkhead walls, concrete pumps for precise concrete placement, bulldozers for grading and leveling tasks, forklifts for efficient material handling, compactors to ensure soil stability, and drilling rigs for foundation work and ground improvement.

Similarly, in Mission Creek/Mission Bay (Reach 3), key first actions involve raising the shorelines, performing ground improvement, installing deployable closure structures, and enhancing wildlife habitat. Subsequent actions include further elevation, maintenance of roadway capacity, incorporation of engineering with nature features, and building adaptations. This could encompass excavators and backhoes for earthmoving and excavation, cranes for lifting and placing closure structures and bulkhead walls, concrete pumps for concrete placement, bulldozers for grading, forklifts for material handling, compactors for soil compaction, and drilling rigs for foundation work.

In Islais Creek/Bayview (Reach 4), first actions involve elevating the shorelines, installing concrete curbs, performing ground improvement, and incorporating engineering with nature features. Subsequent actions include additional shoreline elevation, construction of levees, building adaptations, and the consideration of additional infrastructure for stormwater management. This could include excavators, cranes, concrete pumps, bulldozers, forklifts, compactors, and drilling rigs, depending on the specific tasks required for shoreline elevation, concrete curb installation, and the deployment of closure structures.

Finally, first actions also include the following: (1) living seawalls that will incorporate textured concrete into the design of any new vertical seawall wherever maritime uses and pier configuration allow; (2) robust coastal defense of the Ferry Building and the

Agriculture Building including raising the ferry building, a utility-basement like substructure under the two buildings, and coastal defense on bayside edge; (3) a coarse beach at Rincon Park; and (4) adjusted alignment of the line of defense near Pier 40 to avoid demolition of two significant historic buildings (but there will be no floodproofing of these buildings which will be outside the line of defense). Construction of these actions would likely require a variety of heavy machinery. This could include excavators for site preparation and backfilling, pile- driving equipment if piles are to be installed, cranes for lifting and placing materials, potentially barges for storage of equipment and materials, cranes, tiebacks, anchors, welding equipment, and other specialized equipment. Concrete mixers and pumps may also be needed when raising structures.

Both the Recommended Plan and Alternative G would involve significant construction activities that would require heavy equipment and specialized materials. Overall, Alternative G and the Recommended Plan would implement similar measures; however, the Recommended Plan plans to construct more measures than Alternative G, such as bay fill, a closure structure, and a sheetpile wall.

Given the information known about the Recommended Plan, the potential exists for construction emissions to conflict with implementation of air quality plans and violate ambient air quality standards for both first and subsequent actions. The intensity and magnitude of criteria pollutant emissions and the potential for violations of ambient air quality standards would be reduced during buildout of the Recommended Plan by State and local regulations that result in changes in vehicle emissions—principally, the Advanced Clean Truck and Advanced Clean Cars II regulations, which ban the sale of fossil fuel–powered heavy vehicles, as well as passenger cars and trucks, beyond certain future dates. These and other future regulations adopted to support attainment of the State's air quality and GHG goals would reduce the emissions intensity of equipment and vehicles used to construct the Recommended Plan. Nevertheless, implementation of AMM-AQ-1 and AMM-AQ-2 would be required to reduce construction emissions from individual phases implemented under the Recommended Plan for both the first and subsequent actions.

If construction emissions from future individual phases still exceed the GCR *de minimis* levels after implementation of AMM-AQ-1 and AMM-AQ-2, AMM-AQ-4 would be required for both the first and subsequent actions. With full implementation of AMM-AQ-1, AMM-AQ-2, and AMM-AQ-4, this alternative would not conflict with air quality plans and would contribute to ambient air quality violations, and the impact would be ***less than significant with mitigation***.

2.3.3.3.2 Substantial Pollutant Concentrations

Similar to the activities under other action alternatives, construction activities under the Recommended Plan through 2040 (first actions) and from 2070–2130 (subsequent actions) would generally not be located near sensitive receptors; however, there are housing units (e.g., apartment complexes, houseboats on Mission Creek) that may be within 1,000 feet of construction activities. Sensitive receptors that may be within 1,000 feet of the robust coastal defense of the Ferry Building and Agriculture Building and

coarse beach at Rincon Park include recreational areas (e.g., Sue Bierman and Parrot Park). Because construction of the Living Seawall would occur wherever current maritime uses and pier configurations are located, sensitive receptors that may be within 1,000 feet of construction activities could include various residential and recreational areas. The potential for the Recommended Plan to expose sensitive receptors to substantial pollutant concentrations would be similar to the potential exposure for the other action alternatives but slightly decreased because the Recommended Plan would most likely incorporate more phasing and adaptability, potentially reducing its impact on sensitive receptors.

Compared to Alternative A (FWOP), emissions generated by the Recommended Plan may be offset, to some degree, by a reduced need for emergency action and response. However, the specific nature of future emergency events cannot be predicted, nor can the location of activities relative to construction and receptors. Implementation of AMM-AQ-1 and AMM-AQ-2 would, therefore, be required to reduce the likelihood of receptors being exposed to substantial pollutant concentrations for both first and subsequent actions.

AMM-AQ-5 would also be required for future construction located within 1,000 feet of sensitive receptors for both first and subsequent actions. Although the control strategies identified in AMM-AQ-1, AMM-AQ-2, and AMM-AQ-5 would achieve considerable emission reductions, there may be instances in which project-specific conditions would preclude reductions in health risks to a level that would be below adopted thresholds. Consequently, this EIS takes the conservative approach in its post-mitigation significance conclusion and discloses, for NEPA compliance purposes, that the alternative would expose sensitive receptors to substantial pollutant concentrations. With implementation of AMM-AQ-1, AMM-AQ-2, and AMM-AQ-5, this impact would be ***significant and unavoidable***.

2.3.3.3.3 Greenhouse Gas Emissions

The Recommended Plan would require specialized equipment that could contribute to additional GHG emissions for both the first and subsequent actions. Compared to the other alternatives, the Recommended Plan would likely generate more GHG emissions because it would implement the most measures.

The specific intensity of GHG emissions through 2040 (first actions) and through 2070–2130 (subsequent actions) would depend on various factors, including the specific location of construction, the duration of construction or modification activities, and the type and number of pieces of equipment used. The intensity and magnitude of GHGs from construction emission sources would be reduced during buildout of the Recommended Plan by State and local regulations. Compared to Alternative A (FWOP), GHG emissions generated by the Recommended Plan may be offset, to some degree, by a reduced need for emergency action and response.

As discussed in Section 2.3.3.3, *Future Without-Project (FWOP) (Alternative A)*, CO_2 emissions can be estimated from fuel use. To determine the gallons of fuel used to implement the Recommended Plan, it was assumed that 10 percent of construction costs are associated with fuel consumption. Based on the 10-year average of data

collected by the U.S. Army Corps of Engineers (USACE) Cost Center of Expertise, the average cost of diesel is $6 per gallon.

Using these assumptions, the Recommended Plan is expected to spend approximately $9.5 billion on construction in total, of which 10 percent ($9.5 million) would be spent on fuel. This translates to about 158 million gallons of fuel used and 1,604,964 $MTCO_2$ (1,769,169 tons CO_2) for the entire construction period (240 months) (see Table 2-2 above). This translates into about 6,687 $MTCO_2$ per month (7,369 tons per month) or 80,248 $MTCO_2$ per year (88,433 tons per year CO_2).

Implementation of AMM-AQ-1 through AMM-AQ-3 would be required to reduce GHGs for both the first and subsequent actions.

2.3.3.4 Alternative B: Nonstructural

2.3.3.4.1 Regional Air Quality Effects

Alternative B is nonstructural and includes floodproofing, modifying, or relocating buildings and infrastructure to reduce flood risks for both the first and subsequent actions. As sea levels rise, areas with higher flood risks could be managed for responsible retreat, while areas with lower risks could be floodproofed or modified. Nature-based features would be added to retreat areas to reduce flood risks, while policy changes would be implemented to allow for increased housing density and business relocations in inland areas. Essential utilities and major transportation and transit corridors would be relocated or modified to continue providing service.

Some of the first and subsequent actions in Alternative B, such as relocating or modifying buildings and infrastructure, could have effects on air quality. For example, if new buildings are constructed in areas that were previously undeveloped, the construction of new buildings and demolition of old buildings would contribute to air pollution through the use of construction equipment and vehicles, such as haul trucks, excavators, cranes, and bulldozers. In addition, new buildings could lead to increased vehicular traffic and associated air pollution. Similarly, if utilities are relocated, this could require new construction or modifications to existing facilities, which would result in emissions from construction equipment and the transport of materials for both the first and subsequent actions.

Construction emissions impacts associated with each individual intervention would be short term and limited to the period when construction would be taking place for a particular activity. Although these emissions may not individually exceed GCR *de minimis* levels, the concurrent construction of multiple interventions under Alternative B could generate combined criteria pollutant emissions in a single year that would have the potential to conflict with implementation of air quality plans and violate ambient air quality standards.

The intensity and magnitude of criteria pollutant emissions and the potential for violations of ambient air quality standards through 2040 (first actions) and through 2090 (subsequent actions) would be reduced during buildout of Alternative B by State and local regulations that result in changes in vehicle emissions—principally, the Advanced Clean Truck and Advanced Clean Cars II regulations, which ban the sale of fossil fuel–

powered heavy vehicles, as well as passenger cars and trucks, beyond certain future dates. These and other future regulations adopted to support attainment of the State's air quality and GHG goals would reduce the emissions intensity of equipment and vehicles used to construct Alternative B.

Implementation of Alternative B would provide more reliable flood protection, which would reduce the risk of emergency events and flooding. Compared to Alternative A (FWOP), criteria pollutant emissions generated by Alternative B may be offset, to some degree, by reduced emergency action. Implementation of the BAAQMD's best management practices under AMM-AQ-1 would also be required to reduce criteria pollutant emissions for both first and subsequent actions. This avoidance, minimization, and mitigation (AMM) measure would be required for all future construction activity under Alternative B. Although this AMM would reduce the intensity of construction emissions, the potential to conflict with air quality plans and violate standards still exists, particularly for larger or concurrent construction activities. AMM-AQ-2 would be required for those activities in which a future detailed analysis identifies a significant impact for both first and subsequent actions. AMM-AQ-2 would further reduce construction emissions from individual phases implemented under Alternative B.

If construction emissions from future individual phases still exceed GCR *de minimis* levels after implementation of AMM-AQ-1 and AMM-AQ-2, MM AQ-1 would be required for both first and subsequent actions. Specifically, AMM-AQ-4 would require USACE to make a good-faith effort to enter into a contractual agreement with the Bay Area Clean Air Foundation (Foundation), a public nonprofit and supporting organization for the BAAQMD. Under such an agreement, USACE would agree to mitigate the project's emissions by providing funds to the Foundation for grants that will go to projects that have been designed to achieve emission reductions, thereby offsetting project-related effects on air quality. Although the Foundation has successfully delivered emission reductions throughout the Bay Area for more than a decade, the precise quantity of emissions generated by Alternative B cannot currently be quantified, and thus, the amount of required grant funding, as well as the associated offset, is unknown.

Emissions generated by buildout of Alternative B for both first and subsequent actions would occur over several decades. Ultimately, because of the plan-level nature of this analysis, coupled with the unknowns surrounding the future availability and affordability of funding for emission reduction projects, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts.

With full implementation of AMM-AQ-1, AMM-AQ-2, and AMM-AQ-4, this alternative would not conflict with air quality plans and contribute to ambient air quality violations and the impact would be ***less than significant with mitigation***.

2.3.3.4.2 Substantial Pollutant Concentrations

Alternative B construction activities through 2040 (first actions) and through 2090 (subsequent actions) would occur mostly near commercial or industrial uses; however, there are housing units (e.g., apartment complexes, houseboats on Mission Creek) throughout the study area that may be within 1,000 feet of construction activities (Annex D.1.2, *Noise and Vibrations*, Figure D.1.2-1). In general, the construction of

infrastructure would be a relatively short-term activity and spread out throughout the area of construction, as opposed to concentrated at a single location. However, the combustion of fossil fuel in diesel- and gasoline-powered equipment could expose receptors to increased pollutant concentrations. In addition, the demolition of structures may result in particulates that may disperse asbestos-containing materials (ACMs) to adjacent sensitive receptor locations; however, all demolition activities would be subject to EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) if asbestos is present at existing facilities.

As discussed above, compared to Alternative A (FWOP), emissions generated by Alternative B may be offset, to some degree, by a reduced need for emergency action and response. However, the specific nature of future emergency events cannot be predicted, nor can the location of activities relative to alternative construction and receptors for both first and subsequent actions. Implementation of AMM-AQ-1 and AMM-AQ-2 would reduce construction exhaust emissions and, therefore, would be required to reduce the likelihood of receptors being exposed to substantial pollutant concentrations under Alternative B. AMM-AQ-5 would also be required for future construction located within 1,000 feet of sensitive receptors and would require performing a health risk assessment and implement feasible control strategies to protect public health.

Although the control strategies identified in AMM-AQ-1, AMM-AQ-2, and AMM-AQ-5 would achieve considerable emission reductions, there may be instances in which project-specific conditions would preclude reductions in health risks to a level that would be below adopted thresholds. Consequently, this EIS takes the conservative approach in its post-mitigation significance conclusion and discloses, for NEPA compliance purposes, that the alternative would expose sensitive receptors to substantial pollutant concentrations. With implementation of AMM-AQ-1, AMM-AQ-2, and AMM-AQ-5, this impact would be ***significant and unavoidable***.

2.3.3.4.3 Greenhouse Gas Emissions

The same types of equipment and activities discussed for Alternative B would contribute to GHG emissions under Alternative B. Although the electricity needed to power equipment and vehicles would result in indirect GHG emissions prior to 2045, pursuant to State regulation, electricity generated and provided by local utilities would be carbon free by December 31, 2045. Material manufacturing, particularly cement, aggregate, and steel manufacturing, would also result in indirect GHG emissions upstream of construction activities.

The specific intensity of GHG emissions through 2040 (first actions) and through 2090 (subsequent actions) would depend on various factors, including the specific location of construction, the duration of construction or modification activities, and the type and number of pieces of equipment used. Because these variables are not known at this time, the precise GHG emissions of construction activities associated with Alternative B, cannot be accurately quantified. As discussed above for Alternative B, the intensity and magnitude of GHGs from construction emission sources would be reduced during buildout of Alternative B by State and local regulations. Compared to Alternative A

(FWOP), GHG emissions generated by Alternative B may be offset, to some degree, by a reduced need for emergency action and response.

As discussed in Section 2.3.3.3, *Future Without-Project (FWOP) (Alternative A)*, CO_2 emissions can be estimated from fuel use. To determine the gallons of fuel used to implement Alternative B, it was assumed that 10 percent of construction costs are associated with fuel consumption. Based on the 10-year average of data collected by the USACE Cost Center of Expertise, the average cost of diesel is $6 per gallon.

Using these assumptions, Alternative B is expected to spend approximately $7.2 billion on construction in total, of which 10 percent ($720 million) would be spent on fuel. This translates into 120 million gallons of fuel used and 1,222,000 $MTCO_2$ (1,346,583 tons CO_2) for the entire construction period (300 months) (see Table 2-2 above). This translates into about 2,036 $MTCO_2$ per month (2,244 tons per month) or 24,432 $MTCO_2$ per year (26,924 tons per year CO_2).

Implementation of AMM-AQ-1 and AMM-AQ-2 would reduce construction exhaust emissions and, therefore, would be required to reduce GHGs for both first and subsequent actions. Environmental review completed for future activities implemented under the project could identify additional project-specific mitigation, as informed by AMM-AQ-3.

2.3.3.5 Alternative F: Manage the Water, Scaled for Higher Risk

Table D.1.1-4 shows a summary of the air quality impacts associated with Alternative F**.**

Table D.1.1-4: Summary of Air Quality Impacts Associated with Alternative F

Alternative F Air Quality Impact Rating by Measure	**Bay fill**	**Levee**	**Bulkhead wall/Seawall**	**Roadway Impact**	**Tide Gate**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Marsh Enhancement***
Construction Footprint	4	4	5	4	3	4	4	5	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	3	3	4	3	2	3	3	4	2	2	2

2.3.3.5.1 Regional Air Quality Effects

Alternative F proposes a coastal flood defense infrastructure that would rely on the construction of tide gates, shoreline extensions, levees, raised roads, and floodwalls along the current Bay shoreline, following the “manage the water” strategy. The shoreline would be extended into the Bay to make space for underground stormwater

storage capacity. Inland drainage modifications would also be necessary. This may include measures that involve the consolidation of combined sewer discharge outfalls, new pumps, and green infrastructure. Floodproofing for maritime and industrial facilities would also be included. Residual coastal and inland flood risks could be addressed through floodproofing. More than 1,000,000 cubic yards of fill would be used during construction in 2040 (first actions), with more than 113,000 cubic yards in 2090 (subsequent actions).

Constructing the infrastructure proposed in Alternative F, for both first and subsequent actions, would require a diverse range of equipment and machinery as well as specialized materials. Excavators and bulldozers would be required for significant earthmoving. Pile drivers would be used to install supports for structures. Pumps and mixers would be necessary for the construction of concrete infrastructure. Cranes, scaffolding, and other construction equipment would be used for floodproofing as well as raising or relocating structures.

Alternative F would most likely have substantial air quality emissions due to the need for more specialized equipment and the larger scale of the construction activities involved. Alternative F would also require cubic yards of fill in both 2040 (first actions) and 2090 (subsequent actions) (total of 1.113 million cubic yards).

Although the precise magnitude of emissions generated by Alternative F cannot be quantified, given the information known about Alternative F, the potential exists for construction emissions to conflict with implementation of air quality plans and violate ambient air quality standards for both first and subsequent actions. The intensity and magnitude of criteria pollutant emissions and the potential for violations of ambient air quality standards would be reduced during buildout of Alternative F by State and local regulations that result in changes in vehicle emissions—principally, the Advanced Clean Truck and Advanced Clean Cars II regulations, which ban the sale of fossil fuel–powered heavy vehicles, as well as passenger cars and trucks, beyond certain future dates. These and other future regulations adopted to support attainment of the State's air quality and GHG goals would reduce the emissions intensity of equipment and vehicles used to construct Alternative F. Nevertheless, implementation of AMM-AQ-1 and AMM-AQ-2 would be required to reduce construction emissions from individual phases implemented under Alternative F for both first and subsequent actions. If construction emissions from future individual phases still exceed the GCR *de minimis* levels after implementation of AMM-AQ-1 and AMM-AQ-2, AMM-AQ-4 would be required for both first and subsequent actions.

With full implementation of AMM-AQ-1, AMM-AQ-2, and AMM-AQ-4, this alternative would not conflict with air quality plans and contribute to ambient air quality violations, and the impact would be ***less than significant with mitigation***.

2.3.3.5.2 Substantial Pollutant Concentrations

Similar to the other action alternatives, Alternative F construction activities through 2040 (first actions) and through 2090 (subsequent actions) would generally not be located near sensitive receptors; however, there are housing units (e.g., apartment complexes, houseboats on Mission Creek) throughout the study area that may be within 1,000 feet

of construction activities. The potential for Alternative F to expose sensitive receptors to substantial pollutant concentrations would be similar to the potential exposure described above for the other action alternatives but slightly increased because Alternative F would be likely to require more construction activity. Additionally, sensitive receptors may be exposed to temporary construction odors from diesel equipment; however, these odors would be short-term and would typically disperse once the construction activities are completed. Furthermore, certain measures, such as tide gates, may also expose sensitive receptors to odors due to the accumulation of organic matter and debris in the tidal channels. Over time, this organic matter can decompose, releasing unpleasant odors that may affect the surrounding environment and those close to the tide gates.

As discussed for Alternative F, compared to Alternative A (FWOP), emissions generated by Alternative F may be offset to some degree by a reduced need for emergency action and response. However, the specific nature of future emergency events cannot be predicted, nor can the location of activities relative to construction and receptors. Implementation of AMM-AQ-1 and AMM-AQ-2 would, therefore, be required to reduce the likelihood of receptors being exposed to substantial pollutant concentrations under Alternative F for both first and subsequent actions. AMM-AQ-5 would also be required for future construction located within 1,000 feet of sensitive receptors for both first and subsequent actions.

Although the control strategies identified in AMM-AQ-1, AMM-AQ-2, and AMM-AQ-5 would achieve considerable emission reductions, there may be instances in which project-specific conditions would preclude reductions in health risks to a level that would be below adopted thresholds. Consequently, this EIS takes the conservative approach in its post-mitigation significance conclusion and discloses, for NEPA compliance purposes, that the alternative would expose sensitive receptors to substantial pollutant concentrations. With implementation of AMM-AQ-1, AMM-AQ-2, and AMM-AQ-5, this impact would be ***significant and unavoidable***.

2.3.3.5.3 Greenhouse Gas Emissions

Alternative F would require specialized equipment that could contribute additional GHG emissions for both first and subsequent actions. Compared to Alternative B, Alternative F would be likely to generate more GHG emissions due to the need for more specialized equipment and the larger scale of the construction activities involved.

The specific intensity of GHG emissions through 2040 (first actions) and through 2090 (subsequent actions) would depend on various factors, including the specific location of construction, the duration of construction or modification activities, and the type and number of pieces of equipment used. Because these variables are not known at this time, the precise GHG emissions of construction activities associated with Alternative F, cannot be accurately quantified. As discussed for Alternative F, the Intensity and magnitude of GHGs from construction emission sources would be reduced during buildout of Alternative F by State and local regulations. Compared to Alternative A (FWOP), GHG emissions generated by Alternative F may be offset, to some degree, by a reduced need for emergency action and response.

As discussed in Section 2.3.3.3, *Future Without-Project (FWOP) (Alternative A)*, CO_2 emissions can be estimated from fuel use. To determine the gallons of fuel used to implement Alternative F, it was assumed that 10 percent of construction costs are associated with fuel consumption. Based on the 10-year average of data collected by the USACE Cost Center of Expertise, the average cost of diesel is $6 per gallon.

Using these assumptions, Alternative F is expected to spend approximately $17.4 billion on construction in total, of which 10 percent ($1.74 billion) would be spent on fuel. This translates to 290 million gallons of fuel used and 2,952,000 $MTCO_2$ (3,254,243 tons CO_2) for the entire construction period (240 months) (see Table 2-2 above). This translates into about 12,301 $MTCO_2$ per month (13,556 tons per month) or 147,610 $MTCO_2$ per year (162,666 tons per year CO_2).

Implementation of AMM-AQ-1 through AMM-AQ-3 would be required to reduce GHGs for both first and subsequent actions.

2.3.3.6 Alternative G: Partial Retreat, Scaled for Higher Risk

Table D.1.1-5 shows a summary of the air quality impacts associated with Alternative G.

Table D.1.1-5: Summary of Air Quality Impacts Associated with Alternative G

Alternative G Air Quality Impact Rating by Measure	**Levee**	**Bridge raise**	**Bulkhead wall/Seawall**	**Roadway Impact**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Embankment Shoreline***	**Naturalized Shoreline***	**Marsh Enhancement***
Construction/ Footprint	4	5	5	4	4	4	5	3	3	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	3	4	4	3	3	3	4	2	2	2	2	2

2.3.3.6.1 Regional Air Quality Effects

Alternative G would construct flood defense structures and floodproof buildings in the Mission Bay and Islais Creek/Bayview area and along the Embarcadero. The alternative would involve building levees, floodwalls, seawalls, and closure structures, along with floodproofing and converting some areas to natural and nature-based features. In addition, extensive demolition and displacement of uses would occur throughout the Mission Bay area. By 2040 (first actions), the alternative would aim to defend against 3.5 feet of sea-level rise. It would also require transportation and other infrastructure to be reconfigured. By 2090 (subsequent actions), the alternative would aim to construct

new levees and walls to defend against up to 7 feet of sea-level rise and establish floodable open space zones. The alternative would also include modifying zoning, investing in public access improvements along the creek, and expanding bridges into causeways. In the Embarcadero area, the alternative would involve building an elevated shoreline with a new seawall and a short floodwall, reconstructing the Embarcadero roadway, and raising buildings to defend against sea-level rise. The shoreline would be elevated to defend against 7 feet of sea-level rise by 2090 (subsequent actions). In addition, more than 67,000 cubic yards of fill would be used during construction in 2040 (first actions), with more than 63,000 cubic yards in 2090 (subsequent actions).

Generally, the equipment needed to complete Alternative G could include excavators, bulldozers, graders, cranes, pile drivers, concrete mixers, trucks, and other heavy machinery. Furthermore, the construction of flood defense structures such as levees, floodwalls, and seawalls would require excavation and earthmoving equipment as well as materials such as concrete, steel, and rock. Retrofitting buildings and raising the shoreline would require specialized construction equipment such as hydraulic jacks, scaffolding, and concrete pumps. The installation of new pump stations and drainage systems would require excavation and trenching equipment as well as electrical and plumbing systems.

Both Alternative F and Alternative G would involve significant construction activities that would require heavy equipment and specialized materials. Overall, Alternative G appears to focus more on demolition, relocation, and retreat strategies. However, Alternative G would use fewer cubic yards of fill in both 2040 (first actions) and 2090 (subsequent actions) compared with Alternative F (total of 130,000 cubic yards vs 1,113,000 cubic yards), indicating that emissions from earthmoving activities would be less than the emissions discussed above for Alternative F.

Although the precise magnitude of emissions generated by Alternative G for both first and subsequent actions cannot be quantified, given the information known about Alternative G, the potential exists for construction emissions to conflict with implementation of air quality plans and violate ambient air quality standards. The intensity and magnitude of criteria pollutant emissions and the potential for violations of ambient air quality standards would be reduced during buildout of Alternative G by State and local regulations that result in changes in vehicle emissions—principally, the Advanced Clean Truck and Advanced Clean Cars II regulations, which ban the sale of fossil fuel–powered heavy vehicles, as well as passenger cars and trucks, beyond certain future dates. These and other future regulations adopted to support attainment of the State's air quality and GHG goals would reduce the emissions intensity of equipment and vehicles used to construct Alternative G. Nevertheless, implementation of AMM-AQ-1 and AMM-AQ-2 would be required to reduce construction emissions from individual phases implemented under Alternative G for both first and subsequent actions. If construction emissions from future individual phases still exceed the GCR *de minimis* levels after implementation of AMM-AQ-1 and AMM-AQ-2, AMM-AQ-4 would be required for both first and subsequent actions.

With full implementation of AMM-AQ-1, AMM-AQ-2, and AMM-AQ-4, this alternative would not conflict with air quality plans and contribute to ambient air quality violations, and the impact would be ***less than significant with mitigation***.

2.3.3.6.2 Substantial Pollutant Concentrations

Similar to the activities under other action alternatives, construction activities under Alternative G through 2040 (first actions) and through 2090 (subsequent actions) would generally not be located near sensitive receptors; however, there are housing units (e.g., apartment complexes, houseboats on Mission Creek) that may be within 1,000 feet of construction activities. The potential for Alternative G to expose sensitive receptors to substantial pollutant concentrations would be similar to the potential exposure described above for the other action alternatives but slightly increased (with the exception of Alternative F) because Alternative G would most likely require more construction activity.

As discussed for Alternative G, compared to Alternative A (FWOP), emissions generated by Alternative G may be offset, to some degree, by a reduced need for emergency action and response. However, the specific nature of future emergency events cannot be predicted, nor can the location of activities relative to construction and receptors. Implementation of AMM-AQ-1 and AMM-AQ-2 would therefore be required to reduce the likelihood of receptors being exposed to substantial pollutant concentrations under Alternative G for both first and subsequent actions. AMM-AQ-5 would also be required for future construction within 1,000 feet of sensitive receptors for both first and subsequent actions.

Although the control strategies identified in AMM-AQ-1, AMM-AQ-2, and AMM-AQ-5 would achieve considerable emission reductions, there may be instances in which project-specific conditions would preclude reductions in health risks to a level that would be below adopted thresholds. Consequently, this EIS takes the conservative approach in its post-mitigation significance conclusion and discloses, for NEPA compliance purposes, that the alternative would expose sensitive receptors to substantial pollutant concentrations. With implementation of AMM-AQ-1, AMM-AQ-2, and AMM-AQ-5, this impact would be ***significant and unavoidable***.

2.3.3.6.3 Greenhouse Gas Emissions

Alternative G would require specialized equipment that could contribute additional GHG emissions. Compared to Alternative B, Alternative G would be likely to generate more GHG emissions due to the need for more specialized equipment and the larger scale of the construction activities involved.

The specific intensity of GHG emissions through 2040 (first actions) and through 2090 (subsequent actions) would depend on various factors, including the specific location of construction, the duration of construction or modification activities, and the type and number of pieces of equipment used. Because these variables are not known at this time, the precise GHG emissions of construction activities associated with Alternative G, cannot be accurately quantified. As discussed for Alternative G, the Intensity and magnitude of GHGs from construction emission sources would be reduced during buildout of Alternative G by State and local regulations. Compared to Alternative A (FWOP), GHG emissions generated by Alternative G may be offset, to some degree, by a reduced need for emergency action and response.

As discussed in Section 2.3.3.3, *Future Without-Project (FWOP) (Alternative A)*, CO_2 emissions can be estimated from fuel use. To determine the gallons of fuel used to implement Alternative G, it was assumed that 10 percent of construction costs are associated with fuel consumption. Based on the 10-year average of data collected by the USACE Cost Center of Expertise, the average cost of diesel is $6 per gallon.

Using these assumptions, Alternative G is expected to spend approximately $11.7 billion on construction in total, of which 10 percent ($1.17 billion) would be spent on fuel. This translates to 195 million gallons of fuel used and 1,985,000 $MTCO_2$ (2,188,198 tons CO_2) for the entire construction period (240 months) (see Table 2-2 above). This translates into about 8,271 $MTCO_2$ per month (9,115 tons per month) or 99,255 $MTCO_2$ per year (109,379 tons per year CO_2).

Implementation of AMM-AQ-1 through AMM-AQ-3 would be required to reduce GHGs for both first and subsequent actions.

2.3.4 Mitigation

The measures below are available to reduce construction emissions under Alternative A (FWOP), as necessary. For the Recommended Plan and Alternatives B, F, and G, the AMMs that follow would be necessary to reduce impacts. Based on the best available information at the time of this analysis, first actions are below *de minimis*. However, it is acknowledged that analyses performed in the future, with refined data, may result in a different outcome for first or subsequent actions. The minimization measures described in this section could be used to reduce or eliminate the likelihood of needing compensatory mitigation to offset effects to AQ at time of construction.

AMM-AQ-1: Implement BAAQMD's Basic and Enhanced Best Management Practices for Construction

The following list of strategies is informed by measures recommended by the BAAQMD (2023) to reduce construction-generated criteria pollutant emissions:

- All exposed surfaces (e.g., unpaved parking and staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day, except during rainy days.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph).
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.

- All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.
- All trucks and equipment, including their tires, shall be washed off prior to leaving the active site.
- Unpaved roads providing access to sites located 100 feet or more from a paved road shall be treated with a 6- to 12-inch layer of compacted wood chips, mulch, or gravel.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The air district's general air pollution complaints number shall also be visible to ensure compliance with applicable regulations. In addition, the construction schedule and mitigation measures shall be posted. Notices shall be multilingual.
- Limit the simultaneous occurrence of excavation, grading, and ground-disturbing construction activities.
- Install wind breaks (e.g., trees, fences) on the windward side(s) of actively disturbed areas of construction. Wind breaks should have a maximum of 50 percent air porosity.
- Plant vegetative ground cover (e.g., fast-germinating native grass seed) in disturbed areas as soon as possible and water appropriately until the vegetation is established.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than 1 percent.
- Minimize the amount of excavated material or waste materials stored at the site.
- Hydroseed or apply non-toxic soil stabilizers to construction areas, including previously graded areas, that are inactive for at least 10 calendar days.
- Implement other measures to reduce emissions as they become available in the future.

AMM-AQ-2: Implement Additional Control Strategies to Reduce Criteria Pollutant Emissions

Prior to construction, a quantitative air quality analysis will be completed for construction, including the identification of any and all measures necessary to reduce criteria pollutant emissions to levels below *de minimis* thresholds. Reductions in emissions can be accomplished by the following measures, as feasible:

- Requiring that all construction equipment, diesel trucks, marine equipment, and generators be equipped with best available control technology for reductions in NO_X and PM emissions to the greatest extent feasible. Acceptable options for

reducing emissions include the use of late-model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as they become available.

- Use coatings that are low in volatile organic compounds (VOCs) or ROGs and go beyond local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings)
- Modify the construction schedule to minimize simultaneous construction activity when possible.
- Use of zero-emission electric equipment to the degree feasible to reduce emissions, maintain air quality, and reduce noise impacts.
- Implement other measures to reduce emissions as they become available in the future.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding complaints. This person shall respond and take corrective action within 48 hours. The air district's general air pollution complaints number shall also be visible to ensure compliance with applicable regulations. In addition, the construction schedule and mitigation measures shall be posted. Notices shall be multilingual.

AMM-AQ-3: Implement Control Strategies to Reduce Greenhouse Gas Emissions

After detailed construction assessments are conducted, and impacts are identified, if necessary, include measures to reduce GHG emissions. Reductions in emissions can be accomplished by the measures listed below, as feasible. The list of strategies is informed by measures recommended by the BAAQMD (2023) to reduce construction-generated GHG emissions; as such, these measures should be updated as project-specific analyses are conducted.

- Require all on-road heavy-duty trucks, and marine equipment (where used), to be zero-emission or meet the most stringent emissions standard as feasible at the time of construction, such as a model-year (MY) standard, as a condition of contract.
- Minimize idling time, either by shutting equipment off when not in use or reducing the time of idling to no more than 2 minutes (a 5-minute limit is required by the State airborne toxics control measure [Title 13, Sections 2449(d)(3) and 2485 of the California Code of Regulations]). Provide clear signage that posts this requirement for workers at the entrances to the sites and develop an enforceable mechanism to monitor idling time and ensure compliance with this measure.
- Prohibit off-road diesel-powered equipment from being in the "on" position for more than 10 hours per day.

- Use CARB-approved renewable diesel fuel in off-road construction equipment and on-road trucks.
- Use EPA SmartWay-certified trucks for deliveries and equipment transport.
- Require all construction equipment to be maintained and properly tuned in accordance with manufacturer's specifications. Equipment should be checked by a certified mechanic and determined to be running in proper condition prior to operation.
- Where grid power is available, prohibit portable diesel engines and provide electrical hook-ups for electric construction tools, such as saws, drills, and compressors; use electric tools whenever feasible.
- Encourage and provide carpools, shuttle vans, transit passes, and/or secure bicycle parking to construction workers and offer meal options on-site or shuttles to nearby meal destinations for construction employees.
- Reduce electricity use in construction offices by using LED bulbs, powering off computers every day, and replacing heating and cooling units with more efficient ones.
- Minimize energy used during site preparation by deconstructing existing structures to the greatest extent feasible instead of demolishing structures and discarding all materials.
- Recycle or salvage non-hazardous construction and demolition debris, with a goal of recycling at least 15 percent more by weight than the diversion requirement in Title 24.
- Use locally sourced or recycled materials for construction materials (goal of at least 20 percent, based on costs for building materials and volume for roadway, parking lot, sidewalks, and curb materials). Wood products used should be certified through a sustainable forestry program.
- Use low-carbon concrete, minimize the amount of concrete used, and produce concrete on-site if it is more efficient and lower emitting than transporting ready-mix.
- Develop a plan to efficiently use water for adequate dust control because substantial amounts of energy can be consumed during the pumping of water.
- Purchase carbon offsets.
- Implement other measures to reduce emissions as they become available in the future.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding complaints. This person shall respond and take corrective action within 48 hours. The air district's general air

pollution complaints number shall also be visible to ensure compliance with applicable regulations. In addition, the construction schedule and mitigation measures shall be posted. Notices shall be multilingual.

For Alternatives B through G, the mitigation measures that follow would be necessary to reduce impacts.

AMM-AQ-4: Offset Construction-Generated Criteria Pollutants in the San Francisco Bay Area Air Basin

Offset construction-generated emissions that exceed federal *de minimis* levels to net zero. The preferred means of undertaking such offsite mitigation will be through a memorandum of understanding (MOU) with the Bay Area Clean Air Foundation (Foundation), a public nonprofit and supporting organization for the BAAQMD, or with the approval of BAAQMD, a partner agency that manages emissions incentive programs. The mitigation offset fee amount will be determined at the time of mitigation to fund one or more emissions reduction projects within the San Francisco Bay Area Air Basin (SFBAAB). The primary goal for emission reduction projects is to implement them as close to the source of emissions as possible. If this is not feasible, the next preference is to carry out these projects within the city, prioritizing areas that are heavily burdened by pollution. This can be determined using data from the air pollutant exposure zone, CalEnviroScreen, or similar sources. If these options are not viable, the projects should be executed within the larger SFBAAB. The terms and conditions of the MOU will be negotiated prior to groundbreaking of each future construction phase. To qualify under this mitigation measure, the specific emissions reduction project(s) must result in emissions reductions in the SFBAAB that are real, surplus, quantifiable, and enforceable and will not otherwise be achieved through compliance with existing regulatory requirements or any other legal requirement. Funding will need to be received prior to contracting with participants and should allow enough time to receive and process applications to fund off-site reduction projects prior to commencement of the project activities that are being offset.

AMM-AQ-5: Conduct Site-Specific Health Risk Assessments and Implement Measures to Reduce Public Exposure to Emissions

Require future construction located within 1,000 feet of sensitive receptors to perform a health risk assessment (HRA). Sensitive receptors are defined as facilities or land uses that include members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses, who are at a heightened risk of negative health outcomes due to exposure to air pollution. Locations where sensitive receptors congregate are considered sensitive receptor locations, such as housing units, parks, and schools. HRAs would be conducted during PED when construction specifics and sequencing are known. HRAs recommended for multiple mitigation measures may be consolidated for resource efficiency based on specific sites and in alignment with construction sequencing. If the HRA demonstrates health risks would be significant, additional feasible on- and off-site mitigation shall be analyzed to help reduce risks to the greatest extent practicable. Potential measures may include the following:

- Create buffers between residences and construction (e.g., vegetative barriers or other temporary buffers).
- Use construction equipment, including marine equipment, with the highest commercially available tier of emissions controls to the greatest extent practicable (in 2023, this is Tier 4).
- Use equipment during times when receptors are not present (e.g., when school is not in session or during non-school hours), as feasible.
- Establish staging areas for the construction equipment that are as distant as possible from off-site receptors, including existing residences.
- Where feasible, use haul trucks with on-road engines instead of off-road engines, even for on-site hauling.
- Provide financial assistance for high-efficiency air filtration systems to those affected for use in residences.
- Implement dust-suppression site controls to limit the exposure to potential contaminated soils, as necessary. Refer to the Hazardous, Toxic, and Radioactive Waste (HTRW)/soil quality section, as needed.
- Implement other measures to reduce emissions as they become available in the future.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding complaints. This person shall respond and take corrective action within 48 hours. The air district's general air pollution complaints number shall also be visible to ensure compliance with applicable regulations. In addition, the construction schedule and mitigation measures shall be posted. Notices shall be multilingual.

2.4 Cumulative and Other Impacts

The SFBAAB is the cumulative study area for air quality, while the global atmosphere is the cumulative study area for GHGs. Consequently, there are numerous past, present and reasonably foreseeable projects within these study areas. Implementation of the three AMMs and two MMs would reduce criteria pollutant emissions generated by the alternatives but would not avoid the exposure of receptors to substantial pollutant concentrations in localized areas. Other projects in the cumulative impacts area may implement comparable mitigation measures, such as using water or dust control chemicals to reduce fugitive dust or complying with relevant air quality regulations. Other cumulative projects may also contribute pollutant concentrations in the same localized areas affected by project construction. Thus, construction of the project would cumulatively contribute to existing localized air quality impacts in the study area but would not cumulatively contribute to regional air quality impacts. As a result, cumulative impacts relative to localized air quality would be ***significant and unavoidable***.

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.1.2
NOISE AND VIBRATION

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Acronyms and Abbreviations

Acronym	**Definition**
AMM	Avoidance and Minimization Measure
dBA	A-weighted decibel
Caltrans	California Department of Transportation
City	City and County of San Francisco
Ldn	Day-night Sound Level
dB	Decibel
EWN	Engineering with Nature
Leq	Equivalent Sound Level
Final IFR/EIS	Final Integrated Feasibility Report and Environmental Impact Statement
FTA	Federal Transit Administration
FWOP	Future Without Project Conditions
Lmax	Maximum Sound Levels
PPV	Peak Particle Velocity
SCMs	Standard Construction Measures
State	State of California
VdB	Vibration Decibels

1.0 Affected Environment

This section describes the regulatory setting and existing conditions for noise and vibration in the area of construction, evaluates the significance of impacts on sensitive land uses that could result from construction of the alternatives, and provides avoidance and minimization measures to reduce the significance of noise or vibration impacts.

Definitions of the noise and vibration terms used in this analysis are provided below.

- **A-weighted decibels (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear for low- to mid-level sounds. The dBA scale is the most widely used for environmental noise assessment.
- **Day-night sound level (Ldn).** The energy average of A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during nighttime hours between 10:00 p.m. and 7:00 a.m.
- **Decibel (dB).** A unitless measure of sound. Decibels use a logarithmic scale that indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure for airborne sound is 20 micropascals.
- **Equivalent sound level (Leq).** Leq represents an average of the sound energy occurring over a specified period. In effect, Leq is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The one-hour A weighted equivalent sound level (Leq(h)) is the energy average of A-weighted sound levels occurring during a one-hour period.
- **Maximum sound levels (Lmax).** The highest instantaneous sound level measured during a specified period.
- **Peak particle velocity (PPV).** A measurement of ground vibration, defined as the maximum speed at which a particle in the ground is moving, expressed in inches per second (in/sec). This is used for analysis of building damage due to groundborne vibration and as a measure of potential annoyance to sensitive receptors due to vibration from construction activities.
- **Vibration decibels (VdB).** Vibration velocity decibel level, expressed as a maximum value for repeated events from the same source. This is commonly used to evaluate vibration annoyance potential from permanent operating sources but is also used for long-term construction.

1.1 Regulatory Framework

1.1.1 Noise

Noise and vibration from construction equipment is regulated at the local level. The City and County of San Francisco (City) has adopted policies related to noise limits on individual items of construction equipment in Article 29, Sections 2907 and 2908 of the San Francisco Police Code. Additional criteria for analysis of noise and vibration effects on sensitive receptors are obtained from federal and State of California (State) guidance, and the California Building Code. A noise-sensitive receptor is an area where frequent use occurs and where a lowered noise level would be beneficial. Examples of noise-sensitive land uses include residences, schools, places of worship, and outdoor areas for commercial properties. The regulatory framework for noise and vibration is discussed in the sections that follow.

1.1.1.1 Federal

1.1.1.1.1 Federal Transit Administration Standards for Construction Noise

Construction noise and vibration effects are assessed using analysis methods recommended by the U.S. Department of Transportation for construction of large public works infrastructure projects. The Federal Transit Administration (FTA) has developed methods for evaluating construction noise levels, as described in the *Transit Noise and Vibration Impact Assessment Manual* (2018). Although these methods are not standardized criteria, they are often applied as guidelines for noise limits at sensitive land uses and used to describe noise levels that could result in a negative community reaction.

FTA guidelines for construction noise level criteria are shown in **Table D.1.2-1**. For residences, the recommended standard noise limits are 90 dBA, hourly equivalent noise level (Leq, 1 hour), during daytime hours (7:00 a.m. to 10:00 p.m.), and 80 dBA Leq, 1 hour during nighttime hours (10:00 p.m. to 7:00 a.m.)

Table D.1.2-1: Federal Transit Administration Criteria for Construction Noise

Land Use	1-hour Leq (dBA)	
	Day [a]	Night [a]
Residential	90	80
Commercial	100	100
Industrial	100	100

Source: Federal Transit Administration, 2018.

[a] Daytime hours are 7:00 a.m. to 10:00 p.m.; nighttime hours are 10:00 p.m. to 7:00 a.m.

dBA = A-weighted decibel

Leq = equivalent sound level

1.1.1.2 State

1.1.1.2.1 California Building Code

California Building Code Title 24 establishes minimum noise insulation standards to protect persons within new hotels, motels, dormitories, long-term care facilities, apartment houses, and dwellings other than single-family residences. Under this regulation, interior noise levels attributable to exterior noise sources cannot exceed 45 dBA Ldn in any habitable room.

1.1.1.3 Local

1.1.1.3.1 San Francisco Noise Ordinance

1.1.1.1.1.1 Construction (Sections 2907 and 2908)

Article 29 of the San Francisco Police Code regulates noise and establishes policies to prohibit excessive or unnecessary noise. Section 2907(a) prohibits any powered construction equipment that exceeds a sound level of 80 dBA, when measured at a distance of 100 feet. Impact tools, such as jackhammers and pavement breakers, are exempt from this requirement, but Section 2907(b) requires that all such equipment be used with manufacturer-approved acoustic shields.

Section 2908 addresses construction work at night. This prohibits construction between 8:00 p.m. and 7:00 a.m. if the resulting noise level would exceed the ambient noise level by 5 dB or more. This restriction can be waived or modified only by special permit issued by the Director of San Francisco Public Works. The decision to approve a permit would consider the potential for disturbance at nearby receptors. Disturbance from nighttime noise is more likely to occur in a neighborhood where there are existing residential receptors because of the potential for sleep disturbance. An approved nighttime construction permit would include conditions regarding the types of equipment to be used, as well as the allowed durations for nighttime use to minimize disturbances in the community. Contractors of development projects would be required to comply with these permit conditions.

1.1.1.1.1.2 Public Works' Standard Construction Measures for Noise

San Francisco Public Works requires all construction contractors to include standard construction measures (SCMs) in bid packages for the purposes of environmental protection. The noise SCM requires all projects to use best available noise control technologies on noise-generating equipment, to locate stationary noise sources away from sensitive receptors, and erect temporary noise barriers where applicable. For nighttime construction activities, additional requirements of the SCM include intake exhaust mufflers or acoustic shields or shrouds for impact tools, avoiding the use of water blasters, and minimizing the use of backup warning alarms.

1.1.2 Vibration

Groundborne vibration produced by construction equipment is generally localized around the site of construction activity. Vibration produced at a level high enough to be perceptible inside buildings can result in annoyance and sleep disturbance for occupants of the buildings. Vibration can also result in building or property damage, depending on the level of vibration at the affected structures.

1.1.2.1 Federal

FTA criteria regarding vibration annoyance potential from repeated events by the same source of vibration are shown in **Table D.1.2-2**. Vibration levels for FTA criteria are stated in terms of vibration velocity levels, or VdB. Generally, people are more sensitive to groundborne vibration during nighttime hours when sleeping than during daytime hours.

Table D.1.2-2: Federal Transit Administration Criteria for Groundborne Vibration

Land Use Category	Impact Levels (VdB [a] relative to 1 micro-in/sec)		
	Frequent Events [b]	Occasional Events [c]	Infrequent Events [d]
Category 1: Buildings where vibration would interfere with interior operations	65 [e]	65 [e]	65 [e]
Category 2: Residences and buildings where people normally sleep	72	75	80
Category 3: Institutional land uses with primarily daytime uses	75	78	83

Source: Federal Transit Administration, 2018.

Notes:

[a] VdB, or vibration velocity decibel levels, expresses vibration annoyance potential.

[b] "Frequent events" is defined as more than 70 vibration events from the same source per day.

[c] "Occasional events" is defined as 30 to 70 vibration events from the same source per day.

[d.] "Infrequent events" is defined as fewer than 30 vibration events from the same source per day.

[e] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels.

in/sec = inches per second

1.1.2.2 State

There are no state regulations related to construction-induced vibration. However, the California Department of Transportation (Caltrans) provides guidance regarding the evaluation of vibration impacts associated with construction activities in its *Transportation and Construction-Induced Vibration Guidance Manual* (Caltrans, 2020). The manual includes prediction methods, assessment procedures, and impact criteria regarding construction vibration. **Table D.1.2-3** contains guidelines developed by

Caltrans regarding building damage from the transient and continuous vibration that is usually associated with construction activity. The activities that are typically associated with single-impact (transient) or infrequent vibration include blasting and the use of drop balls or dropped metal plates. Impact pile drivers, “pogo stick” compactors (small handheld soil compactors), crack-and-seat equipment (equipment that breaks and re-seats pavement), excavation equipment, static compaction equipment, tracked vehicles, vehicles on highways, vibratory pile drivers, pile extraction equipment, and vibratory compaction equipment are typically associated with continuous vibration.

Table D.1.2-3: Vibration Guidelines for Potential Damage to Structures

Structure Type and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: California Department of Transportation, 2020.

Notes: Transient sources create a single, isolated vibration event (e.g., from blasting or the use of drop balls). Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

PPV = peak particle velocity; in/sec = inches per second

1.2 Existing Condition

1.2.1 Existing Noise and Vibration Sources

Noise levels in the area of construction and adjacent areas in all reaches are influenced by traffic, transit vehicles, construction, aircraft, watercraft, industrial, commercial, and other sources associated with a densely populated urban environment. The influence of each of these sources of noise on ambient levels depends on the proximity of receptors to transportation corridors and developed areas.

Ambient noise levels have been measured for previous environmental studies of projects along the Port waterfront. A noise measurement of 75 Ldn was taken in 2018 for the Better Market Street project, located in Reach 2 (San Francisco Planning Department, 2019). For the Pier 70 project, located in Reach 3 (Mission Creek/Mission Bay Reach), noise measurements taken in 2012 and 2015 were in the range of 58 to 68 Ldn, with an average value of 64 Ldn, influenced primarily by traffic, heavy equipment, and ship repair activities (San Francisco Planning Department, 2016). For the Warrior Arena (now known as the Chase Center) environmental study, located in Reach 3

(Mission Creek/Mission Bay Reach), ambient noise levels taken in 2014 were measured at a consistent value of 75 Ldn, due primarily to local traffic (San Francisco Planning Department 2015). Noise measurements were also taken for the Mission Rock development project in 2015, located in Reach 3 (Mission Creek/Mission Bay Reach), where ambient levels around the site were in the range of 64 to 83 Ldn, with an average value of 71 Ldn (San Francisco Planning Department, 2017). Noise levels in this area were influenced by traffic, light rail, construction noise, and noise from baseball games at Oracle Park (formerly AT&T Park). These levels are typical of an urban or a dense urban environment, based on historical measured levels taken in these settings (U.S. Environmental Protection Agency, 1971).

Sources of vibration include heavy trucks and transit vehicles producing vibration from contact between the moving wheel and the surface of the traveled way (rail or road). The levels of vibration associated with these sources are generally perceptible only within short distances, generally less than 100 feet from the source. Pile driving can produce vibration at distances of greater than 100 feet from the source, depending on the method of installation and the size of pile used.

1.2.2 Noise- and Vibration-Sensitive Land Uses

Noise- and vibration-sensitive land uses are generally defined as locations where people reside or where the presence of elevated noise could significantly affect use of the land. Typical sensitive land uses include residences, schools, hospitals, places of worship, and hotels. In general, in all reaches, the area surrounding the zones of construction consists of a mix of residential, recreational, commercial, and industrial uses. The area is generally densely populated with multi-family, condominium, and transient lodging uses that face the Port waterfront areas. Outdoor noise-sensitive receptors in the area also include parks, recreational uses, and outdoor dining areas. Outdoor areas are generally not considered to be sensitive to vibration. **Figure D.1.2-1** shows the sensitive receptors within and up to 1,000 feet from the zones of construction.

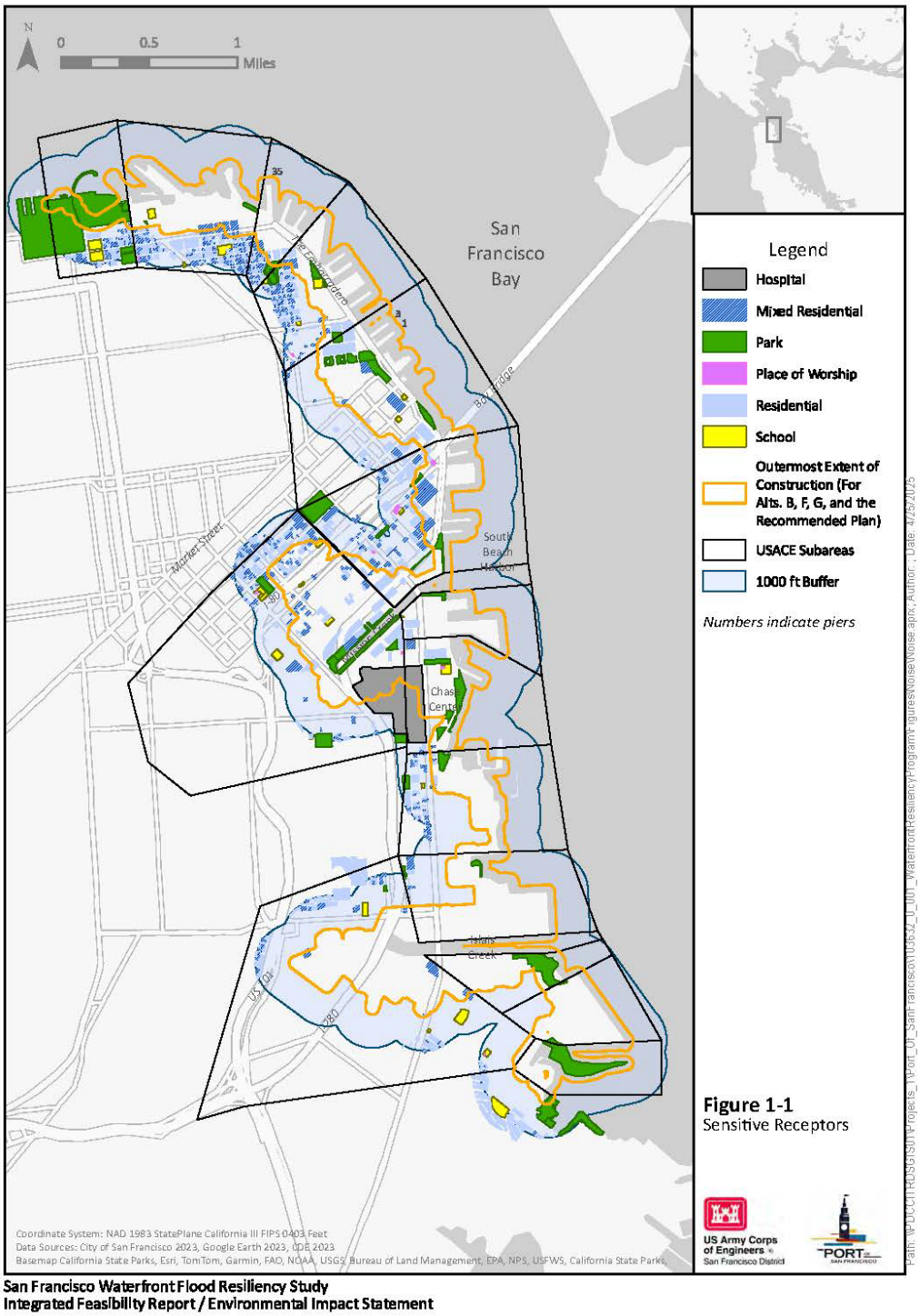


Figure D.1.2-1: Sensitive Receptors within and 1,000 Feet from the Zones of Construction

2.0 Environmental Consequences

2.1 Assessment Method

This section describes the methods used to analyze potential sound levels from heavy equipment during construction of adaptation measures and associated activities. Operation of the project would include the ongoing use of equipment to manage inland flooding and changes and redistribution of traffic on the City road network along the waterfront compared to Future without Project Conditions (FWOP) for both first and subsequent actions. A doubling of traffic volume would cause the sound level from traffic to increase by 3 dB, which is a perceptible increase in sound level. No impact from traffic is anticipated because none of the alternatives are expected to induce a doubling of traffic volume compared to FWOP conditions. Operation of Alternative F would require pumps for managing water from flooding events, which would be a source of operational noise on a permanent intermittent basis. Pump facilities would be required to be designed to comply with the City noise ordinance and are not a significant source of vibration.

2.1.1 Construction Equipment Noise

The assessment of potential construction noise levels was based on methodology developed by the FTA (2018) and construction noise criteria from applicable local guidance (such as local general plan documents or noise ordinances). Noise levels produced by commonly used construction equipment are shown in **Table D.1.2-4**. Pile drivers can be expected to generate maximum noise levels of 96 to 117 dBA, depending on the driving method and size of pile. Other types of heavy construction equipment generate maximum noise levels ranging from 80 to 90 dBA at a distance of 50 feet. The construction noise level at a given receptor location depends on the type of construction activity and the distance and shielding between the activity and noise-sensitive receptors.

Table D.1.2-4: Construction Equipment Noise Emission Levels

Equipment	Noise Level (dBA) at 50 Feet	Noise Level (dBA) at 100 Feet
Pile-driver (impact)	101 to 117	95 to 111
Pile-driver (sonic)	96	90
Impact Hammer (Hoe Ram)	90	84
Auger Drill Rig (for drilled piles)	85	79
Heavy Truck	84	78
Excavator	85	79
Bulldozer	85	79
Pump	81	75
Generator	81	75
Mixer	80	74

Equipment	Noise Level (dBA) at 50 Feet	Noise Level (dBA) at 100 Feet
Grader	85	79
Compactor	82	76

Source: Federal Transit Administration, 2018.

dBA = A-weighted decibel.

Construction equipment used would vary by component or construction phase of the alternatives and would involve the use of impact pile drivers (or possibly vibratory pile drivers or drills), excavators, bulldozers, heavy trucks, pumps, generators, graders, compactors, impact hammers, and other heavy equipment. To provide a conservative assessment, this construction noise analysis assumes that piles would be driven using impact methods. However, other methods may be used, such as vibratory or drilling methods, which would result in lower levels of noise levels relative to impact pile-driving. The source levels used to calculate noise exposure are based on the Lmax of equipment emission levels developed by FTA. The Leq value accounts for the energy-average of noise over a specified interval (usually 1 hour). For this analysis it is assumed a given piece of equipment may operate 100 percent of the time.

The analysis assumes that roads along waterfront areas of adaptation would be closed. In general, night work would not be required except for limited cases, such as for continuous concrete pours and ground improvements, which would progress in a linear fashion along the waterfront and are not high-impact activities.

Potential noise levels resulting from construction of the alternatives were evaluated by combining the noise levels of the three loudest pieces of equipment that would most likely operate at the same time (for example, an excavator, a bulldozer, and a truck being operated simultaneously during the site preparation phase) and applying the appropriate usage factor (percent of time equipment is in operation) to each piece of equipment. Sound levels from construction activities are calculated as a function of distance from the source(s), based on point-source attenuation over hard (i.e., acoustically reflective) ground, noting that 6 dB of reduction per doubling of distance can be assumed over hard ground.

2.1.1.1 Construction Equipment Vibration

With regard to potential vibration impacts during construction, such effects were evaluated using the construction vibration modeling methods from guidance by FTA. Worst-case construction vibration levels are provided and compared to FTA criteria for groundborne vibration and Caltrans vibration guidelines for building damage.

To provide a conservative assessment, this construction vibration analysis assumes that piles would be driven using impact methods. However, other methods may be used, such as vibratory or drilling methods, which would result in lower levels of noise levels relative to impact pile driving.

Source vibration levels for different types of construction equipment are shown in **Table D.1.2-5**.

Table D.1.2-5: Construction Equipment Vibration Levels

Equipment		Peak Particle Velocity (in/sec)			
		25 Feet	50 Feet	75 Feet	100 Feet
Pile Driver (impact)	Upper range	1.518	0.537	0.292	0.190
	Typical	0.644	0.228	0.124	0.081
Pile Driver (vibratory)	Upper range	0.734	0.260	0.141	0.092
	Typical	0.170	0.060	0.033	0.021
Clam Shovel Drop (slurry wall)		0.202	0.071	0.039	0.025
Vibratory Roller		0.210	0.074	0.040	0.026
Hoe Ram		0.089	0.031	0.017	0.011
Bulldozer		0.089	0.031	0.017	0.011
Caisson Drilling		0.089	0.031	0.017	0.011
Drill Rig (excavator mounted)		0.003	0.001	0.001	0.000
Loaded Trucks		0.076	0.027	0.015	0.010
Jackhammer		0.035	0.012	0.007	0.004

Source: Federal Transit Administration, 2018.

in/sec = inches per second.

2.1.2 Basis of Significance

An alternative would have a significant impact if it would:

- Generate a substantial temporary increase in ambient noise levels in the vicinity of the alternatives in excess of applicable federal, state or local criteria.
- Generate excessive groundborne vibration or groundborne noise levels.

The analysis evaluates noise levels from heavy equipment likely to be used for construction under each of the alternatives for both first and subsequent actions. Overall equipment noise levels were calculated for each phase of construction for each alternative. In accordance with FTA construction noise guidance, the noise levels assume simultaneous operation of the three loudest pieces of equipment for a given construction phase relative to receptors at specified distances from the noise source.

The following criteria will be evaluated to determine whether the alternatives would result in a substantial temporary increase in ambient noise.

- Compliance with San Francisco Police Code Section 2907(a), which limits noise from construction equipment to 80 dBA at 100 feet. Impact tools that exceed the limit are required to be fitted with mufflers, acoustical shields, or enclosures. As shown in **Table D.1.2-4**, except for pile drivers and hoe rams, construction of shoreline adaptation measures would meet the requirements of the City noise ordinance for individual pieces of equipment. The use of multiple pieces of equipment simultaneously on a construction site is evaluated separately, as discussed below.

- Construction phase inventory, schedule and duration for the alternatives are still in development at the time of this analysis. As such the evaluation considers the potential maximum construction noise exposures relative to the extent of construction. If any of the following three criteria are met, the heavy equipment noise from construction of the project would result in a significant impact:
    - Construction noise levels from the simultaneous use of the two loudest pieces of equipment would equal or exceed 90 dBA 1-hour Leq at the nearest sensitive receptor.
    - The simultaneous use of the two loudest pieces of equipment would result in a noise level that would exceed existing ambient levels by more than 10 dBA.
    - Construction during nighttime hours would result in noise levels that would equal or exceed 45 dBA at the interior of the nearest residence, motel, hotel, hospital, or convalescent home. An interior noise level of 45 dBA correlates to an exterior level of 70 dBA, assuming an indoor-to-outdoor noise reduction of at least 25 dBA. Interior noise levels of 45 dBA or lower are generally necessary to prevent sleep disturbance.
- Traffic generated by construction would result in a 3 dBA increase relative to No Action conditions.

Vibration from construction equipment is evaluated using the following criteria:

- Potential for construction-generated vibration to damage nearby buildings according to Caltrans vibration criteria for building damage in **Table D.1.2-5**.
- Construction-generated vibration could result in sleep disturbance to occupants of nearby buildings. This analysis assumes no high-impact activity, such as pile driving and demolition work would occur during nighttime hours. Concrete pours are generally not a significant source of vibration. As such, sleep disturbance due to vibration is not anticipated under the alternatives, and this effect is not discussed further in the section.
- Construction-generated vibration could result in interference or damage to equipment that is highly sensitive to vibration, such as medical or scientific instruments, according to FTA criteria for Category 1 vibration-sensitive use in **Table D.1.2-2**. This effect could occur where impact hammer pile driving is performed near buildings containing sensitive equipment but is unlikely to occur during the use of other types of heavy equipment.

2.2 Effects

Construction equipment noise and vibration levels are evaluated in this section for each of the alternatives. Noise impacts can result when people are exposed to noise from construction and demolition equipment, traffic, or operations as related to

implementation of the alternatives, where these are perceptible and sufficiently elevated over background or existing noise levels. Vibration can also result from construction equipment and traffic, particularly related to activities such as pile driving, and can cause damage to buildings and disturbance to residents, visitors, and workers.

2.2.1 Construction Impact Summary

Project noise impacts would consist of noise related to construction machinery and construction-related traffic. This section describes the methods used to analyze potential sound levels from heavy equipment during construction of adaptation measures and associated activities.

The construction noise level at a given receptor location depends on the type of construction activity and the distance and shielding between the activity and noise-sensitive receptors, such as residences and schools.

The assessment of potential construction noise levels was based on methodology developed by the FTA (2018) and construction noise criteria from applicable local guidance (such as local general plan documents or noise ordinances). Noise levels produced by commonly used construction equipment are discussed in the previous section 2.1, Assessment Methods.

For both first and subsequent actions, construction activities would produce a variety of noise and vibration levels depending on the type of equipment used and distance to sensitive receptors. Impact pile drivers would produce the highest levels of construction noise and vibration and thus would be the type of construction equipment most likely to exceed noise and vibration thresholds. Pile drivers can be expected to generate maximum noise levels of 96 to 117 dBA, depending on the driving method and size of pile. Other types of heavy construction equipment generate maximum noise levels ranging from 80 to 90 dBA at a distance of 50 feet. It is assumed that piles would be installed with use of an impact hammer, though a vibratory hammer may be used where feasible. Pile driving and related equipment would likely be operated from a barge when installing cofferdams, sheetpile, or bulkhead walls along the waterfront. Work in locations such as along edges of Mission or Islais Creek could take place from land. No pile driving would be performed at night. Piles would be installed along a linear path, and noise from pile driving would only exceed the daytime noise level criterion for intermittent periods for up to a week for a given receptor. Temporary construction vibration from impact pile driving could also result in damage to more fragile historic buildings, according to Caltrans Building Damage Criteria in **Table D.1.2-3**.

Temporary construction noise and vibration impacts would be minimized by implementing avoidance and minimization measures as described in the mitigation section below. Following completion of construction activities, construction noise and vibration impacts would cease and ambient noise levels would return to baseline conditions.

2.2.2 Operations and Maintenance Impact Summary

Operations and maintenance for both first and Subsequent Actions include the ongoing use of equipment to manage inland flooding and changes and redistribution of traffic on the City road network along the waterfront compared to FWOP conditions. A doubling of traffic volume would cause the sound level from traffic to increase by 3 dBA, which is considered a perceptible increase in sound level. No impact from traffic is anticipated because a doubling of traffic volume for either first or Subsequent Actions compared to FWOP conditions is not expected to occur under any of the alternatives.

Operational noise could include noise from operating tidal gates where used, and noise from pump stations that will be established to pump stormwater or combined sewer outflow to the Bay from inland areas. Operation of Alternative F, and depending on flood events, other alternatives as well, would require pumps for managing water from flooding events, which would be a source of operational noise on a permanent intermittent basis. However, pump facilities would be required to be designed to comply with the City noise ordinance and are not a significant source of vibration. Operation impacts would be ***less than significant*** for all alternatives.

2.2.3 Recommended Plan

The Recommended Plan first and Subsequent Actions would involve floodproofing of buildings and elevation of the shorelines and ground improvements for fortification against flooding risk.

Flood protection would be provided by raised and rebuilt seawalls, floodwalls and levees. The construction of levees and walls would require demolition of pavement and parking areas. Heavy trucks would deliver fill and material, and mixer trucks would be used to pour concrete for walls and fill areas. The levees would be paved once constructed. Engineering with nature (EWN) features along the shoreline would be added to provide ecological armoring. These measures would primarily use light-duty construction equipment, with occasional use of heavy trucks for deliveries. A crane operated from a barge may be used for placement of riprap and other materials along the shoreline.

Ground improvements to mitigate seismic risks would be included in both First Actions and subsequent actions. Concrete work and ground improvements would need to be made continuously for some features; therefore, the need for night work is likely.

Additional First Actions include the following measures: (1) robust coastal defense of the Ferry Building and the Agriculture Building including raising the Ferry Building, a utility-basement like substructure under the two buildings, and coastal defense on bayside edge; (2) deployable closure structures along the Mission Creek and Islais Creek bridges; (3) floodproofing buildings and infrastructure in Fisherman’s Wharf and (4) demolition of select buildings around Islais Channel, (5) living seawalls that will incorporate textured concrete into the design of any new vertical seawall wherever maritime uses and pier configuration allow.

Flood control measures would be designed to be adaptable to future sea level change events. Adaptations under Subsequent Actions would use similar equipment for raising walls and levees and additional ground improvements.

Table D.1.2-6 shows a summary of the noise impacts associated with the Recommended Plan.

Table D.1.2-6: Summary of Noise Impacts Associated with the Recommended Plan

Recommended Plan Noise Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Roadway Impact	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/ Footprint (1st Action)	3	3	4	3	3	4	3	3	4	3	3	3	3	1
Construction/Footprint (2nd Action)	3	3	4	1	1	1	3	1	4	3	3	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	2	2	3	2	2	3	2	2	3	2	2	2	2	2

* Denotes EWN measure.

2.2.3.1 Construction Noise

Construction of seawalls along the shorelines would produce the highest noise levels among the first and subsequent actions. Seawall piles would be 66 inches in diameter with 18-inch closure piles. The impact hammer force required to drive the seawall piles would be substantial given the size of the pile, and as such, noise levels from pile driving could be as high as 117 dBA at 50 feet from the pile hammer equipment. A noise level of this magnitude would exceed FTA construction noise criterion of 90 dBA 1-hour Leq at receptors up to a distance of 1,100 feet from the pile driver location.

Sheet-pile wall construction for terrace walls, cofferdams, and seepage barriers under the First Actions would produce a noise level of 101 dBA for an impact pile driver at a distance of 50 feet, as shown in **Table D.1.2-7**. A noise level of this magnitude would

exceed FTA construction noise criterion of 90 dBA 1-hour Leq at a distance of 175 feet from the pile-driver location. Wharf buildings at South Beach and Fisherman's Wharf would be raised in place and installed on new foundations. Pile drivers and heavy construction equipment would be used to build the new wharf support structures. Pile driving would be performed on an intermittent basis during the day, and, considering that piles would be installed along a linear path, few piles would be within 175 feet of any given receptor, noise from pile driving would only exceed daytime noise level criterion for up to a week.

The reconstruction of the Embarcadero roadway under the First Actions would use trucks, graders, bulldozers, and equipment similar to the types used for other adaptation measures. Adaptations under the Subsequent Actions would use similar equipment for raising walls and levees and additional ground improvements.

Noise levels anticipated from temporary construction activities under the Recommended Plan are shown in **Table D.1.2-7**.

Table D.1.2-7: Construction Equipment Noise Levels, Recommended Plan

Construction Activity	Equipment Used [a]	Overall Combined Source Level, dBA 1-hour Leq [b]			
		50 feet	100 feet	200 feet	400 feet
Demolition	Hoe Ram, Excavator, Heavy Truck	92	86	80	74
Pile Driving for Seawall and bulkheads	Impact Pile Driver (66-inch piles), Heavy Trucks	117	111	105	99
Sheet-Pile Wall Construction	Impact Pile Driver, Heavy Truck	101	95	89	83
Levee, Bridge and Wall Construction, Relocated buildings, Ground improvements, Roadway Reconstruction	Heavy Truck, Bulldozer, Grader	89	83	77	71

[a] The two or three loudest items of equipment that may operate in one location simultaneously.

[b] Distance calculations do not include the effects, if any, of local shielding from walls, topography or other barriers, which may further reduce sound levels.

Leq = equivalent sound level; dBA = A-weighted decibel.

As shown in **Figure D.1.2-1**, the construction extent overlaps and adjoins several areas of residential, mixed-residential, school, and park use. Construction of sheet-pile walls and demolition activities under the Recommended Plan could produce noise 10 dBA or greater above ambient levels, while also exceeding FTA criterion of 90 dBA 1-hour Leq at the nearest noise-sensitive receptors, which would be up to 1,100 feet away from the extent of construction, under the first and subsequent actions. In addition, FTA criteria for commercial use (100 dBA) may be exceeded up to 350 feet away from pile-driving

sites. With implementation of AMM-NOI-1, temporary noise impacts under the Recommended Plan would be ***significant and unavoidable***.

Due to extensive pile driving, the noise impact of the Recommended Plan would be greater than FWOP conditions (see section 2.2.4), but pile driving would be done on a temporary basis, and noise from pile drivers and other heavy equipment would cease once work is complete. As such the noise impact under the Recommended Plan would be shorter in duration than for FWOP. Construction work for the Recommended Plan would normally not be done under emergency conditions for flood fighting, so there would be a much lower need for night work compared to FWOP conditions. Measures to reduce noise in AMM-NOI-1 would be implemented under the Recommended Plan, in contrast to FWOP conditions, which would not require these measures due to the emergency nature of flood fighting.

2.2.3.2 Construction Vibration

Construction of First Actions under the Recommended Plan would require impact pile drivers for construction of the seawall along the northern waterfront. Due to the size of the piles and the force required for driving, structures within 100 feet of pile-driving activity could be exposed to vibration levels higher than the upper range of values shown in **Table D.1.2-5**. Due to the proximity of existing structures, vibration during pile driving of the seawall could result in damage to buildings along the waterfront, according to Caltrans Building Damage Criteria listed in **Table D.1.2-3**. Vibration levels may exceed the FTA criterion of 65 VdB for vibration sensitive use up to 1,000 feet away from pile-driving sites.

Heavy equipment types, such as jackhammers or hoe rams, used for demolition under the Recommended Plan would create a perceptible level of vibration, but only in the immediate vicinity of the equipment. Generally, vibration from these types of equipment is not perceptible more than 50 feet from the source. Subsequent actions would use conventional heavy equipment, which generate vibration that is similarly localized, and only perceptible about 50 feet from the source.

Therefore, pile-driving and demolition activities under the Recommended Plan could exceed Caltrans vibration criteria for building damage, and/or FTA criteria for construction vibration for any buildings containing sensitive equipment located within 1,000 feet of pile driving. Because of the size of piles that would be used, the potential effects on historic buildings and vibration sensitive uses would require a high degree of site-specific planning to mitigate vibration effects. The vibration effect under the Recommended Plan would be the same as Alternative F and greater than the other alternatives. Implementation of AMM-NOI-2 may not be sufficient to mitigate effects of vibration. Due to uncertainty of vibration effects from piles along the northern waterfront, vibration impacts under the Recommended Plan would be ***significant and unavoidable***.

Vibration impacts would be lower for the Recommended Plan compared to FWOP conditions. This is due to the lower amount of land potentially inundated in a 100-year flood scenario for the Recommended Plan compared to FWOP conditions. However, pile driving for the seawall and bulkheads with the Recommended Plan would cause

greater intensity of vibration for the receptors around those improvements compared to FWOP conditions.

The use of heavy equipment for the Recommended Plan would not normally be needed on an emergency basis for flood fighting, so measures to reduce vibration in AMM-NOI-2 would be implemented.

2.2.4 Alternative A: FWOP (No Action)

It was assumed no actions would be taken to reduce flood risks beyond projects already approved along the San Francisco waterfront as described in Section 2.4.6 in the Final Integration Feasibility Report and Environmental Impact Statement (final IFR/EIS); thus, the No Action Alternative has the potential to result in significant noise and vibration effects from increased maintenance, emergency response, and recovery activities to address coastal flooding including demolition and relocation of buildings within the inundation areas. The increased risk of coastal flooding increases the potential for damage to public and private properties, disruptions to utilities, interruptions to transportation services, and road closures. Potential noise and vibration impacts from construction and operation for existing and planned projects as well as emergency response, recovery, and clean up were considered for the FWOP scenario.

Identifying the specific noise and vibration generating activities under the FWOP involves a high degree of uncertainty because the timing, type, and magnitude of maintenance, construction, response, and relocation would be strongly influenced by the severity of storms, which are unpredictable. While it is improbable to fully estimate all noise and vibration levels, an estimate of the ranges of noise and vibration generating equipment was made for the potential construction projects in Section 2.4.6 of the final IFR/EIS. Construction equipment noise at 50 feet is estimated to be 80-117 A-weighted decibel (dBA) and at 100 feet is estimated to be 74-111 dBA. Construction equipment vibration in Peak Particle Velocity (PPV) is estimated to be 0.003-1.518 inches per second (in/sec) at 25 feet and 0.000-0.190 in/sec at 100 feet. It is likely noise and vibration impacts would be significant.

2.2.4.1 Construction Noise

A flooding event would require the use of a considerable amount of heavy equipment for emergency flood-fighting and cleanup actions, commensurate with the size of the flood. The presence of heavy equipment and associated transportation would generate noise in the areas they are protecting. Buildings and infrastructure damaged by flooding would need to be demolished and the services provided would need to be relocated to other areas of the City, requiring new construction. Demolition would require the use of heavy equipment such as wrecking balls, jackhammers, hoe rams, heavy trucks, excavators, and bulldozers.

Alternative A could involve use of a considerable amount of heavy trucks and earthmoving equipment to respond to flooding events. These activities would be reactive to flooding events as they occur. Construction of new buildings and

infrastructure would increase within inland areas of the City to replace assets and property lost to flooding events. The frequency and duration of these activities would be commensurate with flooding events; however, the use of heavy equipment for flood fighting on an emergency basis would very likely be substantial and could be any hour of the day or night. As such, there is a high potential for sleep interference due to emergency flood-fighting activities.

Under Alternative A, heavy equipment noise during flood fighting could occur at any location for an unknown span of time, affecting receptors within and surrounding areas of inundation. For all types of land uses needing to be relocated due to flooding events, redevelopment of zones to accommodate residents and businesses displaced by flooding could potentially occur at any location within the City. These redevelopment projects would involve all phases of building construction, including demolition, grading, building construction, and paving. The extents of redevelopment areas would be commensurate to the scale of losses from flooding, and the duration and intensity of construction noise would vary widely relative to specific receptors.

In areas of redevelopment, AMM-NOI-1 is available to reduce the impact of noise from heavy equipment. However, due to the emergency nature of flood fighting activities and potential for large areas of the City to be inundated without a LOD, heavy equipment would be required within City neighborhoods and in close proximity to structures. Emergency work would occur day and night, resulting in noise levels exceeding FTA criteria at surrounding receptors. Construction activity would have varying intensity and duration in different areas of the City, depending on the level of flood fighting required or extent of redevelopment. Implementation of noise mitigation would not be required where heavy equipment is used on an emergency basis per Section 2907 of the Police Code. For these reasons, noise impacts under Alternative A would be ***significant and unavoidable***.

2.2.4.2 Construction Vibration

Heavy equipment types used for responses to substantial flooding and demolition under Alternative A would create a perceptible level of vibration in the immediate vicinity of the equipment. It is unlikely that high-impact equipment, such as pile drivers, would be used for these types of activities, although jackhammers and hoe rams may be used for demolition. The relocation of services and properties to as yet unknown areas would use heavy equipment that may potentially produce vibration near sensitive receptors and historic buildings that are more susceptible to building damage. The frequency and duration of these activities would be commensurate with flooding events, which could occur on an emergency basis within residential areas with a high risk or flooding.

Relocation of buildings to other areas of the City would involve the use of vibration-generating heavy equipment for site preparation, grading, building construction and paving. In situations where deep support systems are needed for building foundations, vibratory or impact pile driving may be used. Because potential sites for future development are not known, there is no data available currently to identify impacts to specific receptors from redevelopment in other areas of the City.

Demolition and reconstruction activities under Alternative A could potentially exceed Caltrans vibration criteria for building damage in Table 1-3 and/or FTA criteria for construction vibration in Table 1-2 in situations where heavy equipment is operated within 50 feet of existing buildings. Due to the emergency nature of flood fighting activities and potential for large areas of the City to be inundated without a LOD, heavy equipment would be required within City neighborhoods and in close proximity to structures.

In areas of redevelopment, AMM-NOI-2 is available to reduce the impact of vibration from heavy equipment. However, due to the emergency nature of flood fighting activities, implementation of vibration mitigation would not be feasible within and surrounding areas inundated by flooding. For these reasons, vibration impacts under Alternative A would be **significant and unavoidable**.

2.2.5 Alternative B: Nonstructural

Alternative B involves a combination of dry floodproofing of certain buildings, relocation of buildings and assets, and a planned retreat from areas susceptible to frequent flood events. There would be no structural changes to the shoreline for the purpose of managing flooding events, apart from currently approved projects.

2.2.5.1 Construction Noise

Land uses in areas where there is a higher risk of flooding would be managed for retreat and relocation to inland areas of the City or region. The managed retreat would require demolition of some buildings and infrastructure in areas where natural flooding would be allowed under Alternative B. Demolition would require the use of heavy equipment, such as wrecking balls, jackhammers, hoe rams, heavy trucks, excavators, and bulldozers. The buildings and infrastructure in areas of retreat would be relocated inland or be modified. Building of transportation and transit causeways may be done for some transportation systems to raise the elevation of highways or railways above flooding levels.

Policy changes would be required to allow for redevelopment at higher densities in other areas of the City. Redevelopment would involve all phases of building construction, including demolition, grading, building construction, and paving. Depending on policy choices, equipment noise from redevelopment could theoretically occur at any scale or location within the City. As such, noise and vibration impacts would be expected, but there is no data available currently to identify impacts to specific receptors from redevelopment in other areas of the City.

Dry floodproofing of individual buildings would involve material delivery and use of light-duty construction equipment. These activities would generally be short term (i.e., less than a month for an individual building) and would require little or no use of heavy-duty equipment.

Noise levels from construction activities under Alternative B are shown in **Table D.1.2-8**.

Table D.1.2-8: Construction Equipment Noise Levels, Alternative B

Construction Activity	Equipment Used [a]	Overall Combined Source Level, dBA 1-hour Leq [b]			
		50 feet	100 feet	200 feet	400 feet
Demolition	Hoe Ram, Excavator, Heavy Truck	92	86	80	74
Site Preparation (for redevelopment projects)	Heavy Truck, Bulldozer, Grader	89	83	77	71
Building Construction (for redevelopment projects)	Crane, Loader	85	79	73	67
Paving (for redevelopment projects)	Roller, Loader	86	80	74	68

Note: Distance calculation do not include the effects, if any, of local shielding from walls, topography or other barriers which may further reduce sound levels.

[a] The two or three loudest items of equipment that may operate in one location simultaneously.

[b] Distance calculations do not include the effects, if any, of local shielding from walls, topography or other barriers, which may further reduce sound levels.

Leq = equivalent sound level; dBA = A-weighted decibel.

Demolition and reconstruction activities under Alternative B could exceed FTA criteria (i.e., 90 dBA 1-hour Leq) at the nearest noise-sensitive receptor or result in an increase of 10 dBA or more above the ambient noise level at receptors up to 60 feet away from construction areas. With implementation of AMM NOI-1, noise impacts under Alternative B would be ***less than significant***.

The noise impact of Alternative B would be lower than FWOP conditions (see section 2.2.4). Under Alternative B the amount of land potentially inundated in a 100-year flood scenario would be the same as FWOP conditions. However, construction work for Alternative B would normally not be done under emergency conditions for flood fighting, so there would be a much lower need for night work compared to FWOP conditions. Measures to reduce noise in AMM-NOI-1 would be implemented under Alternative B, in contrast to FWOP conditions, which would not require these measures due to the emergency nature of flood fighting.

2.2.5.2 Construction Vibration

Heavy equipment types, such as jackhammers or hoe rams, used for demolition under Alternative B would create a perceptible level of vibration in the immediate vicinity of the equipment. Because the retreat would be managed and would involve groups of buildings within areas of flooding, vibration effects would generally only be a concern where there are historic buildings directly adjacent to areas of demolition.

Demolition and reconstruction activities under Alternative B could exceed Caltrans vibration criteria for building damage listed in **Table D.1.2-3**, and/or FTA criteria for

construction vibration listed in **Table D.1.2-2**. With implementation of AMM-NOI-2, vibration impacts under Alternative B would be ***less than significant***.

Vibration impacts would be slightly lower for Alternative B compared to FWOP conditions. While the amount of land potentially inundated in a 100-year flood scenario for Alternative B would be the same as FWOP conditions, the use of heavy equipment for Alternative B would not normally be needed on an emergency basis for flood fighting. Measures to reduce vibration in AMM-NOI-2 would be implemented, reducing vibration impacts from construction.

2.2.6 Alternative F: Manage the Water, Scaled for Higher Risk

Flood-protection measures under Alternative F include tide gates in Mission Creek and Islais Creek to manage sea-level rise and seawalls and bay fill along the northern waterfront, levees, and walls. Measures would be adaptable under Subsequent Actions to additional sea-level rise in 2090.

Table D.1.2-9 shows a summary of the noise impacts associated with Alternative F.

Table D.1.2-9: Summary of Noise Impacts Associated with Alternative F

Alternative F Noise Impact Rating by Measure	**Bay fill**	**Levee**	**Bulkhead wall/Seawall**	**Roadway Impact**	**Tide Gate**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Marsh Enhancement***
Construction Footprint	3	3	4	3	4	3	3	3	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	2	2	3	2	3	2	2	2	2	2	2

* Denotes EWN measure.

2.2.6.1 Construction Noise

First actions under Alternative F include the placement of fill in the Bay and construction of extensive seawalls along the northern waterfront for approximately 2.5 miles. Seawall piles would be 66 inches in diameter, in addition to 18-inch closure piles. The impact hammer force required to drive the seawall piles would be substantial given the size of the pile, and as such, noise levels from pile driving could be as high as 117 dBA at 50 feet from the pile hammer equipment. A noise level of this magnitude would exceed

FTA construction noise criterion of 90 dBA 1-hour Leq at receptors up to a distance of 1,100 feet from the pile driver location.

The building of tide gates would require pile driving for installation of temporary cofferdams for in-water work. The gate structures would be built using cast-in-place methods.

Flood protection would be provided by cast-in-place walls and levees. The construction of levees and walls would require demolition of pavement and parking areas. Heavy trucks would deliver fill and material, and mixer trucks would be used to pour concrete for walls and fill areas. The levees would be paved once constructed. Alternative F would also include engineering with nature (EWN) features along the shoreline to provide ecological armoring. These measures would primarily use light-duty construction equipment, with occasional use of heavy trucks for deliveries. A crane operated from a barge may be used for placement of riprap and other materials along the shoreline.

Flood control measures would be designed to be adaptable to future sea level change events. Adaptations under Subsequent Actions would use similar equipment for raising walls and levees and additional ground improvements.

Noise levels from construction activities under Alternative F are shown in **Table D.1.2-10**.

Table D.1.2-10: Construction Equipment Noise Levels, Alternative F

Construction Activity	Equipment Used [a]	Overall Combined Source Level, dBA 1-hour Leq [b]			
		50 feet	100 feet	200 feet	400 feet
Demolition	Hoe Ram, Excavator, Heavy Truck	92	86	80	74
Pile Driving for Seawall and bulkheads	Impact Pile Driver (66-inch piles), Heavy Trucks	117	111	105	99
Pile Driving for tide gate cofferdams	Impact Pile Driver	101	95	89	83
Levee, Shoreline extension, Ground Improvement, Bridge and Wall Construction, EWN features	Heavy Truck, Bulldozer, Grader	89	83	77	71

[a] The two or three loudest items of equipment that may operate in one location simultaneously.

[b] Distance calculations do not include the effects, if any, of local shielding from walls, topography or other barriers, which may further reduce sound levels.

Leq = equivalent sound level; dBA = A-weighted decibel.

As shown in **Figure D.1.2-1**, the construction extent overlaps and adjoins several areas of residential, mixed-residential, school, and park use. Demolition activities under Alternative F could produce noise 10 dBA or greater above ambient levels while also

exceeding FTA criterion of 90 dBA 1-hour Leq at the nearest noise-sensitive receptors, which would be up to 60 feet away from the extent of construction. Impact pile driving may exceed these levels up to 1,100 feet away from pile-driving sites. In addition, FTA criteria for commercial use (100 dBA) may be exceeded up to 350 feet away from pile-driving sites. Implementation of AMM-NOI-1 would reduce noise levels from construction, but the magnitude of pile driving noise during construction of the seawall would be difficult to mitigate and would likely be disruptive to daytime activities in the area. As such, noise impacts under Alternative F would be ***significant and unavoidable***.

The noise impact of Alternative F would be lower than FWOP conditions (see section 2.2.4). Under Alternative F a LOD would be established to limit areas of potential flooding, resulting in up to 403 acres of land potentially inundated in a 100-year flood scenario, compared to 1,337 acres under FWOP conditions. However, pile driving for the seawall and bulkheads with Alternative F would cause greater intensity of noise for the receptors around those improvements compared to FWOP conditions.

Construction work for Alternative F would normally not be done under emergency conditions for flood fighting, so there would be a much lower need for night work compared to FWOP conditions. Measures to reduce noise in AMM-NOI-1 would be implemented under Alternative F, in contrast to FWOP conditions, which would not require these measures due to the emergency nature of flood fighting.

2.2.6.2 Construction Vibration

Construction of First Actions under Alternative F would require impact pile drivers for construction of the seawall along the northern waterfront. Due to the size of the piles and the force required for driving, structures within 100 feet of pile-driving activity could be exposed to vibration levels higher than the upper range of values shown in **Table D.1.2-2**. Due to the proximity of existing structures, vibration during pile driving of the seawall could result in damage to buildings along the waterfront, according to Caltrans Building Damage Criteria listed in **Table D.1.2-3**. Vibration levels may exceed the FTA criterion of 65 VdB for vibration sensitive use up to 1,000 feet away from pile-driving sites.

Heavy equipment types, such as jackhammers or hoe rams, used for demolition under Alternative F would create a perceptible level of vibration, but only in the immediate vicinity of the equipment. Generally, vibration from these types of equipment is not perceptible more than 50 feet from the source. Subsequent actions would use conventional heavy equipment, which generate vibration that is similarly localized, and only perceptible about 50 feet from the source.

Therefore, pile-driving and demolition activities under Alternative F could exceed Caltrans vibration criteria for building damage, and/or FTA criteria for construction vibration for any buildings containing sensitive equipment located within 1,000 feet of pile driving. Because of the size of piles that would be used, the potential effects on historic buildings and vibration sensitive uses would be greater than the other alternatives and would require a great high degree of site-specific planning to mitigate vibration effects. Implementation of AMM-NOI-2 may not be sufficient to mitigate effects

of vibration. Due to uncertainty of vibration effects from piles along the northern waterfront, vibration impacts under Alternative F would be ***significant and unavoidable***.

Vibration impacts would be lower for Alternative F compared to FWOP conditions. This is due to the lower amount of land potentially inundated in a 100-year flood scenario for Alternative F compared to FWOP conditions. However, pile driving for the seawall and bulkheads with Alternative F would cause greater intensity of vibration for the receptors around those improvements compared to FWOP conditions.

The use of heavy equipment for Alternative F would not normally be needed on an emergency basis for flood fighting, so measures to reduce vibration in AMM-NOI-2 would be implemented.

2.2.7 Alternative G: Partial Retreat, Scaled for Higher Risk

Alternative G includes structural floodproofing measures that would adapt the shoreline to natural flooding in the City. This would include building levees or walls in some areas and demolishing or relocating buildings, transportation systems, and assets that lie within areas of natural flooding.

Table D.1.2-11 shows a summary of the anticipated noise impacts associated with Alternative G.

Table D.1.2-11: Summary of Noise Impacts Associated with Alternative G

Alternative G Noise Impact Rating by Measure	**Levee**	**Bridge raise**	**Bulkhead wall/Seawall**	**Roadway Impact**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Embankment Shoreline***	**Naturalized Shoreline***	**Marsh Enhancement***
Construction/Footprint	3	3	3	3	3	3	3	3	3	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	2	2	2	2	2	2	2	2	2	2	2	2

* Denotes EWN measure.

2.2.7.1 Construction Noise

Under Alternative G, first and Subsequent Actions would be similar to the TNBP. Levees, walls and T-walls would be constructed for fortification against flooding risk. Bridge crossings over Mission Creek and Islais Creek would be raised (rather than building closure structures as indicated for the TNBP), which would require demolition of existing bridges and building of truss bridges at a higher elevation to adapt to sea level change. Heavy trucks would deliver fill and material, and mixer trucks would be used to pour concrete for walls and fill areas. Roadways would be reconstructed to conform to revised elevation changes landward of new walls. Concrete work and ground improvements would need to be done continuously for some features; therefore, the need for night work is likely.

Demolition, relocation or reconstruction of buildings and infrastructure in areas of managed retreat would be similar to the TNBP. The building of EWN shoreline adaptation measures would be similar to Alternative F.

Noise levels from construction activities under Alternative G are shown in **Table D.1.2-12**.

Table D.1.2-12: Construction Equipment Noise Levels, Alternative G

Construction Activity	Equipment Used [a]	Overall Combined Source Level, dBA 1-hour Leq [b]			
		50 feet	100 feet	200 feet	400 feet
Demolition	Hoe Ram, Excavator, Heavy Truck	92	86	80	74
Levee, Bridge and Wall Construction, Ground Improvement	Heavy Truck, Bulldozer, Grader	89	83	77	71
Site Preparation (for redevelopment projects)	Heavy Truck, Bulldozer, Grader	89	83	77	71
Building Construction (for redevelopment projects)	Crane, Loader	85	79	73	67
Paving (for redevelopment projects)	Roller, Loader	86	80	74	68

[a] The two or three loudest items of equipment that may operate in one location simultaneously.

[b] Distance calculations do not include the effects, if any, of local shielding from walls, topography or other barriers, which may further reduce sound levels.

Leq = equivalent sound level; dBA = A-weighted decibel.

As shown in **Figure D.1.2-1**, the construction extent overlaps and adjoins several areas of residential, mixed-residential, school, and park use. Construction and demolition activities under Alternative G could produce noise 10 dBA or greater above ambient

levels while also exceeding FTA criterion of 90 dBA 1-hour Leq at the nearest noise-sensitive receptors, which would be up to 60 feet away from the extent of construction.

With implementation of AMM-NOI-1, noise impacts under Alternative G would be ***less than significant***.

The noise impact of Alternative G would be lower than FWOP conditions (see section 2.2.4). Under Alternative G a LOD would be established to limit areas of potential flooding, resulting in up to 719 acres of land potentially inundated in a 100-year flood scenario, compared to 1,337 acres under FWOP conditions. Construction work for Alternative G would normally not be done under emergency conditions for flood fighting, so there would be a much lower need for night work compared to FWOP conditions. Measures to reduce noise in AMM-NOI-1 would be implemented under Alternative G, in contrast to FWOP conditions, which would not require these measures due to the emergency nature of flood fighting.

2.2.7.2 Construction Vibration

Heavy equipment types, such as jackhammers or hoe rams, used for demolition under Alternative G would create a perceptible level of vibration in the immediate vicinity of the equipment. Because the retreat would be managed and would involve groups of buildings in areas of flooding, vibration effects under both first and Subsequent Actions would generally only be a concern where there are historic buildings directly adjacent to areas of demolition.

Reconstruction of the buildings that were demolished within areas of flooding would involve the use of heavy equipment for site preparation, grading, building construction, and paving. In situations where deep support systems are needed for building foundations, vibratory or impact pile driving may be used. Because potential sites for future development are not known, there is no data available currently to identify impacts to specific receptors from redevelopment in other areas of the City. Considering the high densities of existing development throughout the City, vibration from construction equipment in areas of reconstruction could result in building damage based on Caltrans criteria listed in **Table D.1.2-3**.

Demolition and reconstruction activities under Alternative G could exceed Caltrans vibration criteria for building damage listed in, and/or FTA criteria for construction vibration listed in **Table D.1.2-2**, in situations where heavy equipment is operated within 50 feet of existing buildings. With implementation of AMM-NOI-2, vibration impacts under Alternative G would be ***less than significant***.

Vibration impacts would be lower for Alternative G compared to FWOP conditions. This is due to the lower amount of land potentially inundated in a 100-year flood scenario for Alternative G compared to the FWOP conditions. The use of heavy equipment for Alternative G would not normally be needed on an emergency basis for flood fighting, so measures to reduce vibration in AMM-NOI-2 would be implemented.

2.3 Mitigation

The following AMMs can be implemented to reduce impacts due to construction noise and vibration.

AMM-NOI-1 Use Best Noise Control Practices during Construction

The U.S. Army Corps of Engineers will prepare a noise control plan that will specify methods the contractor will implement to minimize construction equipment noise levels at sensitive receptors (i.e. residences, hotels, schools, parks, outdoor recreational use areas, and outdoor commercial use areas). Additional analysis on construction phasing, duration, and the location of measures will inform a site-specific evaluation of the noise control measures most appropriate for implementation.

Best practices to minimize construction noise include the following.

- Limiting heavy equipment use to daytime hours not regulated by the City, between 7:00 a.m. and 8:00 p.m.
    - Limiting pile driving to times of day that would be least disruptive to residences, hotels, motels, hospitals, or convalescent homes.
- Locating stationary equipment (e.g., generators, pumps, cement mixers, idling trucks) as far as possible from noise-sensitive land uses.
- Requiring that all construction equipment powered by gasoline or diesel engines have sound-control devices, such as exhaust mufflers, that are at least as effective as those originally provided by the manufacturer and that all equipment be operated and maintained to minimize noise generation.
- Using equipment powered by electric motors instead of gasoline- or diesel-powered engines.
- Preventing excessive noise by shutting down idle vehicles or equipment.
- Using noise-reducing enclosures around noise-generating equipment.
- Using noise-reducing shrouds for impact pile drivers, where feasible.
- Selecting haul routes that affect the fewest number of people.
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (e.g., terrain, structures) to block sound transmission to noise-sensitive land uses. The barriers should be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment.
- Notifying adjacent residents in advance of construction work regarding duration of construction and mitigation employed. Notices would include liaison contact information and would be multilingual.

AMM-NOI-2 Vibration Control

Prior to construction, the construction contractor will designate a community liaison to respond to complaints about vibration caused by construction of adaptation measures. Through the community liaison, the contractor will provide notification to all property owners and occupants of buildings within 200 feet of pile-driving locations at least 10 days prior to the start of construction informing them of the estimated start date and duration of vibration-generating construction activities. These notifications will also be provided to buildings containing vibration sensitive equipment within 800 feet of pile-driving locations.

For demolition of structures, the contractor will provide notification through the community liaison to all property owners and occupants of buildings within 25 feet of demolition areas at least 10 days prior to the start of construction, informing them of the estimated start date and duration of demolition at the site. Notices would include liaison contact information and would be multilingual. These notifications will also be provided to buildings containing vibration sensitive equipment within 125 feet of demolition sites.

- The following measures will be implemented on a case-by-case basis to address potential vibration impacts to structures during construction:
- Evaluate potential for damage to individual buildings from ground borne vibration based on vibration criteria in Table 1-3. This evaluation should be done for buildings within 200 feet of pile driving sites and/or buildings within 25 feet of demolition sites.
- At vibration-sensitive buildings identified to be potentially affected during pile-driving or demolition, conduct vibration monitoring during pile-driving or demolition as applicable.
- Prepare a building condition report prior to and after pile-driving or demolition for potentially affected buildings. If new cracks or damages are found, the contractor will remediate building damages found to occur.
- Coordinate with managers of buildings containing sensitive equipment to determine actions for avoiding impacts on vibration-sensitive equipment, based on specifications of equipment and hourly/daily schedule of use.
- Additional measures to reduce groundborne vibration from pile driving include:
- Using smaller, lower vibration generating equipment within 200 feet of potentially affected buildings.
- Using alternative pile-driving methods such as vibratory hammers, hydraulic press-in driving, or use of predrilled pile holes.
- Preparing a pile driving schedule that includes driving method(s), locations, pile types, sizes, number of blows and times of day that driving would be done.

2.4 Cumulative and Other Impacts

2.4.1 Noise

Construction activities under the alternatives could coincide with construction activities associated with cumulative projects, resulting in a combined increase in construction noise. In general, the potential for projects to overlap, resulting in combined or prolonged increases in ambient noise, is more likely when the construction noise influence areas of two or more projects overlap. As such, the cumulative noise from simultaneous construction activity in proximity to one another could result in higher noise levels than would otherwise occur with one project under construction. Construction of multiple projects consecutively could increase the duration of construction noise levels that would be 10 dBA above the ambient noise level or 90 dBA at sensitive receptors. Given that the adaptations constructed under the alternatives would occur along the shoreline in the vicinity of Embarcadero Early Projects and other ongoing construction, the alternatives would make a considerable contribution to the significant cumulative construction noise impact. Implementation of AMM-NOI-1 would reduce the contribution to cumulative noise, but cumulative noise may still be **significant and unavoidable** where coincident construction occurs in proximity.

2.4.2 Vibration

Because of the highly localized nature of vibration from heavy equipment, vibration from two projects near one another would generally not combine to further increase vibration levels. Therefore, vibration from the alternatives would not combine with vibration from cumulative projects. This cumulative impact would be ***less than significant***.

3.0 References

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.1.3 SOCIOECONOMICS AND COMMUNITIES

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Acronyms and Abbreviations

Acronym	Definition
ADA	Americans with Disabilities Act
AMM	avoidance and minimization measures
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
City	City and County of San Francisco
EIS	Environmental Impact Statement
EO	Executive Order
EWN	Engineering With Nature
IFR/EIS	Integrated Feasibility Report and Environmental Impact Statement
FWOP	Future without Project Conditions
GIS	geographic information system
LOD	line of defense
NEPA	National Environmental Policy Act
OSE Report	Other Social Effects Report
Port	Port of San Francisco
Public Works	City and San Francisco Public Works
SFMTA	San Francisco Municipal Transportation Agency
SoMa	South of Market
U.S.C.	United States Code
Uniform Act	Uniform Relocation Assistance and Real Property Acquisition Policies Act

USACE	U.S. Army Corps of Engineers

1.0 Affected Environment

1.1. Regulatory Framework

- Title VI of the Civil Rights Act - Title VI of the Civil Rights Act of 1964 (42 United States Code [U.S.C.] § 2000(d) et seq.) prohibits discrimination on the basis of race, color, and national origin in programs and activities receiving federal financial assistance. Under Title VI, each federal agency is required to make sure that no person, on the grounds of race, color, or national origin, is excluded from participation in, denied the benefits of, or subjected to discrimination under any program or activity receiving federal financial assistance.
- Americans with Disabilities Act of 1990 - The Americans with Disabilities Act of 1990 extends the protection of the Civil Rights Act of 1964 to people with disabilities, prohibiting discrimination in public accommodations, transportation, or other services.
- Protection of Children from Environmental Health Risks and Safety Risks (EO 13045) - EO 13045 requires federal agencies to minimize environmental health and safety risks to children and to prioritize the identification and assessment of environmental health and safety risks that may have a disproportionate impact on children.
- Americans with Disabilities Act (42 U.S.C. §§ 12101–12213) - The Americans with Disabilities Act (ADA) (42 U.S.C. §§ 12101–12213) prohibits discrimination against persons with disability and requires equal opportunity in employment, state and local government services, public accommodations, commercial facilities, and transportation.
- Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. § 61) - The Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act) requires that persons displaced as a result of a federal action or undertaking involving federal funds must be treated fairly, consistently, and equitably. The Uniform Act outlines a process to provide displaced persons fair and just compensation for any acquisition of property taken for the project. The Uniform Act also requires relocation assistance and benefits to displaced persons.

1.2. Existing Condition

1.2.1. Study Area

The reference community is the area that represents the general population that could be affected adversely or beneficially by the alternatives. For this study, the reference community is the City and County of San Francisco (City). Information for the City is

presented throughout this analysis to provide context and allow for comparison and contrast among census blocks within the study area.

The study area for direct and indirect effects for socioeconomics and for minority populations and low-income populations encompasses the census blocks within the maximum project alternative area footprint plus a 200-foot buffer, and that would experience flooding under the 2090-sea-level rise plus 100-year storm event as addressed in Section 2, *Existing and Future Without Project Conditions*, in the Final Integrated Feasibility Report and Environmental Impact Statement (final IFR/EIS). This is the area in which direct impacts on communities associated with construction and property displacement are most likely to occur related to Alternatives B, F, and G and the Recommended Plan along with adjoining areas that might be indirectly affected. Refer to **Figure D.1.3-1**, for a visual of the study area including the census blocks, the outermost extent of construction for all alternatives, U.S. Army Corps of Engineers (USACE) reaches, and inundation area. **Table D.1.3-1** through **Table D.1.3-3** also indicate which census blocks within the study area also fall within the project footprint for the maximum construction area under Alternatives B, F, and G and the Recommended Plan.

For this section, the most recent and comprehensive U.S. Census Bureau data are considered. This data, the 2017–2021 American Community Survey data are used to describe existing (2020) population, housing, employment, and income in the reference community and study area.[1]

1.2.2. Neighborhoods/Communities/Community Character

The study area is highly developed and characterized by multiple land uses. It encompasses several neighborhoods, including North Beach/Fisherman's Wharf, the Financial District, South of Market (SoMa)/Mission Bay, Potrero Hill/Central Waterfront, and Bayview North/Islais Creek. These are described below, starting with the northernmost portion of construction under Alternatives B, F, and G and the Recommended Plan and proceeding to the southernmost portion (City and County of San Francisco, 2020).

[1] The 5-year estimates are published for areas with populations of all sizes and are the most reliable and precise of the American Community Survey period estimates, as well as the most comprehensive. Over the 1- and 3-year estimates it provides detail for very small populations, geographies down to census tracts and block groups. The population controls for the 2017–2021 American Community Survey data products are the average of the population estimates across the 5-year period.

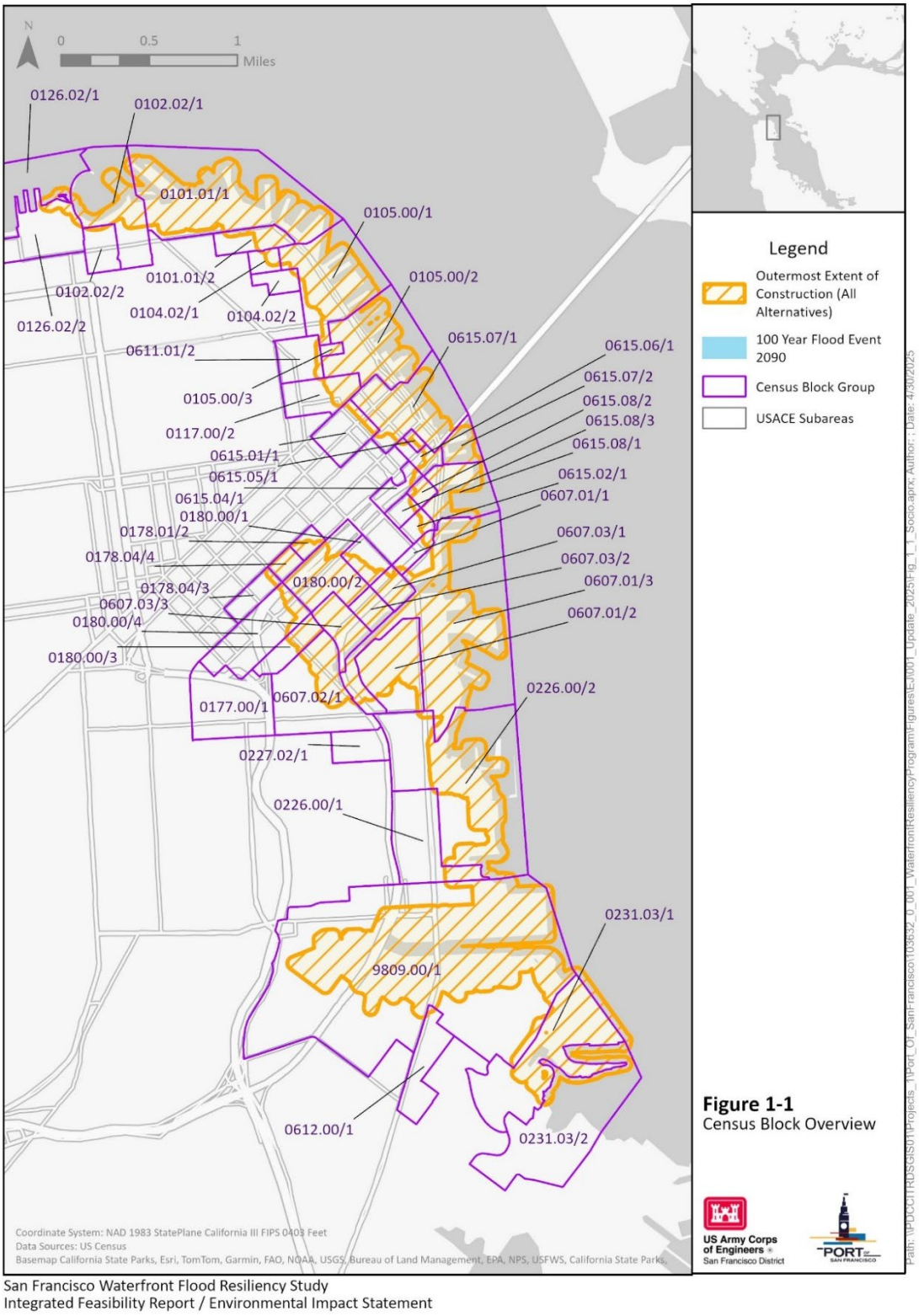


Figure D.1.3-1: Study Area and Census Block Overview, 2090 + 100 Year Flood Event

The North Beach and Fisherman's Wharf neighborhoods are located along the northeast edge of the City's waterfront. These neighborhoods include mainly commercial land uses, with some residential buildings, as well as large City tourist attractions. The Financial District is the Bay Area's largest and densest job center, comprising large areas of high-density housing, commercial, and mixed-use space near the Embarcadero and Market Street.

Next, the SoMa and Mission Bay neighborhoods comprise developing mixed-use neighborhoods as well as large commercial buildings on both sides of Mission Creek; Mission Bay includes health industry sues, as well as residential and other commercial uses. The Potrero Hill and Central Waterfront neighborhoods include residential areas along the hillside as well as mixed industrial and residential uses along the shoreline in an area known as Dogpatch. This neighborhood is located along the east edge of the City, between the SoMa and Bayview neighborhoods.

Finally, the Bayview North/Islais Creek neighborhood, located along the southeast edge of the City, includes the industrial areas surrounding Islais Creek, as well as residential areas and developments.

The occupied housing units in the city and the study area are occupied primarily by renters, approximately 61.8 percent and 67.3 percent, respectively, which may suggest that these are desirable places to live (U.S. Census Bureau, 2021a). However, areas with higher levels of renter-occupied housing could indicate that people do not stay in these locations for extended periods of time and move to different neighborhoods frequently, suggesting weaker community cohesion (Rohe et al., 2013).

Community resources and services within the study area, more specifically, the construction area related to the Recommended Plan, Alternatives B, F, and G, includes the emergency water system for firefighting (e.g., the Auxiliary Water Supply System, fireboat pump stations, hydrants, valves, cisterns, pipes); San Francisco Fire Department stations 4, 8, 9, 13, 25, and 35; San Francisco Police Department headquarters and county jail; open space, trails, and parks (e.g., Aquatic Park, Shoreline Park, China Basin Park, Pier 52 Bay Front Park, Agua Vista Park, Crane Cove Park, Warm Water Cove Park, and Heron's Head); and Port of San Francisco (Port) facilities and several piers and ferry terminals (e.g., WETA Pier 39, Ferry Building, and China Basin ferry terminals; South Beach Harbor and Park, McCovey Cove, and India Basin Marina).

Additional community resources and services include regional and local transportation infrastructure (e.g., the Bay Bridge, Bay Area Rapid Transit [BART], San Francisco Municipal Railway [Muni], Caltrain); wastewater infrastructure (e.g., pump stations, the Southeast Wastewater Treatment Plant, the North Point Wet-Weather Treatment Plant); the Recology Recycle Center; University of California, San Francisco Medical Center at Mission Bay; Oracle Park and Chase Center; and tourist attractions (e.g., the Ferry Building, The Embarcadero Promenade, Fisherman's Wharf, the Exploratorium, historic buildings and piers, restaurants, hotels).

1.2.3. Population Characteristics

As shown in **Table D.1.3-1**, racial and ethnic data were collected for 873,965 persons in the City (U.S. Census Bureau, 2020). Of these, 341,306 (39.1 percent) identified themselves as White; 294,220 (33.7 percent) Asian; 136,761 (15.6 percent) as Hispanic or Latino; 45,071 (5.2 percent) Black or African American; 1,570 (0.2 percent) American Indian and Alaska Native; 3,244 (0.4 percent) Native Hawaiian and Other Pacific Islanders; 6,347 (0.7 percent) Some Other Race; and 45,446 (5.2 percent) Two or More Races. Depending on how persons of two or more races are considered, the City population is 61 percent minority (including two or more races).

In comparison, the study area has a total population of 63,483 within 45 census tract blocks and a lower percentage of White (38.6 percent), Hispanic or Latino (11.8 percent), and Asian Alone (33.4 percent). The study area has a higher percentage Black or African American (8.8 percent), Some Other Race (0.9 percent), and Native Hawaiian and Other Pacific Islanders (1.1 percent) compared to the City. The study area and the City have the same percentage of Two or More Races Alone (5.2 percent) and American Indian and Alaskan Native (0.2 percent). The study area population is 61 percent minority (including two or more races), which is higher than in the City as a whole.

1.2.4. Housing

As shown in **Table D.1.3-2**, according to the U.S. Census Bureau, there are 404,720 housing units in the City, of which 361,222 (89.3 percent) are occupied and 43,498 (10.7 percent) are vacant (U.S. Census Bureau, 2021b). The average household size within the occupied housing units is 2.3 persons (U.S. Census Bureau, 2021c); 138,048 (38.2 percent) of the housing units are owner occupied, and 223,174 (61.8 percent) are renter occupied (U.S. Census Bureau, 2021d).

Overall, the study area has a slightly lower percentage of occupied units (84.1 percent) compared to the City (89.3 percent). Of the occupied units, the study area has a lower percentage of owner-occupied housing units (32.7 percent) compared to the City (38.2 percent) and a greater proportion (67.3 percent) of renter-occupied housing units compared to the City at large (61.8 percent). In addition, the average household size within the study area (2.0 persons) was slightly smaller than that of the City (2.3 persons).

The Bay Area faces many challenges related to housing, which have an impact on the region's low-income population. These challenges include (among others) rising housing costs and decreasing affordability and a spatial mismatch between the location of jobs and housing. The housing costs in Bay Area metro centers (San Francisco, Oakland, and San Jose) are extremely high, with most affordable Bay Area homes located in inland communities.

1.2.5. Employment and Income

As shown in **Table D.1.3-3**, according to the U.S. Census Bureau, per capita income in the City is $77,267, and the median household income is $126,187 (U.S. Census Bureau, 2021d and 2021e). As of 2021, 9.8 percent of the residents within the City were living below the poverty level, which equates to 82,356 residents (U.S. Census Bureau, 2021g).

The per capita income for the study area ($110,299) is higher than that of the City, as is the median household income for the study area ($157,093) (U.S. Census Bureau, 2021d and 2021e). The number of citizens within the study area living below the poverty level is 6,157 (11.2 percent), which is slightly higher than the number in the City (9.8 percent) (U.S. Census Bureau, 2021f).

1.2.6. Community Impacts

To evaluate potential community impacts within the study area, a demographic profile of the relevant census blocks was developed to identify the low-income and minority populations. For the purposes of this analysis, a census block included a population to be evaluated for community issues if:

- The total minority population of the census block was more than 50 percent of the total population or substantially higher (i.e., more than 15 percent) than that of the city or county (reference area) where it is located, or
- The proportion of the census block population that was below the poverty level was substantially higher (i.e., more than 15 percent greater) than the proportion of the City/county of San Francisco (reference area) population below the poverty level.

Because the city has a minority population that totals more than 50 percent, at 61 percent, the “substantially higher” criterion (i.e., more than 15 percent) was used in this analysis (i.e., more than 61 percent + 15 percent = 76 percent).

The census blocks shown on **Figure D.1.3-1**, as well as in **Table D.1.3-1** and **Table D.1.3-3**, present ethnicity and income data for the study area.

As described above, minorities represent approximately 61 percent of the total population of the City and approximately 61 percent of that of the study area. As shown in **Table D.1.3-1**, the 2017–2021 American Community Survey 5-year estimates indicate that the proportion of the population within the study area composed of minority populations ranges from 23 percent (census track block 0126.02/1) to 98 percent (census tract block 0231.03/1). Using the “substantially higher” criterion, census tract, 0231.03/1, 231.03/02, and 0612.00/1 in the Bayview Neighborhood, and 0611.01/2 in the Financial District each meet the minority criteria, because the percentage of minority populations is more than 15 percent greater than the proportion of minority populations in the City (61 percent), that is, more than 76 percent meeting the minority criteria. Of these minority-population-identified census blocks, only blocks, 0231.03/2, and 0612.00/1 are located within the footprints of Alternatives B, F, and G, and the

Recommended Plan. See **Figure D.1.3-2** for an overview of the footprint and the minority-population-identified census blocks.

Table D.1.3-1: Race and Ethnicity for the City and County of San Francisco and the Study Area

Region (a)	Total Population for Whom Data Were Compiled	White Alone		Black or African American Alone		American Indian and Alaskan Native Alone		Asian Alone		Native Hawaiian and Other Pacific Islanders Alone		Some Other Race Alone		Two or More Races Alone		Hispanic or Latino Ethnicity		Percent Minority
	No.	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%
San Francisco	873,965	341,306	39.1%	45,071	5.2%	1,570	0.2%	294,220	33.7%	3,244	0.4%	6,347	0.7%	45,446	5.2%	136,761	15.6%	61%
Study Area Total	63,483	24,477	38.6%	5,564	8.8%	128	0.2%	21,227	33.4%	715	1.1%	588	0.9%	3,294	5.2%	7,490	11.8%	61%
0101.01/1[a]	838	423	50.5%	38	4.5%	0	0.0%	199	23.7%	4	0.5%	5	0.6%	58	6.9%	111	13.2%	50%
0101.01/2[a]*	1,188	540	45.5%	31	2.6%	3	0.3%	467	39.3%	1	0.1%	5	0.4%	55	4.6%	86	7.2%	55%
0102.02/1[a]	1,017	705	69.3%	15	1.5%	0	0.0%	155	15.2%	2	0.2%	14	1.4%	56	5.5%	70	6.9%	31%
0102.02/2	1,057	730	69.1%	11	1.0%	0	0.0%	196	18.5%	1	0.1%	5	0.5%	49	4.6%	65	6.1%	31%
0104.02/1	780	481	61.7%	9	1.2%	2	0.3%	172	22.1%	1	0.1%	6	0.8%	51	6.5%	58	7.4%	38%
0104.02/2	699	490	70.1%	2	0.3%	1	0.1%	112	16.0%	0	0.0%	7	1.0%	32	4.6%	55	7.9%	30%
0105.00/1[a]	1,265	564	44.6%	32	2.5%	2	0.2%	493	39.0%	6	0.5%	15	1.2%	62	4.9%	91	7.2%	55%
0105.00/2[a]	865	452	52.3%	36	4.2%	3	0.3%	260	30.1%	3	0.3%	3	0.3%	39	4.5%	69	8.0%	48%
0105.00/3	1,104	513	46.5%	25	2.3%	0	0.0%	449	40.7%	0	0.0%	13	1.2%	27	2.4%	77	7.0%	54%
0117.00/2	442	114	25.8%	14	3.2%	2	0.5%	229	51.8%	0	0.0%	2	0.5%	32	7.2%	49	11.1%	74%
0126.02/1	1,595	1,221	76.6%	11	0.7%	1	0.1%	135	8.5%	0	0.0%	4	0.3%	106	6.6%	117	7.3%	23%
0126.02/2[a]	1,463	1,085	74.2%	14	1.0%	1	0.1%	166	11.3%	3	0.2%	14	1.0%	54	3.7%	126	8.6%	26%
0177.00/1	1,041	410	39.4%	139	13.4%	2	0.2%	233	22.4%	7	0.7%	15	1.4%	62	6.0%	173	16.6%	61%
0178.01/2	1,161	349	30.1%	13	1.1%	0	0.0%	689	59.3%	0	0.0%	2	0.2%	56	4.8%	52	4.5%	70%
0178.04/3	687	231	33.6%	63	9.2%	3	0.4%	215	31.3%	3	0.4%	8	1.2%	51	7.4%	113	16.4%	66%
0178.04/4	680	265	39.0%	31	4.6%	2	0.3%	233	34.3%	2	0.3%	5	0.7%	25	3.7%	117	17.2%	61%
0180.00/1	880	324	36.8%	12	1.4%	0	0.0%	378	43.0%	0	0.0%	9	1.0%	43	4.9%	114	13.0%	63%
0180.00/2	1,063	431	40.5%	106	10.0%	0	0.0%	304	28.6%	10	0.9%	13	1.2%	77	7.2%	122	11.5%	59%
0180.00/3	1,088	409	37.6%	72	6.6%	2	0.2%	465	42.7%	12	1.1%	2	0.2%	52	4.8%	74	6.8%	62%
0180.00/4	1,727	503	29.1%	472	27.3%	13	0.8%	247	14.3%	18	1.0%	8	0.5%	116	6.7%	350	20.3%	71%

Region (a)	Total Population for Whom Data Were Compiled	White Alone		Black or African American Alone		American Indian and Alaskan Native Alone		Asian Alone		Native Hawaiian and Other Pacific Islanders Alone		Some Other Race Alone		Two or More Races Alone		Hispanic or Latino Ethnicity		Percent Minority
	No.	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%
0226.00/1 [a]	2,390	1,150	48.1%	66	2.8%	3	0.1%	813	34.0%	2	0.1%	5	0.2%	143	6.0%	208	8.7%	52%
0226.00/2 [a]	2,611	1,253	48.0%	125	4.8%	6	0.2%	646	24.7%	3	0.1%	54	2.1%	194	7.4%	330	12.6%	52%
0227.02/1	1,128	672	59.6%	17	1.5%	2	0.2%	226	20.0%	0	0.0%	6	0.5%	73	6.5%	132	11.7%	40%
0231.03/1	**2,246**	**50**	**2.2%**	**1,230**	**54.8%**	**8**	**0.4%**	**273**	**12.2%**	**284**	**12.6%**	**22**	**1.0%**	**121**	**5.4%**	**258**	**11.5%**	**98%**
0231.03/2 [a]	**2,655**	**107**	**4.0%**	**1,201**	**45.2%**	**16**	**0.6%**	**188**	**7.1%**	**252**	**9.5%**	**48**	**1.8%**	**161**	**6.1%**	**682**	**25.7%**	**96%**
0607.01/1 [a]	1,043	496	47.6%	23	2.2%	0	0.0%	382	36.6%	3	0.3%	15	1.4%	52	5.0%	72	6.9%	52%
0607.01/2 [a]	6,050	2,045	33.8%	417	6.9%	21	0.3%	2,187	36.1%	50	0.8%	76	1.3%	290	4.8%	964	15.9%	66%
0607.01/3 [a]	1,517	558	36.8%	19	1.3%	2	0.1%	697	45.9%	2	0.1%	16	1.1%	101	6.7%	122	8.0%	63%
0607.02/1 [a]	3,142	933	29.7%	154	4.9%	5	0.2%	1,518	48.3%	6	0.2%	18	0.6%	185	5.9%	323	10.3%	70%
0607.03/1 [a]	1,804	569	31.5%	70	3.9%	0	0.0%	827	45.8%	0	0.0%	13	0.7%	85	4.7%	240	13.3%	68%
0607.03/2 [a]	1,788	539	30.1%	109	6.1%	1	0.1%	887	49.6%	3	0.2%	18	1.0%	81	4.5%	150	8.4%	70%
0607.03/3 [a]	2,088	634	30.4%	65	3.1%	1	0.0%	1,063	50.9%	4	0.2%	12	0.6%	114	5.5%	195	9.3%	70%
0611.01/2	**871**	**125**	**14.4%**	**18**	**2.1%**	**0**	**0.0%**	**679**	**78.0%**	**7**	**0.8%**	**0**	**0.0%**	**18**	**2.1%**	**24**	**2.8%**	**86%**
0612.00/1 [a]	**1,428**	**148**	**10.4%**	**286**	**20.0%**	**1**	**0.1%**	**409**	**28.6%**	**4**	**0.3%**	**6**	**0.4%**	**52**	**3.6%**	**522**	**36.6%**	**90%**
0615.01/1	809	486	60.1%	37	4.6%	0	0.0%	203	25.1%	0	0.0%	0	0.0%	39	4.8%	44	5.4%	40%
0615.02/1 [a]	1,452	784	54.0%	13	0.9%	0	0.0%	515	35.5%	0	0.0%	26	1.8%	48	3.3%	66	4.5%	46%
0615.04/1	1,294	468	36.2%	62	4.8%	2	0.2%	599	46.3%	1	0.1%	7	0.5%	54	4.2%	101	7.8%	64%
0615.05/1	1,051	393	37.4%	20	1.9%	0	0.0%	546	52.0%	0	0.0%	9	0.9%	34	3.2%	49	4.7%	63%
0615.06/1 [a]	1,983	742	37.4%	32	1.6%	1	0.1%	956	48.2%	0	0.0%	19	1.0%	87	4.4%	146	7.4%	63%
0615.07/1 [a]	1,738	595	34.2%	161	9.3%	2	0.1%	637	36.7%	2	0.1%	23	1.3%	70	4.0%	248	14.3%	66%
0615.07/2 [a]	0	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	NA
0615.08/1 [a]	521	264	50.7%	34	6.5%	3	0.6%	129	24.8%	3	0.6%	2	0.4%	30	5.8%	56	10.7%	49%
0615.08/2 [a]	1,396	537	38.5%	22	1.6%	3	0.2%	673	48.2%	1	0.1%	22	1.6%	47	3.4%	91	6.5%	62%
0615.08/3	590	268	45.4%	12	2.0%	0	0.0%	209	35.4%	0	0.0%	8	1.4%	53	9.0%	40	6.8%	55%
9809.00/1 [a]	1,248	421	33.7%	225	18.0%	14	1.1%	168	13.5%	15	1.2%	8	0.6%	59	4.7%	338	27.1%	66%

Source: U.S. Census Bureau, 2020.

[a] Indicates the block is located within the maximum construction area related to the other alternatives. Study area includes 45 census block groups, listed as "census tract ID/block number".

Bolded census blocks are identified as minority populations.

Table D.1.3-2: Housing Characteristics for the City of San Francisco and the Study Area

	Total Households	Average Household Size [b]	Housing Units [c]					Occupied Housing Units [d]			
			Total	Occupied	Percent Occupied	Vacant	Percent Vacant	Owner Occupied	Percent Owner Occupied	Renter Occupied	Percent Renter Occupied
San Francisco	361,222	2.3	404,720	361,222	89.3%	43,498	10.7%	138,048	38.2%	223,174	61.8%
Study Area Total [e]	26,213	2.0	31,158	26,211	84.1%	4,945	15.9%	8,565	32.7%	17,648	67.3%
0101.01/1 [a]	448	1.7	515	448	87.0%	67	13.0%	15	3.3%	433	96.7%
0101.01/2 [a]	784	1.7	883	784	88.8%	99	11.2%	158	20.2%	626	79.8%
0102.02/1 [a]	446	2.0	700	446	63.7%	254	36.3%	117	26.2%	329	73.8%
102.02/2	584	1.7	719	582	80.9%	135	18.8%	202	34.6%	382	65.4%
0104.02/1	336	2.0	451	336	74.5%	115	25.5%	167	49.7%	169	50.3%
0104.02/2	562	2.0	620	562	90.6%	58	9.4%	154	27.4%	408	72.6%
0105.00/1 [a]	625	2.3	764	625	81.8%	139	18.2%	327	52.3%	298	47.7%
0105.00/2 [a]	517	2.0	568	517	91.0%	51	9.0%	76	14.7%	441	85.3%
0105.00/3	668	1.4	719	668	92.9%	51	7.1%	0	0.0%	668	100.0%
0117.00/2	152	2.5	198	152	76.8%	46	23.2%	0	0.0%	152	100.0%
0126.02/1	684	2.1	839	684	81.5%	155	18.5%	244	35.7%	440	64.3%
0126.02/2 [a]	720	2.2	818	720	88.0%	98	12.0%	211	29.3%	509	70.7%
0177.00/1	194	1.9	241	194	80.5%	47	19.5%	81	41.8%	113	58.2%
0178.01/2	872	1.7	959	872	90.9%	87	9.1%	416	47.7%	456	52.3%
0178.04/3	276	2.3	318	276	86.8%	42	13.2%	114	41.3%	162	58.7%
0178.04/4	371	1.7	478	371	77.6%	107	22.4%	169	45.6%	202	54.4%
0180.00/1	541	1.7	634	541	85.3%	93	14.7%	147	27.2%	394	72.8%
0180.00/2	369	2.0	491	369	75.2%	122	24.8%	97	26.3%	272	73.7%
0180.00/3	413	1.8	491	413	84.1%	78	15.9%	61	14.8%	352	85.2%
0180.00/4	256	2.2	278	256	92.1%	22	7.9%	154	60.2%	102	39.8%
0226.00/1 [a]	1,188	1.8	1,329	1,188	89.4%	141	10.6%	335	28.2%	853	71.8%
0226.00/2 [a]	712	2.0	844	712	84.4%	132	15.6%	168	23.6%	544	76.4%
0227.02/1	586	2.1	597	586	98.2%	11	1.8%	202	34.5%	384	65.5%
0231.03/1 [a]	613	2.7	706	613	86.8%	93	13.2%	0	0.0%	613	100.0%

	Total Households	Average Household Size [b]	Housing Units [c]					Occupied Housing Units [d]			
			Total	Occupied	Percent Occupied	Vacant	Percent Vacant	Owner Occupied	Percent Owner Occupied	Renter Occupied	Percent Renter Occupied
0231.03/2 [a]	695	3.5	785	695	88.5%	90	11.5%	36	5.2%	659	94.8%
0607.01/1 [a]	275	2.2	321	275	85.7%	46	14.3%	58	21.1%	217	78.9%
0607.01/2 [a]	2,236	2.4	2,521	2,236	88.7%	285	11.3%	200	8.9%	2,036	91.1%
0607.01/3 [a]	606	2.6	606	606	100.0%	0	0.0%	435	71.8%	171	28.2%
0607.02/1 [a]	895	1.7	1,096	895	81.7%	201	18.3%	198	22.1%	697	77.9%
0607.03/1 [a]	828	2.2	894	828	92.6%	66	7.4%	287	34.7%	541	65.3%
0607.03/2 [a]	775	1.7	866	775	89.5%	91	10.5%	262	33.8%	513	66.2%
0607.03/3 [a]	1,039	2.3	1,039	1,039	100.0%	0	0.0%	650	62.6%	389	37.4%
0611.01/2	510	2.1	560	510	91.1%	50	8.9%	80	15.7%	430	84.3%
0612.00/1 [a]	404	2.9	432	404	93.5%	28	6.5%	177	43.8%	227	56.2%
0615.01/1	620	1.5	810	620	76.5%	190	23.5%	620	100.0%	0	0.0%
0615.02/1*	601	1.6	1,018	601	59.0%	417	41.0%	117	19.5%	484	80.5%
0615.04/1	491	1.5	642	491	76.5%	151	23.5%	0	0.0%	491	100.0%
0615.05/1	407	1.9	674	407	60.4%	267	39.6%	382	93.9%	25	6.1%
0615.06/1 [a]	1,156	2.0	1,350	1,156	85.6%	194	14.4%	842	72.8%	314	27.2%
0615.07/1 [a]	684	2.8	728	684	94.0%	44	6.0%	54	7.9%	630	92.1%
0615.07/2 [a]	0	-	0	0	NA	0	NA	0	NA	0	NA
0615.08/1 [a]	353	1.6	632	353	55.9%	279	44.1%	299	84.7%	54	15.3%
0615.08/2 [a]	367	2.1	513	367	71.5%	146	28.5%	0	0.0%	367	100.0%
0615.08/3	227	1.9	334	227	68.0%	107	32.0%	227	100.0%	0	0.0%
9809.00/1 [a]	127	2.3	177	127	71.8%	50	28.2%	26	20.5%	101	79.5%

Source: U.S. Census Bureau, 2021b, 2021c, and 2021d.

[a] Indicates the block is located within the maximum construction area related to the alternatives.

[b] Household Size pulled from Table B25010 (U.S. Census Bureau, 2021c).

[c] Housing Units pulled from Table 25002 (U.S. Census Bureau, 2021b).

[d] Occupied Housing Units/or tenure pulled from Table 25003 (U.S. Census Bureau, 2021d).

[e] Resource study area includes 45 census block groups, listed as “census tract ID/block number”.

Table D.1.3-3: Economic Data for the City of San Francisco and the Study Area

Region	Per Capita Income [b]	Median Household Income [c]	Population for Whom Poverty Status Is Determined: Total	People Below the Poverty Level [d]	
San Francisco	**77,267**	**126,187 (d)**	**844,284**	**82,356**	**9.8%**
Study Area Total [e]	**110,299**	**157,093**	**54,748**	**6,157**	**11.2%**
0101.01/1 [a]	55,910	88,790	781	59	7.6%
0101.01/2 [a]	67,741	56,050	1,337	198	14.8%
0102.02/1 [a]	105,638	205,341	911	0	0.0%
0102.02/2	205,605	174,464	975	101	10.4%
0104.02/1	86,671	127,778	662	76	11.5%
0104.02/2	188,901	177,267	1,100	0	0.0%
0105.00/1 [a]	**92,010**	**156,490**	**1,465**	**397**	**27.1%**
0105.00/2 [a]	115,128	209,871	1,055	44	4.2%
0105.00/3	123,196	116,923	910	51	5.6%
0117.00/2	**30,425**	**44,000**	**386**	**96**	**24.9%**
0126.02/1	152,562	217,407	1,404	114	8.1%
0126.02/2 [a]	124,670	157,695	1,573	83	5.3%
0177.00/1	129,549	165,789	364	6	1.6%
0178.01/2	82,938	133,780	1,479	61	4.1%
0178.04/3	69,757	163,000	645	15	2.3%
0178.04/4	154,216	-[f]	631	56	8.9%
0180.00/1	104,207	136,719	942	22	2.3%
0180.00/2	74,037	162,708	733	71	9.7%
0180.00/3	108,425	158,558	748	91	12.2%
0180.00/4	101,028	250,000+	569	28	4.9%
0226.00/1 [a]	161,271	229,713	2,173	34	1.6%
0226.00/2 [a]	126,609	194,444	1,397	0	0.0%
0227.02/1	113,507	216,875	1,228	105	8.6%
0231.03/1 [a]	12,730	27,075	1,627	294	18.1%
0231.03/2 [a]	**12,860**	**29,511**	**2,437**	**1,111**	**45.6%**
0607.01/1 [a]	102,345	99,030	597	18	3.0%
0607.01/2 [a]	81,646	149,483	5,348	733	13.7%
0607.01/3 [a]	160,652	250,000+	1,560	0	0.0%
0607.02/1 [a]	86,830	-	1,488	162	10.9%
0607.03/1 [a]	71,994	169,000	1,858	0	0.0%
0607.03/2 [a]	107,222	213,146	1,297	205	15.8%
0607.03/3 [a]	94,222	211,307	2,378	23	1.0%
0611.01/2	**50,640**	**14,943**	**1,045**	**395**	**37.8%**
0612.00/1 [a]	32,096	66,774	1,163	266	22.9%
0615.01/1	**307,554**	**250,000+**	**903**	**251**	**27.8%**
0615.02/1 [a]	141,398	-	982	70	7.1%

Region	Per Capita Income [b]	Median Household Income [c]	Population for Whom Poverty Status Is Determined: Total	People Below the Poverty Level [d]	
0615.04/1	106,761	-	719	0	0.0%
0615.05/1	147,287	249,901	776	0	0.0%
0615.06/1 [a]	201,507	250,000+	2,251	141	6.3%
0615.07/1 [a]	57,782	93,466	1,940	332	17.1%
0615.07/2 [a]	-	-	-	-	NA
0615.08/1 [a]	178,001	250,000+	553	0	0.0%
0615.08/2 [a]	94,960	102,485	765	74	9.7%
0615.08/3	160,894	-	425	0	NA
9809.00/1 [a]	69,757	137,750	296	63	21.3%

Source: U.S. Census Bureau, 2021h.

[a] Indicates the block is located within the maximum construction area related to Project Alternatives.

[b] Per Capita Income pulled from Table B25010. City and County of San Francisco Median Income pulled from Table S1903.

[c] Median Household Income pulled from Table B19013.

[d] Population and People below the poverty level pulled from Table B17101.

[e] Resource Study Area includes 45 census block groups/0listed as “census tract ID/block number”.

[f] Data were not available.

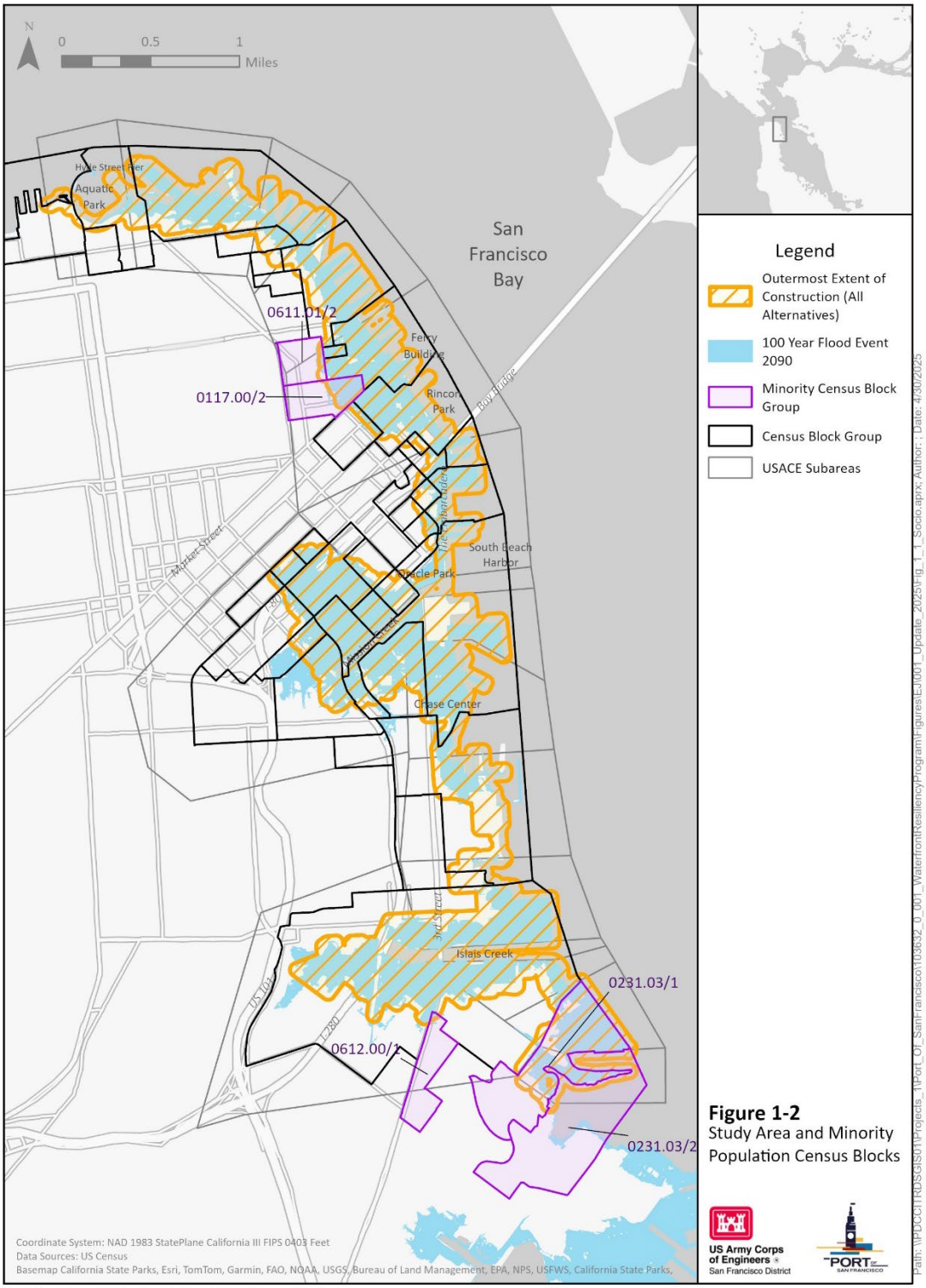
Bolded census blocks are identified as low-income populations.

As described above, the study area has a median household income of $157,093, which is higher than the median household income in the City, $126,187. In contrast, the total percentage of individuals living below the poverty threshold is higher in the study area (11.2 percent) compared to the City as a whole (9.8 percent). However, using the “substantially higher than the city” criterion for population below the poverty level (9.8 percent + 15 percent = 24.8 percent), only the following census blocks meet the low-income criteria (again at or above 24.8 percent): census tract blocks 0105.00/1 in the Northern Waterfront, 0611.01/2, 0117.00/2, and 0615.01/1 in the Financial District, and 0231.03/2 in the Bayview Neighborhood. Of these low-income-population-identified census blocks, only blocks 0105.00/1 and 0231.03/2 are located within the maximum construction footprints of Alternatives B, F, G, and the Recommended Plan. See **Figure D.1.3-3** for an overview of the footprint and the low-income-population-identified census blocks.

1.2.7. Community Outreach

There has been extensive outreach to the local community related to the alternatives. Since 2017, the Port, through the Waterfront Resilience Program, has engaged with tens of thousands of people, including engaging community members at local events and Port-hosted meetings and walking tours, businesses and merchants, advisory committees, non-profit groups, youth, and others.

Engagement has focused on sharing information about the multi-hazard earthquake and flood risks facing San Francisco's waterfront and gaining feedback about community



San Francisco Waterfront Flood Resiliency Study
Integrated Feasibility Report / Environmental Impact Statement

Figure D.1.3-2: Study Area and Minority Population Census Block, 2090 + 100 Year Flood Event

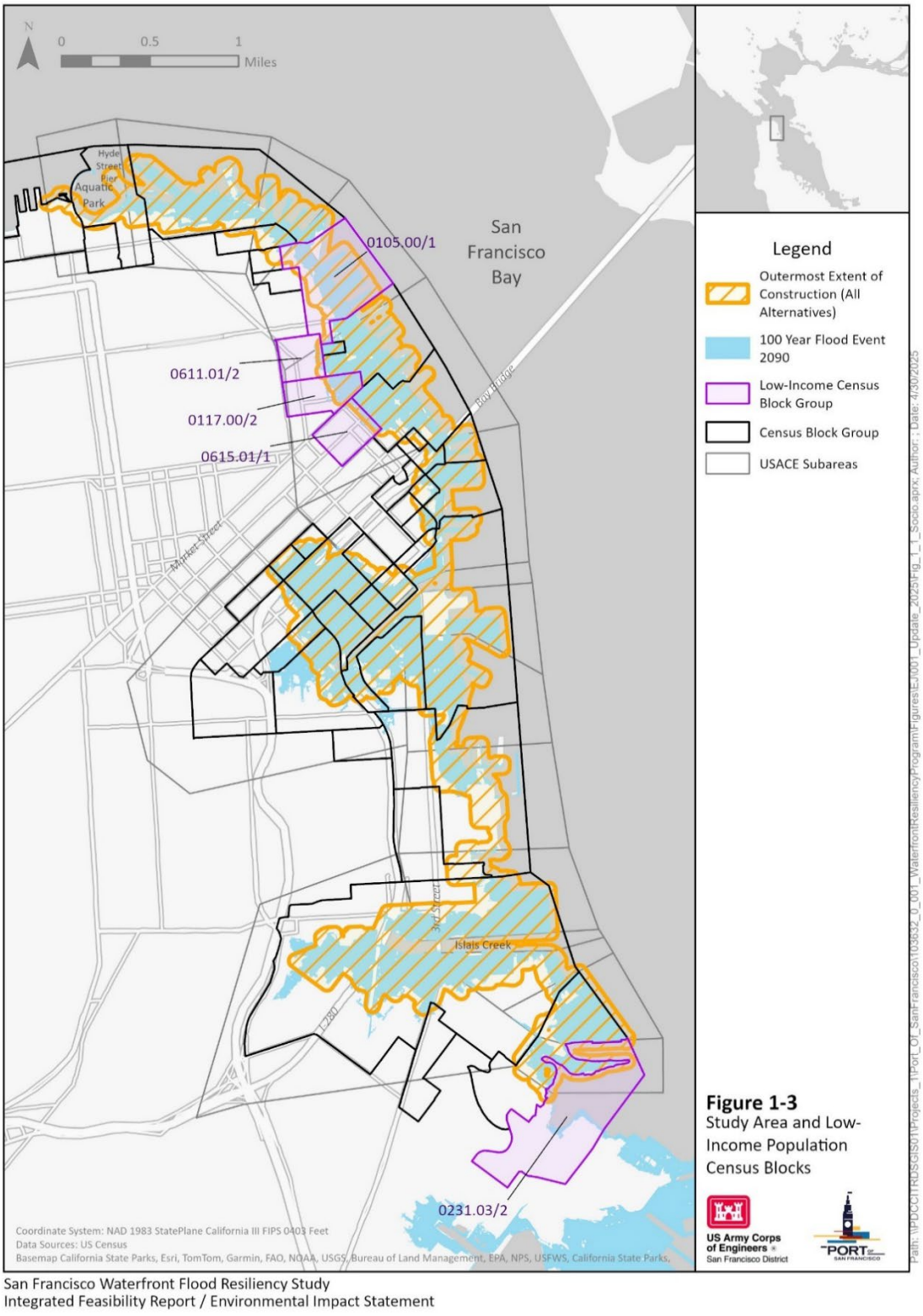


Figure D.1.3-3: Study Area and Low-Income Population Census Block, 2090 + 100 Year Flood Event

priorities and concerns. It also has reflected and reported back to the public how their input has shaped the resilience work led by the Port, including affirming the Waterfront Resilience Program's focus on life safety and emergency response. The Port has conducted outreach and engagement to communities within the project area starting in 2017. Some of the outreach conducted was intercept, where people were stopped on the street and asked questions relevant to the Program at the time. Some outreach was done via community events, where the Port had a table and engaged people via activities at the table. In 2018, we conducted tenant outreach to connect with workers along the waterfront. At all outreach opportunities, we ask people to sign up for the WRP newsletter and stay connected with our work. (Port of San Francisco, 2023a) Regular updates and notifications about upcoming outreach events are shared via a subscription list of over 4,500 recipients and the sfport.com/wrp website, which averages more than 1,200 views a month. The community engagement and outreach strategies are intended to respond to the needs and priorities of San Francisco's waterfront communities and targeted community groups, including youth, seniors, and communities historically excluded from planning processes.

Engagement strategies are inclusive, culturally nuanced, and available in multiple languages, allowing communities, especially those who do not or have never participated in the public process, to participate and provide their input.

2.0 Environmental Consequences

2.1. Assessment Method

The context for socioeconomic and communities includes existing conditions within the worst-case future (2090) sea-level-rise inundation area, as well as existing conditions along the project footprint and within 1,000 feet of construction work areas and permanent project features**.** The results of future sea-level inundation are characterized in detail Section 2, *Existing and Future Without Project Conditions*, in the final IFR/EIS and incorporated by reference to address potential flood impacts under each alternative.

The socioeconomic analysis evaluates how elements of the human environment such as population, employment, education, and housing might be affected by the alternatives.

For socioeconomic impacts, effects are considered in terms of the qualitative scales of displacement, demolition, and inundation experienced under each alternative relative to the division of a community, displacement of persons and structures/resources, and adverse economic impacts caused by either the project construction footprint or the future sea-level-rise flood inundation area. To substantiate these findings, findings identified in Chapter 2, *Future Project without Project Conditions* in the final IFR/EIS, the San Francisco Waterfront Flood Resiliency Study, Other Social Effects Report (OSE Report), prepared for the Port (Port of San Francisco, 2023b) and the Future without Project Conditions (FWOP) Regional Economic Development and OSE Analysis Results presentation (Port of San Francisco 2023c) are incorporated by reference.

For community impacts, the analysis considers the significant construction and operations effects identified in each resource section of this EIS, the magnitude of the effect, whether effects are adverse, the duration of effects (temporary or permanent), and the geographic location of the effects under each alternative relative to the identified minority populations or low-income populations within the specified boundary. It also considers the location of the future sea-level-rise flood inundation area relative to each alternative. Where the alternatives would result in no effect on communities or would result in an effect that does not warrant mitigation, the effect would be negligible, and no further analysis would be conducted.

Adverse effects in the community impact analysis are based on the following considerations:

- Effects that are minimized through mitigation will be evaluated to determine whether the avoidance and minimization measures (AMMs) are (1) equally applied to all populations, and (2) if they address the concerns of all communities. If the AMMs are not successful in addressing (1) and (2), effects will be considered adverse.
- Effects that are not substantially reduced through mitigation will be considered adverse.

The identification of a minority population or a low-income population, as addressed under Section 1.2, *Existing Condition*, is focused on census block data for race and income from U.S. Census Bureau 2017–2021 American Community Survey 5-Year Estimates, as well as from their Decennial Census Redistricting data. To address all alternatives the study area spans 45 census blocks with a total area of approximately 4,580 acres.

Where actions would be moderate in the near-term and localized, and the effects would be within or below regulatory standards, as applicable, and the use of mitigation measures would manage potential adverse impacts, the rating was determined to be a 3; in nearly all cases where there would be construction or demolition activities, mitigation (AMMs) are required, and as such a 3 was selected. Where an action, or their operation and maintenance, does not involve displacement or construction, a rating of 1, which indicates there would be no impacts to the resource because the resource is unaffected, was selected. Overall, where ratings of 3 applied, the mitigated rating was reduced to a 2, which indicates effects to the resource would either be negligible or, if detectable, have minor temporary impacts locally to the resource. The impacts would be below regulatory standards, as applicable, and mitigation measures may be implemented to sustain low to no impact to the resource. This impact rating applies to all alternatives.

2.2. Basis of Significance

Effects are determined by assessing the following conditions:

- Would an adverse socioeconomic effect be generated related to:

- *Communities and Neighborhood*: The potential for construction or operation to disrupt community interactions or physically divide established communities.
- *Displacement:* The potential for construction and operation to require substantial displacement of residences, commercial and industrial businesses, and community and public facilities.
- *Economics*: The potential for construction and operation to cause substantial adverse effects on employment, school district funding, or county and City property and sales tax revenues.

2.3. Effects

2.3.1. Construction Impact Summary

Construction activities have the potential to result in socioeconomic effects related to community and neighborhood interactions and connectivity; to the displacement of residences, commercial and industrial businesses, and community and public facilities; but generally, minimize negative economic effects. For actions that require acquisition and demolition of buildings, there would be a direct displacement effect and for all construction activity there would be temporary interruption related to site access, or road closures, vehicle access, etc. Construction would also result in a demand for construction jobs. Additionally, by preserving businesses and planning for the incremental removal of some existing land uses, the overall population and tax revenues within the City would likely only experience a slight reduction, if at all, but would also shift in location. Any such impacts would be minimized by using AMMs, such as those described Section 3.0, *Mitigation*. Following construction activities, communities and neighborhoods would be expected to return to baseline conditions.

Based on the conclusions of other sections in Appendix D, construction activities would also have the potential to result in adverse environmental effects on a minority or low-income population; specifically, for the topics of transportation, aesthetics, air quality, noise, and socioeconomics. However, based on the location of construction activity including demolition, pile driving, and other actions, and with the application of identified AMMs described in Section 3.0, *Mitigation*, many of these effects would be reduced.

2.3.2. Operations and Maintenance Impact Summary

The operation and maintenance effects are limited to inundation adaptation and operation and maintenance activities. Long term, the protection measures would avoid the worse effects of the FWOP on communities and neighborhoods, displacements, and economics and would avoid long-term effects on communities. Therefore, ***beneficial effects*** related to flood inundation would occur, in contrast to the FWOP.

2.3.3. Recommended Plan

Table D.1.3-4 shows a summary of the socioeconomics and community impacts associated with the Recommended Plan. The Recommended Plan would result in fewer socioeconomic and community impacts than Alternatives B and G, and a similar level of impact to Alternative F, as described in detail below.

Table D.1.3-4: Summary of Socioeconomic and Community Impacts Associated with the Recommended Plan

Recommended Plan Socioeconomic and Community Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Roadway Impact	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Actions)	2	3	3	1	3	1	3	1	3	3	3	3	3	1
Construction/Footprint (Subsequent Actions)	3	3	3	1	3	1	3	1	3	3	3	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	2	2	2	1	2	1	2	1	2	2	2	2	2	2

* Denotes engineering with nature (EWN) measure.

The Recommended Plan consists of two phases of intervention to reduce risk within the study area over a 100-year period of analysis. For analysis, the years 2040 and 2090 were used as approximate first and Subsequent Actions years. The actual timing and implementation of First Actions will be dependent upon project funding and preconstruction activities, while timing of Subsequent Actions will be refined in response to monitoring of RSLC and other changing conditions (*Appendix G: Monitoring and Adaptation Plan*). Recommended Plan First Actions are independent of the rate of RSLC. Recommended Plan Subsequent Actions vary in scale by RSLC (Low, Intermediate, or High) to maintain the performance of the system over the full period of analysis.

2.3.3.1. Fisherman's Wharf (Reach 1)

In Fisherman's Wharf, the Recommended Plan initially relies on floodproofing buildings and infrastructure. Piers are floodproofed with concrete curbs around the perimeter to

reduce flood risk. Subsequent actions include additional floodproofing or elevation of the shoreline with bulkhead seawalls and floodwalls, depending on the rate of RSLC.

- First actions: floodproofing, concrete curbs around pier perimeters
- Subsequent actions
    - Low RSLC: No action
    - Intermediate RSLC: Additional floodproofing
    - High RSLC: Bulkhead seawalls, floodwalls, raised and rebuilt wharves (finish elevation of 19.0 feet NAVD88, adapted according to *Appendix G: Monitoring and Adaptation Plan*); ground improvement; natural and nature-based features; elevating, floodproofing, or removing select buildings and infrastructure; interior drainage infrastructure

2.3.3.2. Embarcadero (Reach 2)

Along the Embarcadero, the Recommended Plan elevates the shoreline in place by raising and reconstructing the bulkhead seawalls and pile-supported wharves north of the Bay Bridge while gradually transitioning down from the new shoreline elevation back to the existing city grade to retain visual and physical access to the waterfront. The plan includes reconstruction of the full Embarcadero roadway right-of-way – surface design of the Embarcadero roadway and promenade will be determined in future project phases. The Ferry Building and bulkhead buildings are raised in place following construction of new pile supported foundations (wharves). Piers are floodproofed with concrete curbs around the perimeter to reduce flood risk.

- First actions: raised and rebuilt bulkhead seawalls and wharves (finish elevation of 15.5 feet NAVD88); ground improvement; closure structure; natural and nature-based features; elevating and floodproofing select buildings; interior drainage infrastructure; concrete curbs around pier perimeters.
- Subsequent actions
    - Low and Intermediate RSLC: No action
    - High RSLC: raise the flood defenses (finish elevation of 19.0’ NAVD88, adapted according to *Appendix G: Monitoring and Adaptation Plan*); natural and nature-based features; elevating, floodproofing, or removing select buildings and infrastructure; interior drainage infrastructure.

2.3.3.3. Mission Creek / Mission Bay (Reach 3)

In the Mission Creek / Mission Bay geography, the Recommended Plan defends existing city and community assets in place by elevating the creek and Bay shorelines with raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls, natural and nature-based features, and closure structures. The coastal defense will tie into existing and planned high ground at Bayfront, Agua Vista, and Crane Cove Parks, and at the

Mission Rock and Pier 70 development areas. The plan also includes partial reconstruction of the Embarcadero roadway south of the Bay Bridge to manage elevation change in this constrained urban area.

- First actions: raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls (finish elevation of 13.5 feet NAVD88); ground improvement; closure structures; natural and nature-based features; floodproofing select buildings; interior drainage infrastructure; concrete curbs around pier perimeters.
- Subsequent actions
    - Low RSLC: No action
    - Intermediate and High RSLC: raise the flood defenses (finish elevation of 15.5 to 19.0 feet NAVD88 for Intermediate and High, respectively, adapted according to *Appendix G: Monitoring and Adaptation Plan*); natural and nature-based features; elevating, floodproofing, or retiring buildings and infrastructure; interior drainage infrastructure.

2.3.3.4. Islais Creek / Bayview (Reach 4)

In the Islais Creek / Bayview geography, the Recommended Plan defends the existing shoreline to retain residential and commercial land uses in place, including Port land uses and maritime facilities. The flood defenses consist of raising the shoreline using bulkhead seawalls, levees, natural and nature-based features, floodwalls, closure structures, and tying into existing or planned high ground, near Potrero Power Station and behind the Pier 94 Wetlands (Port backlands). This area of the waterfront contains large parcels independent of the combined sewer system, such that the elevated shoreline will require modification to handle stormwater in a safe and effective manner.

- First actions: bulkhead seawalls, levees, floodwalls, raised and reconstructed portion of wharves (finish elevation of 13.5 feet NAVD88); ground improvement; closure structures; natural and nature-based features; move or remove select buildings that straddle the coastal defenses; interior drainage infrastructure.
- Subsequent actions
    - Low RSLC: No action
    - Intermediate and High RSLC: raise the flood defenses (finish elevation of 15.5 to 19.0 feet NAVD88 for Intermediate and High, respectively, adapted according to *Appendix G: Monitoring and Adaptation Plan*); natural and nature-based features; elevating, floodproofing, or removing select buildings and infrastructure; interior drainage infrastructure.

2.3.3.5. Socioeconomics

Compared to future inundation conditions addressed in Section 2*, Existing and Future Without Project Conditions* in the final IFR/EIS, the Recommended Plan provides extensive features to reduce flooding through 2040 and 2090. Under FWOP conditions,

there would be no reduction of the risks of coastal flooding, resulting in lower quality of life, lowered property values, and the displacement of businesses, jobs, and homes. Future flooding under the FWOP conditions would also require emergency response and recovery activities, which would also result in effects on socioeconomics**.** FWOP inundation area is shown in **Figure D.1.3-4** and **Figure D.1.3-5** for the First Actions and the Subsequent Actions, respectively. For comparison purposes, the area of inundation and construction under the Recommended Plan is shown in **Figure D.1.3-6** and **Figure D.1.3-7** for the First Actions and the Subsequent Actions, respectively, showing a substantial reduction in inundation area.

To support these sea-level-rise protection measures under the Recommended Plan, an overall estimate of 122,360 square feet of building footprints would be demolished. Direct construction effects would be less than Alternatives B, F, or G. Based on geographic information system (GIS) data approximately 95 acres of land would experience construction activity with the Subsequent Actions, either directly or indirectly within the 200-foot buffer identified in **Figure D.1.3-7**.

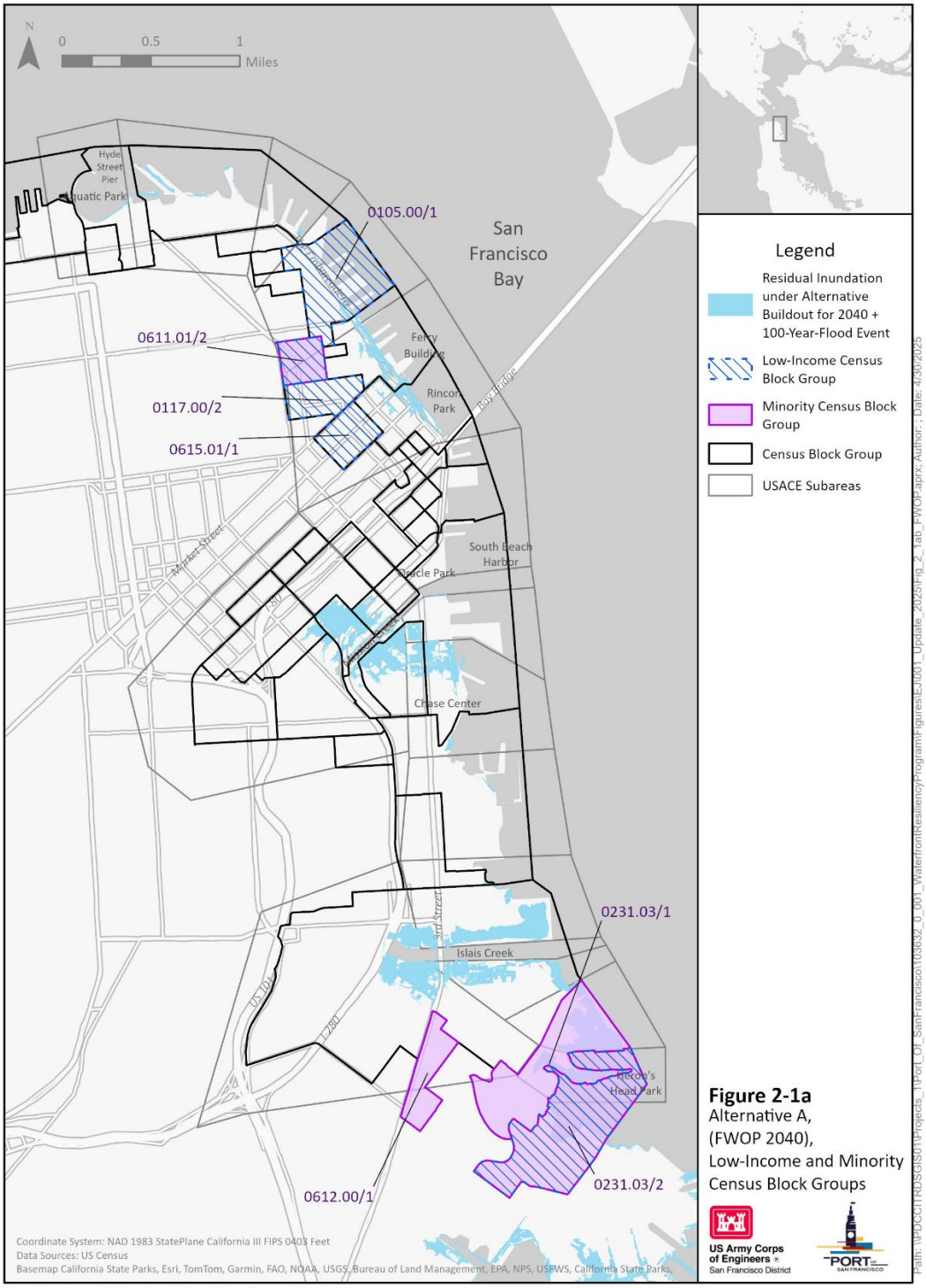
2.3.3.5.1. Communities and Neighborhoods

Residual future flooding under the Recommended Plan would be more limited than all of the alternatives and would cover roughly 58 acres with the First Actions (in 2040) and 250 acres of land with the Subsequent Actions (in 2090), compared to 345 acres (in 2040) and 1,337 acres (in 2090) of land under the FWOP. The living seawalls would also reduce wave hazards and the defense of Ferry Building and Agriculture Building would protect those buildings.

Under FWOP conditions, inundation by 2040 (with the 100-year storm) would expose 55 acres of parks/open space, 4 miles of MUNI transit routes, and 10 miles of streets throughout the four reaches. By contrast, under the Recommended Plan, residual inundation would expose 37 acres of park/open space, 1 mile of MUNI transit routes, and 3 miles of streets (See **Figure D.1.3-4** and **Figure D.1.3-6**).

Under FWOP conditions, inundation by 2090 (with the 100-year storm) would expose 134 acres of parks/open space, 22 miles of MUNI transit routes, and 42 miles of streets throughout the four reaches. By contrast, under the Recommended Plan, only 62 acres of parks/open space, <0.1 miles of MUNI transit routes, and <1 mile of streets would be affected (See **Figure D.1.3-5** and **Figure D.1.3-7**).

Floodproofing structures and transit systems and construction of an elevated LOD would have beneficial effects on communities and neighborhoods within the study area by preserving community features during the flooding.



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Figure D.1.3-4: Alternative A (FWOP) Inundation, 2040 + 100-year Flood Event.

Note: figure included here for comparative purposes, Alternative A (FWOP) not included in the annex discussion but in the No Action separate discussion)

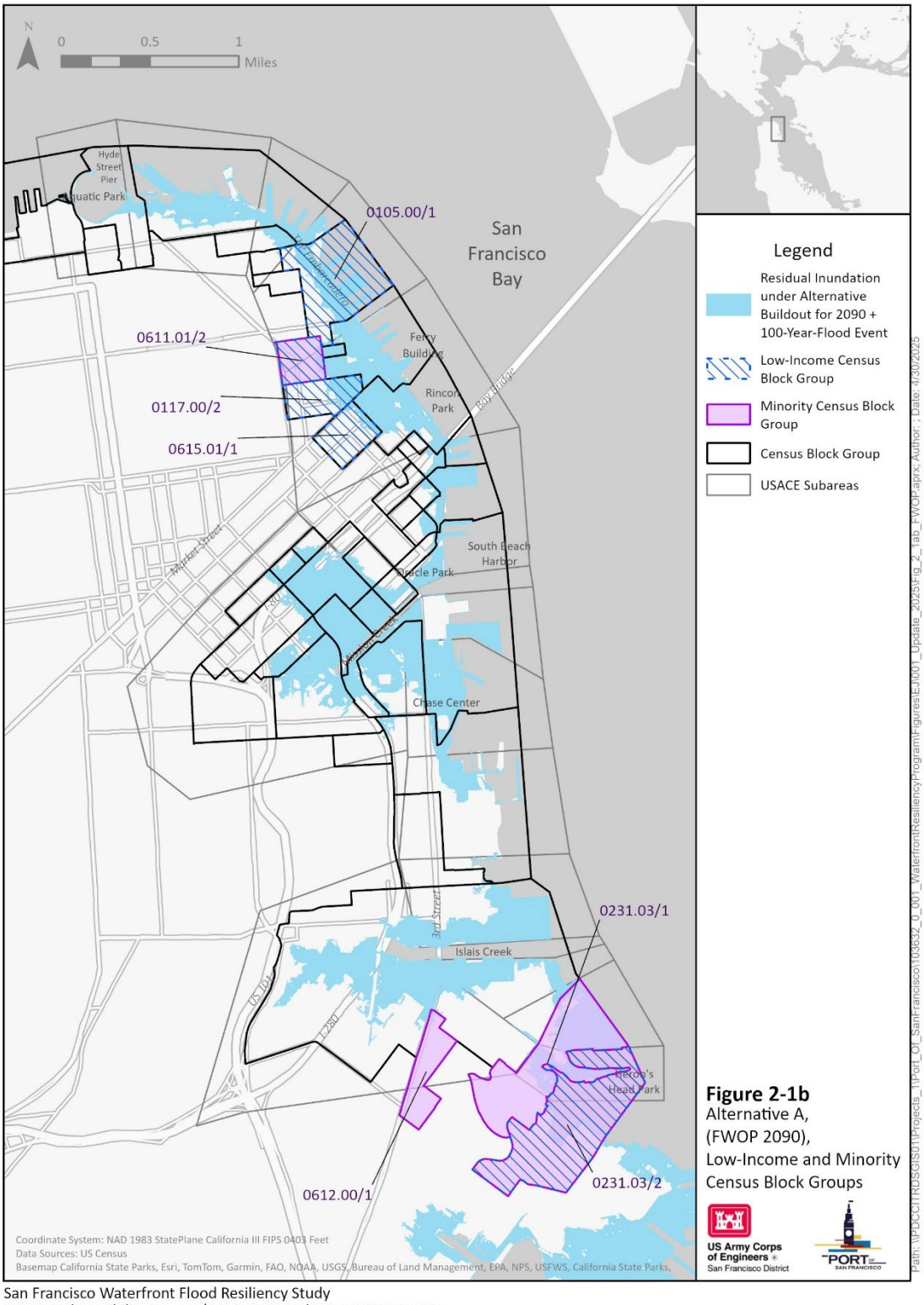


Figure D.1.3-5: Alternative A (FWOP) Inundation, 2090 + 100-year Flood Event.

Note: figure included here for comparative purposes, Alternative A (FWOP) not included in the annex discussion but in the No Action separate discussion)

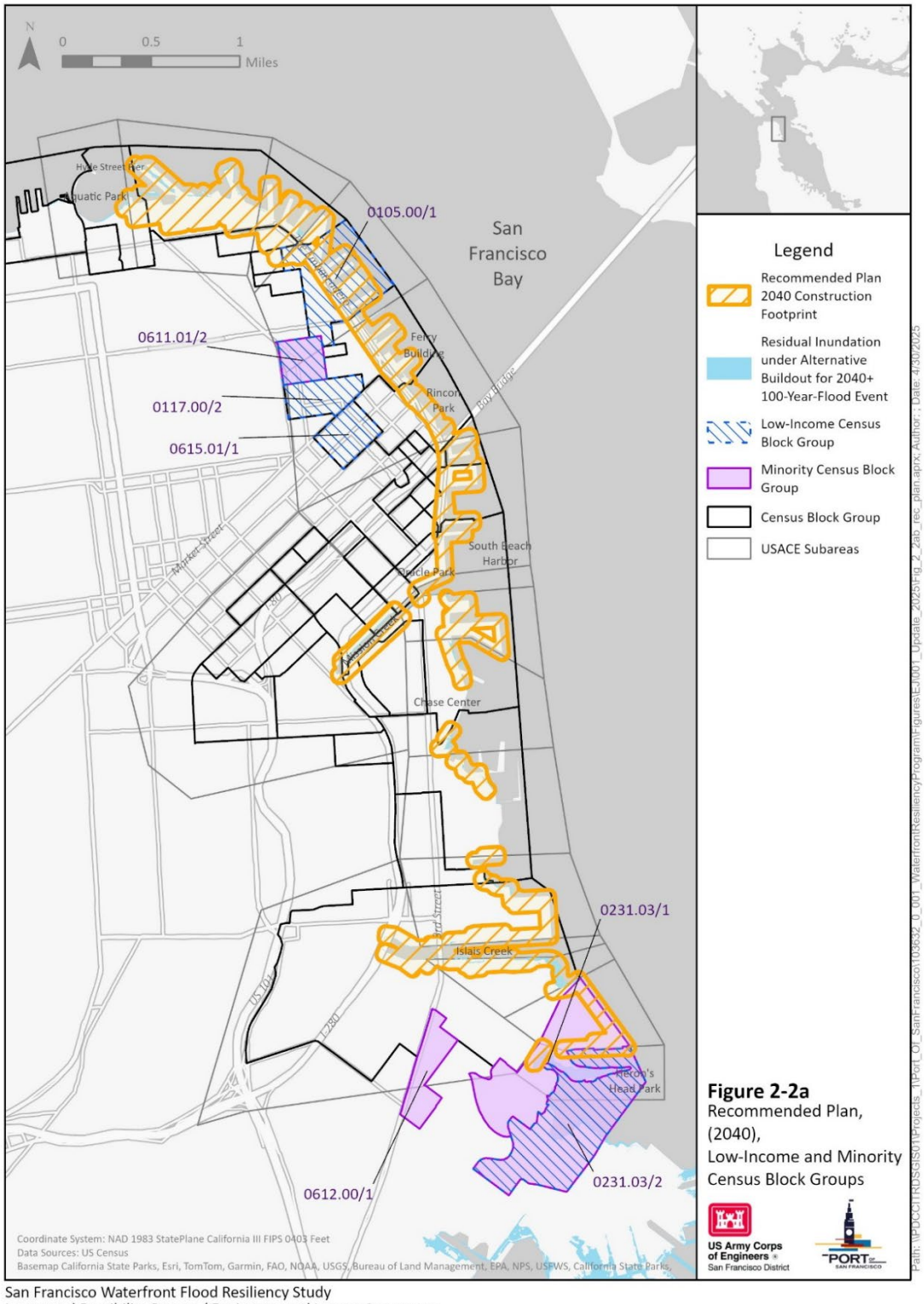


Figure D.1.3-6: Recommended Plan Inundation, First Actions, 2040 + 100 Year Flood Event

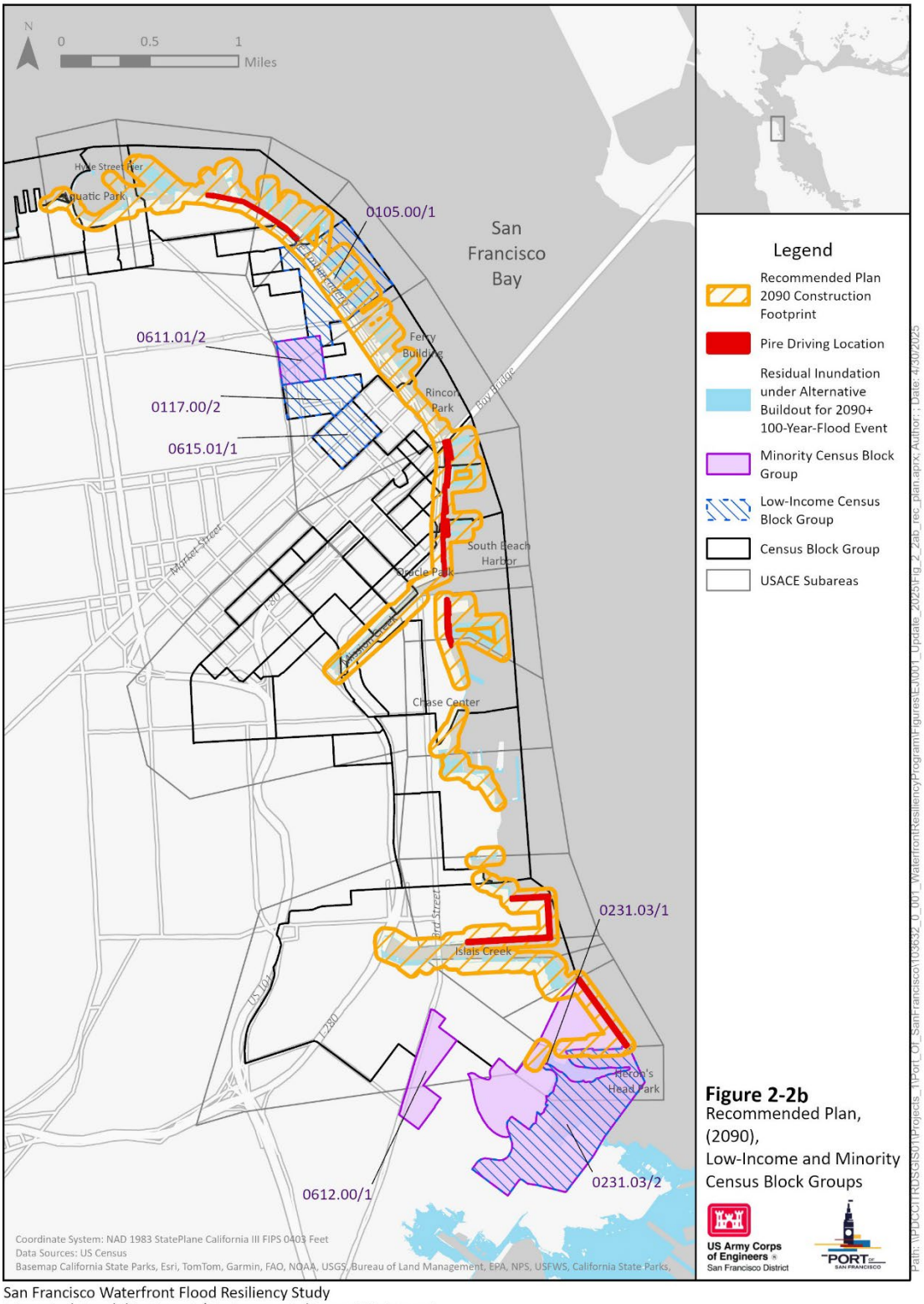


Figure D.1.3-7: Recommended Plan Inundation, Subsequent Actions, 2090 + 100 Year Flood Event

Construction related to dry-floodproofing would be limited to short construction periods per project site and would not divide communities. The construction of the Recommended Plan LOD features would have limited shoreline effects and would not divide a community given their coastal boundary location (**Figure D.1.3-6** and **Figure D.1.3-7**). In addition, use of AMMs would serve to avoid construction disturbance for all construction activities.

2.3.3.5.2. Displacement

With respect to inundation, by 2040 (with a 100-year storm), the Recommended Plan with the First Actions would experience residual inundation which would affect 58 acres compared to 345 acres under FWOP conditions. However, due to acquisition and demolition under this alternative, many of the uses in this area would already be removed. The living seawalls, the defense of the Ferry Building and Agriculture Building, and the coarse beach at Rincon Park would not disrupt communities nor displace residences or businesses.

With respect to inundation, by 2090 (with a 100-year storm), the Recommended Plan would experience residual inundation which would affect 250 acres compared to 1,337 acres under FWOP conditions. However, due to acquisition and demolition under this alternative, many of the uses in this area would already be removed.

Under FWOP conditions, in 2040 (with a 100-year storm), flooding would affect residences, commercial and industrial businesses, and community and public facilities in each reach including 2,420 households, 8 affordable housing sites, 18 disadvantaged businesses, 55 acres of parks/open space and 25 public facilities (including Port facilities, community centers, fire and police facilities, libraries, health centers, clinics, and other City department buildings). With the Recommended Plan, in 2040 (with a 100-year storm) with the first actions, flooding would affect a smaller set of residences, business, and community facilities including 137 households, no affordable housing sites, no disadvantaged businesses, no public facilities, and 37 acres of parks/open space.

Under FWOP conditions, in 2090 (with a 100-year storm), flooding would affect residences, commercial and industrial businesses, and community and public facilities in each reach including 11,204 households, 32 affordable housing sites, 127 disadvantaged businesses, 134 acres of parks/open space and 237 public facilities (including Port facilities, community centers, fire and police facilities, libraries, health centers, clinics, and other City department buildings). With the Recommended Plan, in 2090 (with a 100-year storm) with the Subsequent Actions, flooding would affect a smaller set of residences, business, and community facilities including 1,333 households, no affordable housing sites, no disadvantaged businesses, 62 acres of parks/open space and 50 public facilities.

The Recommended Plan does not propose any relocation of residences or community and public facilities, but would require alterations to commercial and industrial businesses, including the demolition of 122,360 square feet of buildings. By providing an aggressive LOD elevation and retaining much of the existing shoreline, the Recommended Plan requires minimal displacement of existing uses. Additionally,

implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM-CIA-3 through AMM-CIA-9, and AMM-TR-1 through AMM-TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic effects related to the Recommended Plan. These AMMs would be required for all future construction activity under the Recommended Plan.

Overall, displacement from the Recommended Plan would be less than that experienced under FWOP conditions, as the Recommended Plan would protect numerous resources that would otherwise suffer from increasing flood frequencies and depths.

2.3.3.5.3. Economics

Overall, the impacts from construction of the Recommended Plan would be less severe than these economic impacts under the FWOP. Under the FWOP, flooding-related displacement would have a substantial adverse effect on Economics, with the coastal neighborhoods as shown on **Figure D.1.3-4** and **Figure D.1.3-5** experiencing loss in employment, school district funding, or county and City property and sales tax revenues. Based on the findings of the OSE Report, FWOP conditions for 2090 with a 100 Year Event would result in business interruption losses of $2.17 billion.

Construction under the Recommended Plan would result in a demand for construction jobs. Additionally, by preserving most businesses through construction of a robust LOD and planning for the incremental removal of some existing land uses, the overall population and tax revenues within the City would likely only experience a slight reduction, if at all, but also shift in location. The living seawalls, defense of the Ferry Building and the Agricultural Building, and the Coarse Beach at Rincon Park would help to protect economic assets.

Implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM-TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic effects related to the Recommended Plan. These AMMs would be required for all future construction activity under the Recommended Plan.

Overall, economic effects would be less severe than under FWOP conditions.

2.3.3.5.4. Conclusion

Because the Recommended Plan supports the preservation of existing structures and infrastructure relative to FWOP conditions, and long term supports a more aggressive timeline for sea-level-rise defense, the Recommended Plan would preserve substantially more features and values of the existing community relative to the FWOP. While the Recommended Plan includes alterations to the existing community to support some managed retreat inland along the southern waterfront, the new LOD would not generate construction effects that would divide the community and these features would ensure that future flood events do not physically divide the waterfront neighborhoods.

Long term, these protection measures would avoid the worse effects of the FWOP on communities and neighborhoods, displacements, and economics. Additionally,

implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required for all future construction activity under the Recommended Plan for both the first and Subsequent Actions to reduce socioeconomic effects. This impact would be ***less than significant.***

2.3.3.6. Communities

As discussed previously, specific census blocks in the study area contain minority populations and low-income populations. To identify Recommended Plan effects on these populations, **Figure D.1.3-6** and **Figure D.1.3-7** show the census blocks, USACE reach boundaries, the Recommended Plan construction footprint and pile-driving locations, and the future worst-case flood inundation in year 2040 and year 2090. Of the 45 census blocks in the study area, 7 census blocks comprise an a minority or low-income population; **Table D.1.3-5** and **Table D.1.3-6** present the study area acreage relative to the environmental acreage along with related Recommended Plan residual inundation area and construction area for the 2040 and 2090.

Table D.1.3-5: Recommended Plan Inundation and Construction Areas, First Actions (Acres, 2040 + 100-year Flood)

	Total Area	Total Residual Inundation Area	Percentage (%) of Inundation to Total Area	Total Construction Area	Percentage (%) of Construction to Total Area
Alternative A Study Area (FWOP)	4,580	345	8%	0	0%
Recommended Plan Study Area	4,580	58	1%	932	20%
Identified Low-Income Census Blocks	517	7	1%	89	17%
Identified Minority Census Blocks	516	25	5%	55	11%

Table D.1.3-6: Recommended Plan Inundation and Construction Areas, Subsequent Actions (Acres, 2090 + 100-year Flood)

	Total Area	Total Residual Inundation Area	Percentage (%) of Inundation to Total Area	Total Construction Area	Percentage (%) of Construction to Total Area
Alternative A Study Area (FWOP)	4,580	1,337	29%	0	0%
Recommended Plan Study Area	4,580	250	5%	957	21%
Identified Low-Income Census Blocks	517	25	5%	84	16%
Identified Minority Census Blocks	516	35	7%	55	11%

2.3.3.6.1. Flooding- and Displacement-Related Effects

Less-than-significant effects after AMMs are implemented are identified related to displacement under the Recommended Plan for the topics of socioeconomics, transportation, and aesthetics.

Less-than-significant effects after AMMs are implemented are identified under the Recommended Plan related to socioeconomics; the Recommended Plan would result in limited impacts on communities after AMMs are implemented.

Related to this, with the Recommended Plan First Actions (2040+100-year Flood), residual flooding would be reduced from 345 acres to 58 acres of land compared to FWOP conditions, a reduction of 83 percent overall. In identified low-income census blocks, the Recommended Plan would reduce residual flooding from 9 to 7 acres (reduction of 22 percent) and in identified minority census blocks from 63 acres to 25 acres (reduction of 60 percent). With the Recommended Plan, residual flooding would comprise 1 percent of the study area, 1 percent of low-income census blocks, and 5 percent of minority census blocks. Residual flooding would be less than the concentration of flooding effects under FWOP conditions across the project area.

Related to this, with the Recommended Plan Subsequent Actions (2090+100-year Flood), residual flooding would be reduced from 1,337 acres to 250 acres of land compared to FWOP conditions, an 81 percent reduction overall. In identified low-income census blocks, the Recommended Plan would reduce residual flooding from 88 to 25 acres (reduction of 72%) and in identified minority census blocks from 105 to 35 acres (reduction of 66%). With the Recommended Plan, residual flooding would comprise 5 percent of the study area, 5 percent of low-income census blocks, and 7 percent of minority census blocks. Residual flooding would be substantially less than the concentration of flooding effects under FWOP conditions in all areas.

Effects would be reduced to less than significant after AMMs with all mitigation applied equally throughout the study area to all construction-related projects for both the First Actions and Subsequent Actions.

As shown in **Table D.1.3-7** and **Table D.1.3-8** below, the reduction in flooding is nearly the same for employed vs. unemployed persons, white vs. minority persons, owner-occupied units vs. rental units, and total households vs. households in poverty.

Table D.1.3-7: Recommended Plan Inundation Reduction Comparison First Actions

(2040 + 100-year Flood)

Metric	FWOP (Number)	Recommended Plan (Number)	Reduction (Percentage)	Delta
Employed	3,243	174	95%	
Unemployed	1,153	70	94%	-1%
White	2,150	114	93%	
Minority (Non-White)	2,795	184	93%	Same
Owner-occupied units	776	34	96%	
Renter-occupied units	1,654	103	94%	-2%
Total households	2,430	137	94%	
Households in Poverty	254	17	94%	Same

Table D.1.3-8: Recommended Plan Inundation Reduction Comparison Subsequent Actions

(2090 + 100-year Flood)

Metric	FWOP (Number)	Recommended Plan (Number)	Reduction (Percentage)	Delta
Employed	14,358	1,748	88%	
Unemployed	5,644	683	88%	Same
White	10,471	1,338	87%	
Minority (Non-White)	12,042	1,354	89%	+2%
Owner-occupied units	3,515	394	89%	
Renter-occupied units	7,690	939	88%	-1%
Total households	11,204	1,333	88%	
Households in Poverty	1,029	115	87%	-1%

Less-than-significant effects after AMMs are implemented are also identified related to transportation; the Recommended Plan would only experience minimal interruptions to transit lines. While burdened communities may rely on impacted transit systems more

readily than other populations, overall, the effects on the transportation system would be distributed throughout the study area for both the first and Subsequent Actions.

While flooding would remove visual resources, there would be less effect on visual resources compared FWOP conditions so the Recommended Plan would lower visual aesthetic effects for both the first and Subsequent Actions.

2.3.3.6.2. Construction-Related Effects

A mixture of significant and unavoidable effects and less-than-significant effects after AMMs are implemented are identified for construction-related activities under the Recommended Plan for the topics of localized air quality and noise.

Air quality effects related to compliance with air quality plans are determined to be less than significant after AMMs are implemented. Air quality effects under the Recommended Plan with respect to public health effects are determined to be significant and unavoidable related to localized exposure of sensitive receptors even with implementation of AMMs.

Noise effects under the Recommended Plan are determined to be significant and unavoidable after AMMs are implemented with respect to construction noise and construction vibration. Like air quality effects, for each of these noise effects, AMMs are required that would apply to future construction activities and would reduce negative effects.

The Recommended Plan will also affect transit and mobility during construction due to disruption to Muni lines, such as the T-Third. The Muni service, and in particular the T-Third line, are critical transportation services for many low-income populations and minority populations.

Construction under the Recommended Plan with the First Actions would cover roughly 932 acres of land; of this area, approximately 89 acres of construction would be within low-income census blocks and 55 acres within minority census blocks. As such, First Actions construction would take place across 20 percent of the study area, with 17 percent of low-income census blocks experiencing construction and 11 percent of minority census blocks experiencing construction.

The living seawalls would involve construction-related activity in Reaches 1, 2, and 3, this activity would be limited to the shoreline. The defense of Ferry Building and Agriculture Building, and the coarse Beach at Rincon Park would not be located in any low-income or minority census blocks.

Construction under the Recommended Plan with the Subsequent Actions would cover roughly 957 acres of land; of this area, approximately 84 acres of construction would be within low-income census blocks and 55 acres within minority census blocs. As such, Subsequent Actions construction would take place across 21 percent of the study area, with 16 percent of low-income census blocks experiencing construction and 1 percent of minority census blocks experiencing construction.

While some pile driving would also occur near and within minority census blocks and low-income census blocks, with residential uses located in census block 105.00/1 (Annex D.1.2, Section 1, Figure D.1.2-1), most of this activity would be located in census blocks without a minority population or low-income population. Based on relatively even distribution of construction effects throughout study area census blocks, construction-related effects would be distributed throughout the study area.

2.3.3.6.3. Conclusion

Overall, while the Recommended Plan would generate an adverse effect, as discussed above, the distribution of these effects (displacement, flooding, and construction) would be dispersed throughout the study area for both the first and Subsequent Actions; the effect would be ***less than significant***.

2.3.4. Alternative B: Nonstructural

Alternative B would have the largest construction footprint of all of the alternatives and therefore the greatest impact of the alternatives on socioeconomics and minority populations and low-income populations, described in more detail below.

2.3.4.1. Socioeconomics

Alternative B includes floodproofing, modifying, or acquiring and demolishing buildings and infrastructure to reduce flood risks for both the first and Subsequent Actions. As sea levels rise, areas with higher flood risks may be managed for responsible retreat, while areas with lower risks would be floodproofed or modified. Nature-based features would be added to retreat areas to reduce flood risks, while policy changes (such as zoning) would be implemented to allow for increased housing density and business relocations in inland areas. Essential utilities and major transportation and transit corridors would be relocated or modified to continue providing service.

Some of the actions in Alternative B, such as modifying or demolishing buildings and infrastructure, could have direct effects on socioeconomics. With the Subsequent Actions, 1,493 residential, commercial, industrial, institutional, or other city structures would be removed, and 2,782 would be floodproofed. With respect to roadways and transit, with the Subsequent Actions, 88 miles of roadway and 43.2-miles of trackway would be floodproofed. To support the protection of assets under Alternative B with the Subsequent Actions, a total of 1,138,301 square feet of building and wharf footprints would be demolished, part of a total demolition footprint of 1,974 acres.

2.3.4.1.1. Communities and Neighborhoods

During the forecast flooding events, inundation would still physically divide the waterfront neighborhoods, inhibiting community function and interaction throughout every reach, similar to FWOP conditions; refer to inundation on **Figure D.1.3-8** and **Figure D.1.3-9**.

Consistent with FWOP conditions (for 2040 with 100-year flood), future flooding with the First Actions would cover roughly 345 acres of land. Consistent with FWOP conditions (2090 + 100-year flood), future flooding with the Subsequent Actions would cover roughly 1,337 acres of land. However, the acquisition and removal of some buildings and the and the dry-floodproofing of structures under Alternative B would provide a beneficial effect against inundation relative to FWOP conditions.

Under FWOP conditions (for 2040 with 100-year flood), flooding would affect 55 acres of parks/open space, 4 miles of MUNI transit routes and 10 miles of streets throughout the four reaches. These same areas would be affected by inundation with Alternative B with the Subsequent Actions, but due to floodproofing of roadways and transit trackways, impacts on transportation would be less.

Under FWOP conditions (for 2090 with 100-year flood), flooding would affect 134 acres of parks, 22 miles of MUNI transit routes and 42 miles of streets throughout the four reaches. These same areas would be affected by inundation with Alternative B with the Subsequent Actions, but due to floodproofing of roadways and transit trackways, impacts on transportation would be less.

While acquisition of structures for demolition would disrupt existing communities and neighborhoods, the affected structures would otherwise be affected by flooding anyway and relocation could also have an indirect beneficial effect of invigorating other areas within San Francisco and dry-floodproofing structures within the study area would preserve community features through 2090 worst-case scenario flooding.

2.3.4.1.2. Displacement

With respect to inundation, by 2040 (with a 100-year flood) and 2090 (with a 100-year flood), Alternative B with first and Subsequent Actions would experience the residual inundation of 345 acres and 1,337 acres, respectively which is the same as under FWOP conditions and flooding would affect the same locations as the residences, businesses, parks, transit routes and city facilities as under FWOP conditions. However, due to removal of some structures and floodproofing of structures and many miles of roads and transit trackway, the consequences of that flooding would be much lower than under FWOP conditions.

This alternative would require substantial displacement of residences, commercial and industrial businesses, and community and public facilities as part of building acquisition and demolition. According to GIS data, Alternative B through the Subsequent Actions would involve the demolition of nearly 1,168 structures covering 1.1 million square feet of building demolition and 44,270 square feet of pier/wharf removal. Implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM-TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic effects related to Alternative B. These AMMs would be required for all future construction activity.

Overall, displacement would be less than what would occur under FWOP conditions due to the reduction of flooding disruption.

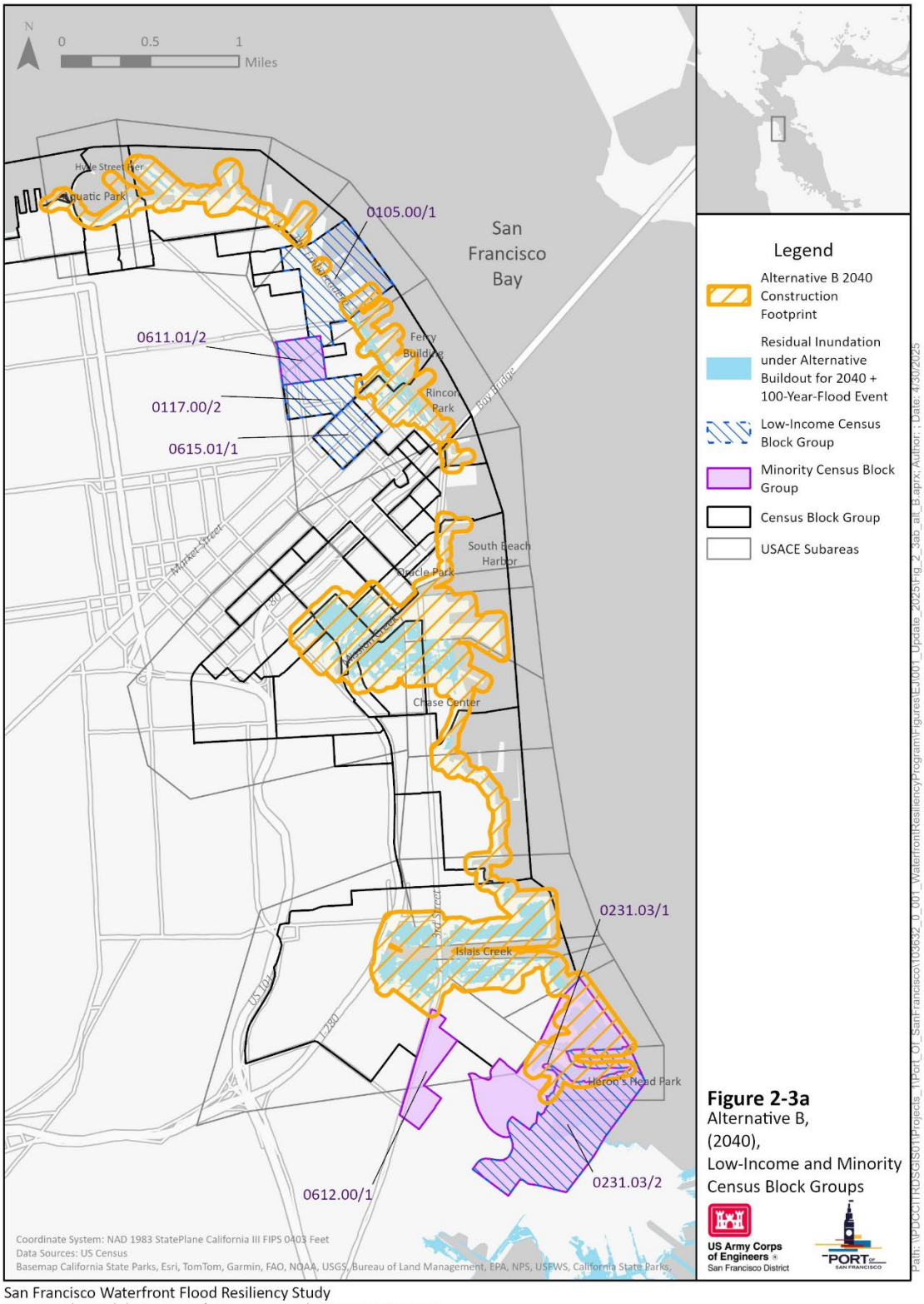
2.3.4.1.3. Economics

Demolition would result in displacement of economic activity, while at the same time demolition would result in an increase in construction-related employment. Additionally, by planning for the staggered removal of residences, commercial and industrial businesses, and community and public facilities, the overall population and tax revenues within the City would experience a shift in location. Implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM-TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic effects related to Alternative B. These AMMs would be required for all future construction activity under Alternative B.

Overall, economic effects would be less severe than under the FWOP due to reduction of flooding disruption.

2.3.4.1.4. Conclusion

While future inundation under Alternative B would be similar to that described in Section 2, *Existing and Future Without Project Conditions* in the final IFR/EIS, with flooding events physically dividing the waterfront neighborhoods, inhibiting community function and interaction, the planned removal of land uses provided under this alternative would largely mitigate a substantial adverse effect on employment, school district funding, or county and city property and sales tax revenues, and dry-floodproofing would support many coastal-lying features of the City from being irrevocably lost. Implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM-TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic effects related to Alternative B. These AMMs would be required for all future construction activity under Alternative B. Overall, this impact would provide beneficial effects when compared with the FWOP and socioeconomic effects for both the first and Subsequent Actions would, therefore, be ***less than significant.***



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Figure D.1.3-8: Alternative B Inundation, 2040 + 100 Year Event

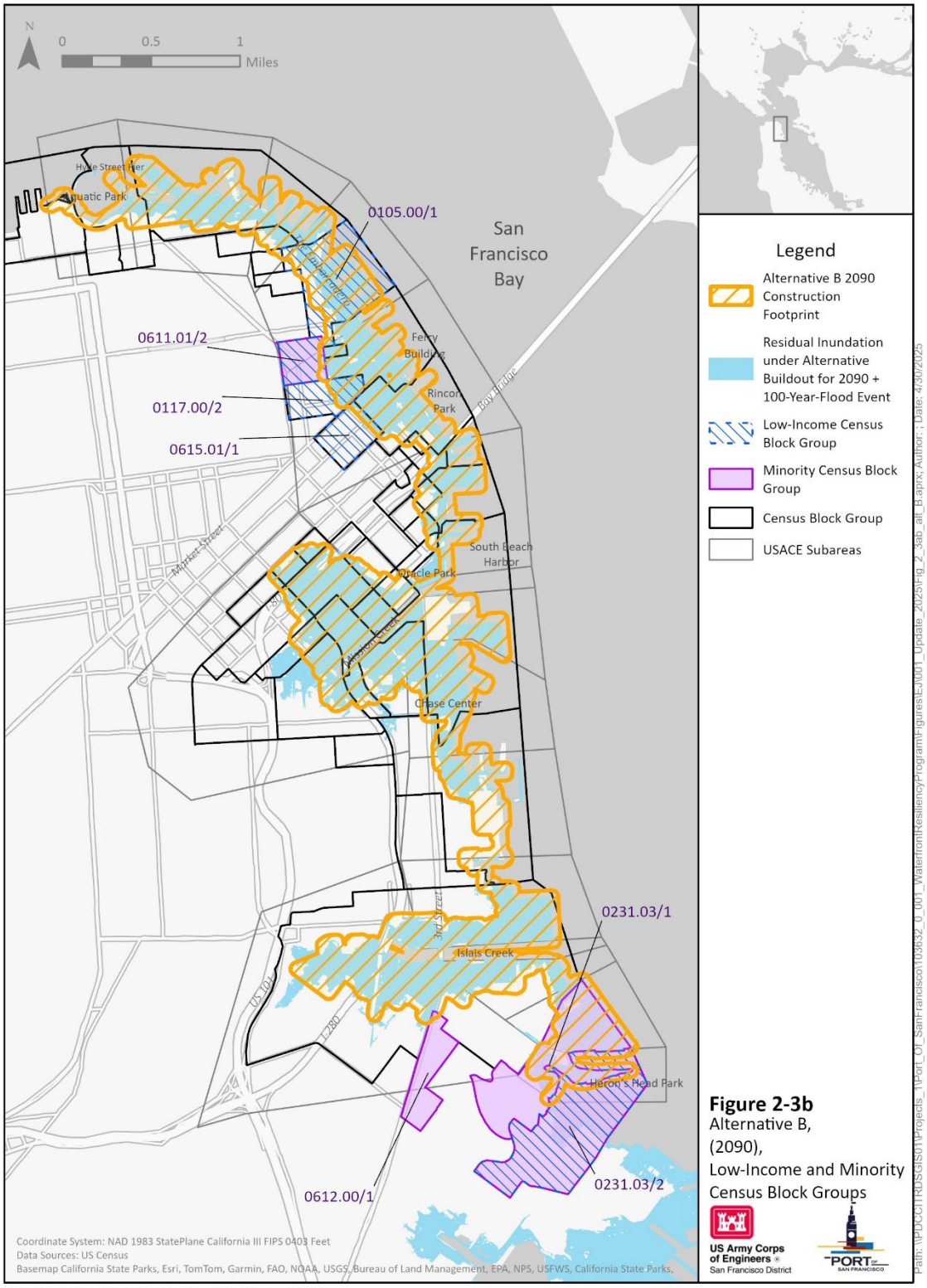


Figure D.1.3-9: Alternative B Inundation, 2090 + 100 Year Event

2.3.4.2. Communities

As discussed previously, specific census blocks in the study area contain minority populations and low-income populations. To identify the nature of the identified Alternative B effects on these populations, **Figure D.1.3-8** and **Figure D.1.3-9** show the minority census blocks and low-income census blocks, USACE reach boundaries, the Alternative B construction footprint, and future worst-case flood inundation in year 2090. Of the 45 census blocks within the study area, 7 census blocks comprise a minority population or low-income population; **Table D.1.3-9** and **Table D.1.3-10** present the study area acreage relative to the environmental acreage along with related Alternative B residual inundation area and construction area.

Table D.1.3-9: Alternative B Inundation and Construction Areas, First Actions

(Acres, 2040 + 100-year Flood)

	Total Area	Total Residual Inundation Area	Percentage (%) of Inundation to Total Area	Total Construction Area	Percentage (%) of Construction to Total Area
Alternative A Study Area (FWOP)	4,580	345	8%	0	0%
Alternative B Study Area	4,580	345	8%	1.261	28%
Identified Low-income Census Blocks	517	9	2%	51	10%
Identified Minority Census Blocks	516	63	12%	134	26%

Table D.1.3-10: Alternative B Inundation and Construction Areas, Subsequent Actions

(Acres, 2090 + 100-year Flood)

	Total Area	Total Residual Inundation Area	Percentage (%) of Inundation to Total Area	Total Construction Area	Percentage (%) of Construction to Total Area
Alternative A Study Area (FWOP)	4,580	1,337	29%	0	0%
Alternative B Study Area	4,580	1,337	29%	1,974	43%
Identified Low-income Census Blocks	517	88	17%	162	31%
Identified Minority Census Blocks	516	105	20%	145	28%

2.3.4.2.1. Flooding- and Displacement-Related Effects

Less-than-significant effects after AMMs are implemented are identified related to future flooding and displacement under Alternative B for the topics of socioeconomics, transportation, and aesthetics.

Less-than-significant effects after AMMs are implemented under Alternative B are identified related to socioeconomics; Alternative B would result in fewer socioeconomics impacts relative to FWOP conditions.

Future flooding under Alternative B with the First Actions would cover roughly 345 acres of land, and of this area approximately 9 acres of flooding would fall within low-income census blocks and 63 acres within minority census blocks (for 2040 + 100-year flood). Residual flooding would comprise 8 percent of the study area, 2 percent in low-income census blocks and 12 percent of minority census blocks.

Future flooding under Alternative B with the Subsequent Actions would cover roughly 1,337 acres of land, and of this area approximately 88 acres of flooding would fall within low-income census blocks and 105 acres within minority census blocks (for 2090 + 100-year flood). Residual flooding would comprise 29 percent of the study area, 17 percent in low-income census blocks and 20 percent of minority census blocks.

Given the wide distribution of flooding and displacement effects under Alternative B and the equal application of AMMs through this area, the less-than-significant effect after AMMs are implemented would apply to all populations.

While there would still be residual flooding affecting transit with Alternative B, Alternative B would provide floodproofing for transit lines and roadways, which would lower the level of flooding-related disruption compared to FWOP conditions.

While flooding would remove visual resources with floodproofing provided under Alternative B, less structures would be adversely affected and, thus, Alternative B would still have a significant but lower effect on community character than FWOP conditions, particularly in the Southern Waterfront.

2.3.4.2.2. Construction-Related Effects

A mixture of significant and unavoidable effects and less-than-significant effects after AMMs are implemented are identified for construction-related activities under Alternative B for the topics of air quality and noise.

Air quality effects related to compliance with air quality plans are determined to be less than significant after AMMs and one MM are implemented. Air quality effects under Alternative B with respect to public health effects are determined to be significant and unavoidable related to localized exposure of sensitive receptors even with implementation of AMMs.

Noise effects under Alternative B are determined to be less than significant after AMMs are implemented with respect to construction noise and construction vibration for

building removal due to flooding. Like air quality effects, for each of these noise effects AMMs are required that would apply to future construction activities equally throughout the study area and would reduce negative effects.

Construction under Alternative B with First Actions by 2040 would involve floodproofing across a broad area. As shown in **Figure D.1.3-9**, this disturbance area would be distributed throughout the study area. Based on GIS data for this construction footprint and noted in **Table D.1.3-10**, there would be approximately 1,261 acres of construction activity (floodproofing and demolition) across the 4,580-acre study area; of this, 51 acres would be within low-income census blocks and 134 acres within minority census blocks. Construction would take place across 28 percent of the study area, with 10 percent in low-income census blocks and 26 percent in minority census blocks.

Construction under Alternative B by 2090 would involve floodproofing of 2,782 structures, 88 miles of roadway and 43.2 miles of trackway along with the demolition of 1,168 structures. As shown in **Figure D.1.3-9**, this disturbance area would be distributed throughout the study area. Based on GIS data for this construction footprint and noted in **Table D.1.3-8**, there would be approximately 1,974 acres of construction activity (floodproofing and demolition) across the 4,580-acre study area; of this, 162 acres would be within low-income census blocks and 145 acres would be within minority census blocs. As such construction would take place across 43 percent of the study area, 31 percent of low-income census blocks and 28 percent of minority census blocks.

Given the wide distribution of project construction effects and equal application of AMMs under Alternative B for both the first and Subsequent Actions, the above air quality and noise effects and related AMMs, would apply across the project area.

2.3.4.2.3. Conclusion

Overall, while Alternative B would generate significant adverse effects as well as mitigable effects as discussed above, the distribution of these effects would be dispersed throughout the study area; the effect would be ***less than significant***.

2.3.5. Alternative F: Manage the Water, Scaled for Higher Risk

Table D.1.3-11 shows a summary of the socioeconomics and community impacts associated with Alternative F. Alternative F would experience a similar amount of construction as under the Recommended Plan and therefore would result in similar socioeconomic and community impacts as the Recommended Plan, described in more detail below.

Table D.1.3-11: Summary of Socioeconomic and Community Impacts Associated with Alternative F

Alternative F Socioeconomics and Communities Impact Rating by Measure	Bay fill	Levee	Bulkhead wall/Seawall	Roadway Impact	Tide Gate	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Marsh Enhancement*
Construction Footprint	3	3	3	3	3	3	3	3	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	2	2	2	2	2	2	2	2	2	2	2

* Denotes EWN measure.

2.3.5.1. Socioeconomics

Alternative F proposes a coastal flood defense infrastructure that relies on the construction of tide gates, shoreline extensions, levees, raised roads, and floodwalls along the current Bay shoreline, following the "manage the water" strategy. The shoreline is extended into the Bay to make space for underground stormwater storage capacity. Inland drainage modifications may include measures such as consolidation of combined sewer discharge outfalls, new pumps, and green infrastructure. Floodproofing of maritime and industrial facilities is also included, while residual coastal and inland flood risk could be addressed through floodproofing.

Alternative F integrates typical passive flood protection measures near the existing shoreline and would transform some parts of the waterfront to enable active flood response management. Compared to future inundation conditions addressed in Section 2*, Existing and Future Without Project Conditions* in the final IFR/EIS, Alternative F provides adaptive measures to increase levee heights for the high sea-level-rise scenario along Illinois Street and other inland locations such that coastal portions of the plan area (Potrero Hill and Bayview neighborhoods) would experience inundation with 7 feet of sea-level rise.

To accommodate these sea-level-rise protection measures, through the Subsequent Actions an overall estimate of 1.5 million square feet of building footprints would be demolished and 15,790 linear feet of wharf would be replaced. Direct construction effects would be extensive as Alternative F involves a substantial building alteration effort, and the LOD would move landward to Illinois Street with buildings removed and

demolished. Based on GIS data, approximately 839 acres of land would experience construction activity through the Subsequent Actions.

2.3.5.1.1. Communities and Neighborhoods

Residual future flooding under Alternative F with the First Actions would cover 130 acres of land, compared to 345 acres under FWOP conditions (for 2040+ 100-year flood). Residual future flooding under Alternative F with the Subsequent Actions would cover 403 acres of land, compared to 1,337 acres under FWOP conditions (for 2090 + 100-year flood).

Under FWOP conditions, inundation by 2040 (with the 100-year flood) would expose 55 acres of parks/open space, 4 miles of MUNI transit routes, and 10 miles of streets throughout the four reaches. By contrast, under the Alternative F first actions, only 35 acres of parks/open space, no MUNI transit routes, and no streets would be inundated.

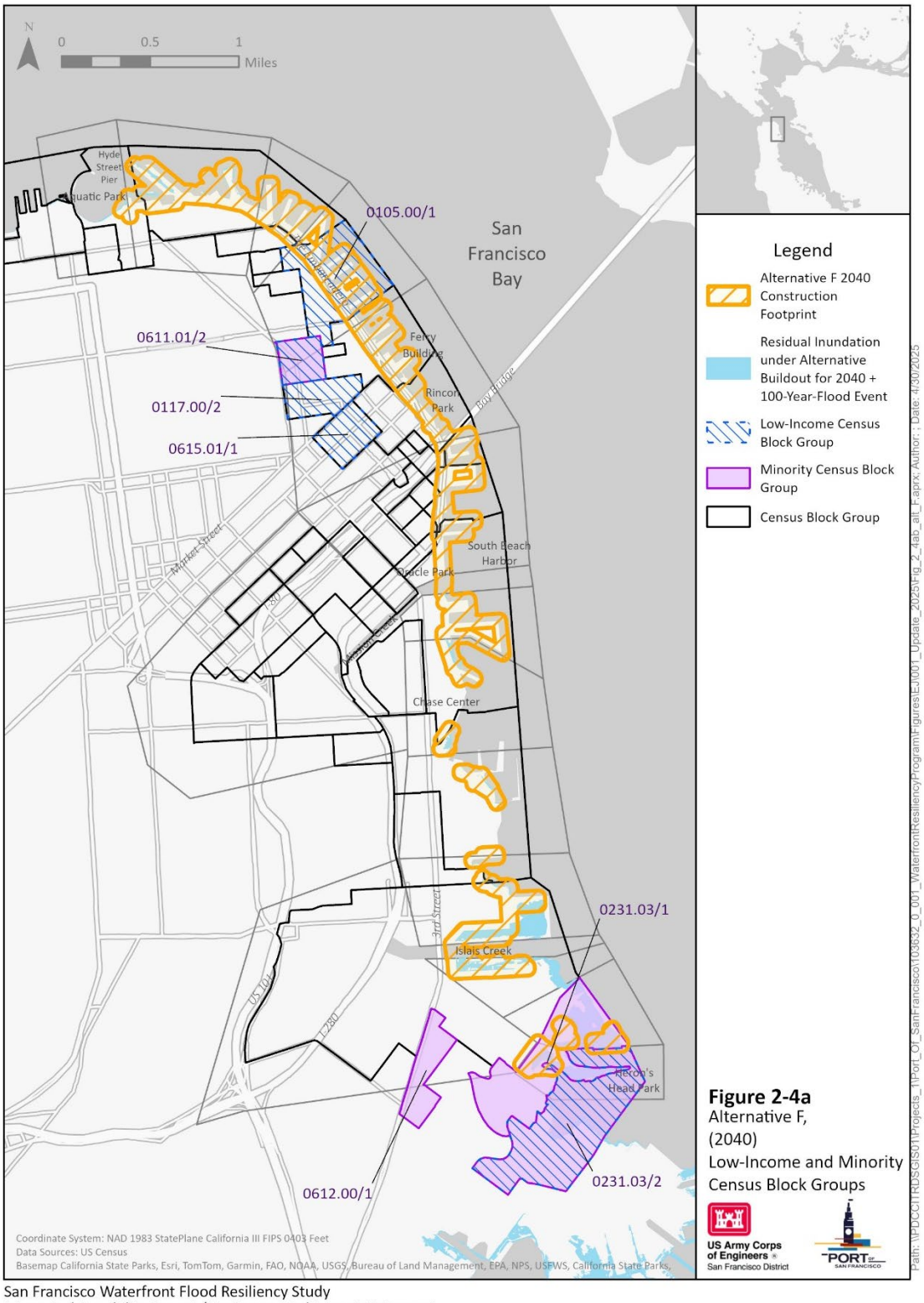
Under FWOP conditions, inundation by 2090 (with the 100-year flood) would expose 134 acres of parks, 22 miles of MUNI transit routes and 42 miles of streets throughout the four reaches. By contrast, under the Alternative F Subsequent Actions, only 63 acres of parks/open space, no MUNI transit routes and only 2 miles of streets would be inundated.

Floodproofing structures and transit systems and construction of an elevated LOD would have beneficial effects on communities and neighborhoods within the plan area by preserving community features during flooding.

Construction related to dry-floodproofing would be limited to short construction periods per project site and would not divide communities. The construction of the Alternative F LOD features would have limited shoreline effects and would not divide a community given their coastal boundary location (**Figure D.1.3-10** and **Figure D.1.3-11**). In addition, use of AMMs would serve to avoid construction disturbance for all construction activities related to communities and neighborhoods for both the first and Subsequent Actions.

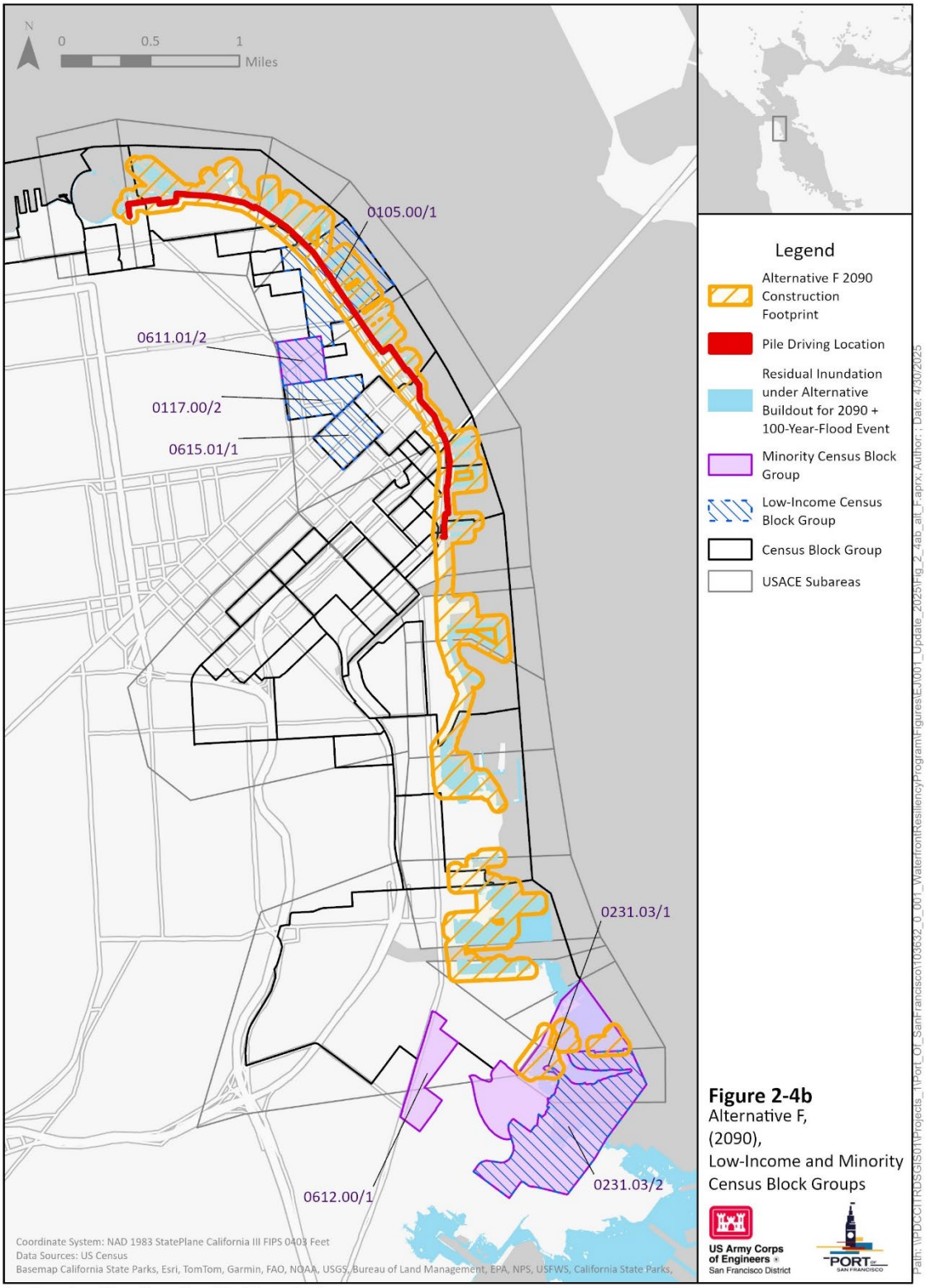
2.3.5.1.2. Displacement

Under FWOP conditions, in 2040 (with a 100-year storm), flooding would cause the affect residences, commercial and industrial businesses, and community and public facilities in each reach including 2,430 households, 8 affordable housing sites, 18 disadvantaged businesses, 55 acres of parks/open space and 25 public facilities (including Port facilities, community centers, fire and police facilities, libraries, health centers, clinics, and other City department buildings). With Alternative F first actions, in 2040 (with a 100-year storm), flooding would affect a smaller set of residences, business, and community facilities including 179 households, no affordable housing sites, no disadvantaged businesses, 37 acres of parks/open space and no public facilities.



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Figure D.1.3-10: Alternative F Inundation, 2040 + 100 Year Flood Event



San Francisco Waterfront Flood Resiliency Study
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Figure D.1.3-11: Alternative F Inundation, 2090 + 100 Year Flood Event

Under FWOP conditions, in 2090 (with a 100-year storm), flooding would cause the affect residences, commercial and industrial businesses, and community and public facilities in each reach including 11,204 households, 32 affordable housing sites, 127 disadvantaged businesses, 134 acres of parks/open space and 237 public facilities (including Port facilities, community centers, fire and police facilities, libraries, health centers, clinics, and other City department buildings). With Alternative F Subsequent Actions, in 2090 (with a 100-year storm), flooding would affect a smaller set of residences, business, and community facilities including 1,437 households, no affordable housing sites, two disadvantaged businesses, 63 acres of parks/open space and only 92 public facilities.

This alternative does not propose any relocation of residences, and community and public facilities, but through the Subsequent Actions would require alterations to commercial and industrial businesses, including 1.5 million square feet of demolition and 15,790 linear feet of wharf replacement. Implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic effects related to Alternative F. These AMMs would be required for all future construction activity.

Overall, displacement for both the first and Subsequent Actions would be less than what would occur under FWOP conditions, No Action.

2.3.5.1.3. Economics

Based on the findings of the OSE Report, Alternative F, through the Subsequent Actions, would result in total business interruption costs of $235 million.

Construction under this alternative would result in construction jobs-demand. Additionally, by preserving most businesses through construction of a robust LOD and planning for the incremental removal of some existing land uses, the overall population and tax revenues within the City would likely only experience a slight reduction, if at all, but would also shift in location. Implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM-TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic effects related to Alternative F. These AMMs would be required for all future construction activity under Alternative F.

Overall, economic effects for both the first and Subsequent Actions would be less severe than under FWOP conditions.

2.3.5.1.4. Conclusion

Because Alternative F would support the preservation of existing structures and infrastructure relative to FWOP conditions and long-term supports a more aggressive timeline for sea-level-rise defense, Alternative F would preserve substantially more features and values of the existing community relative to the FWOP. While Alternative F includes alterations to the existing community to support some managed retreat inland

along the southern waterfront, the new LOD would not generate construction effects that would divide the community. These features would ensure that future flood events do not physically divide the waterfront neighborhoods. Long term, these protection measures would avoid the worse effects of FWOP on employment, school district funding, or county and city property and sales tax revenues. Implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required for all future construction activity under Alternative F for both the first and Subsequent Actions to reduce socioeconomic effects. This impact would be ***less than significant***.

2.3.5.2. Communities

As discussed previously, specific census blocks in the study area contain minority-population or low-income populations. To identify the nature of the identified Alternative F effects on these populations, **Figure D.1.3-10** and **Figure D.1.3-11** show the minority census blocs and low-income census blocks, USACE reach boundaries, the Alternative F construction footprint and pile driving locations, and the future flood inundation in year 2040 and year 2090. Of the 45 census blocks within the study area, 7 census blocks comprise an minority populations and low-income populations; **Table D.1.3-12** and **Table D.1.3-13** present the study area acreage relative to the environmental acreage along with related Alternative F residual inundation area and construction area.

Table D.1.3-12: Alternative F Inundation and Construction Areas, First Actions

(Acres, 2040 + 100-year Flood)

	Total Area	Total Residual Inundation Area	Percentage (%) of Inundation to Total Area	Total Construction Area	Percentage (%) of Construction to Total Area
Alternative A Study Area	4,580	345	8%	0	0%
Alternative F Study Area	4,580	130	3%	741	16%
Identified Low-Income Census Block Groups	517	7	1%	78	15%
Identified Minority Census Blocks	516	63	12%	53	10%

Table D.1.3-13: Alternative F Inundation and Construction Areas, Subsequent Actions

(Acres, 2090 + 100-year Flood)

	Total Area	Total Residual Inundation Area	Percentage (%) of Inundation to Total Area	Total Construction Area	Percentage (%) of Construction to Total Area
Alternative A Study Area	4,580	1,337	29%	0	0%
Alternative F Study Area	4,580	403	9%	839	18%
Identified Low-Income Census Block Groups	517	25	5%	78	15%
Identified Minority Census Blocks	516	99	19%	55	11%

2.3.5.2.1. Flooding- and Displacement-Related Effects

Less-than-significant effects after AMMs are implemented are identified related to future flooding and displacement under Alternative F for the topics of socioeconomics, transportation, and aesthetics.

Less-than-significant effects after AMMs are implemented are identified under Alternative F related to socioeconomics; Alternative F would result in limited impacts on communities after AMM measures are implemented.

Residual flooding under Alternative F with the First Actions for 2040 with 100-year flood would be reduced from 345 acres under FWOP conditions to 130 acres of land, an overall reduction of 62 percent. In low-income census blocks, flooding would be reduced to 7 acres from 9 acres under FWOP conditions (reduction of 22 percent) and in minority census blocks would be the same as FWOP conditions at 63 acres. Residual flooding would comprise 3 percent of the study area, 1 percent of low-income census blocks, and 12 percent of minority census blocks.

Residual flooding under Alternative F with the Subsequent Actions for 2090 with 100-year flood would be reduced from 1,337 acres under FWOP conditions to 403 acres of land, an overall reduction of 70 percent. In low-income census blocks, flooding would be reduced to 25 acres from FWOP conditions of 88 acres, a reduction of 72 percent. In minority census blocks, flooding would be reduced to 99 acres from FWOP conditions of 105 acres, a reduction of 6 percent. Residual flooding would comprise 9 percent of the study area, 5 percent of low-income census blocks, and 19 percent of minority census blocks.

Through the Subsequent Actions, residual flooding would be substantially less than the concentration of flooding effects under FWOP conditions in all communities. Ultimately, given the beneficial flooding prevention measures, the wide distribution of flooding and displacement effects under Alternative F, and the equal application of AMMs through

this area, the less-than-significant effect after AMMs are implemented under Alternative F would apply across the project area.

As shown in **Table D.1.3-14** and **Table D.1.3-15** below, the reduction in flooding for the Subsequent Actions is nearly the same for employed vs. unemployed persons, white vs. minority persons, owner-occupied units vs. rental units, and total households vs. households in poverty, while for the first actions, there is a greater reduction for employed vs. unemployed persons, white vs. minority persons, and owner-occupied units vs. rental units, but total reduction in flooding for total households vs. households in poverty would be the same.

Table D.1.3-14: Alternative F Inundation Reduction Comparison, First Actions

(2040+ 100-year Flood)

Metric	FWOP (Number)	Alternative F (Number)	Reduction (Percentage)	Delta
Employed	3,243	1,853	43%	
Unemployed	1,153	754	35%	-8%
White	2,150	113	95%	
Minority (Non-White)	2,795	328	88%	-7%
Owner-occupied units	776	32	96%	
Renter-occupied units	1,654	147	91%	-5%
Total households	2,430	179	93%	
Households in Poverty	254	32	93%	Same

Table D.1.3-15: Alternative F Inundation Reduction Comparison, Subsequent Actions

(2090+ 1100-year Flood)

Metric	FWOP (Number)	Alternative F (Number)	Reduction (Percentage)	Delta
Employed	14,358	1,853	88%	
Unemployed	5,644	754	87%	-1%
White	10,471	1,397	87%	
Minority (Non-White)	12,042	1,604	87%	Same
Owner-occupied units	3,515	400	89%	
Renter-occupied units	7,690	1,037	87%	-2%
Total households	11,204	1,437	87%	
Households in Poverty	1,029	138	87%	Same

Less-than-significant effects after AMMs are implemented are identified under Alternative F are also identified related to transportation. With the first actions,

Alternative F would only experience inundation of MUNI lines, and only 2 miles of streets (for 2040 + 100-year flood). With the Subsequent Actions, Alternative F would only experience inundation of 0.1 mile of BART lines, no MUNI lines, and only 2 miles of streets (for 2090 + 100-year flood). While burdened communities may rely on impacted transit systems more readily than other populations, overall, as with the discussion related to socioeconomics, the effects on the transportation system would be distributed throughout the study area.

While residual flooding would remove visual resources, the area of effect would be much smaller with Alternative F compared to FWOP conditions. Similar to flooding effects under socioeconomics, the flooding effects to aesthetics would be experienced throughout the study area.

2.3.5.2.2. Construction-Related Effects

A mixture of significant and unavoidable effects and less-than-significant effects after AMMs are implemented are identified for construction-related activities under Alternative F for the topics of air quality and noise.

Air quality effects related to compliance with air quality plans are determined to be less than significant after AMMs and one MM are implemented. Air quality effects under Alternative F with respect to public health are determined to be significant and unavoidable related to localized exposure of sensitive receptors even with implementation of AMMs.

Noise effects under Alternative F are determined to be significant and unavoidable after AMMs are implemented with respect to construction noise and construction vibration. Like air quality effects, for each of these noise effects AMMs are required that would apply to future construction activities and would reduce negative effects.

Construction under the Alternative F First Actions would cover roughly 741 acres of land; of this area, 78 acres would be within low-income census blocks and 53 acres would be within minority census blocs. As such construction would take place across 16 percent of the study area, with 15 percent of low-income census blocks and 10 percent of minority census blocks also experiencing construction.

Construction under the Alternative F Subsequent Actions would cover roughly 839 acres of land; of this area, 78 acres of construction would be within low-income census blocks and 55 acres would be within minority census blocks. As such construction would take place across 18 percent of the study area, with 15 percent of low-income census blocks and 11 percent of minority census blocks also experiencing construction.

As shown in **Figure D.1.3-11**, while some pile driving would also occur near and within minority census blocks and low-income census blocks; with residential uses located in census block 105.00/1 (Annex D.1.2, Noise and Vibration, Figure D.1.2-1), most of this activity would be located in census blocks without a minority population or low-income population. Based on relatively even distribution of construction effects throughout study

area census blocks, construction-related effects would be distributed throughout the project area.

Given the wide distribution of project construction effects under Alternative F for both the first and Subsequent Actions, the above air quality and noise effects and related AMMs, would apply throughout the project area.

2.3.5.2.3. Conclusion

Overall, while Alternative F would generate significant adverse effects as well as mitigable effects, as discussed above, the distribution of these effects (displacement, flooding, and construction) would be dispersed throughout the study area, additionally the effects are experienced at a substantially reduced percentage than under FWOP conditions; the effect would be ***less than significant***.

2.3.6. Alternative G: Partial Retreat, Scaled for Higher Risk

Table D.1.3-16 shows a summary of the socioeconomics and community impacts associated with Alternative G. Alternative G would have the second largest construction footprint among the alternatives, and therefore the second largest impact on socioeconomics and communities.

Table D.1.3-16: Summary of Socioeconomic and Community Impacts Associated with Alternative G

Alternative G Socioeconomic and Community Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	3	3	3	3	3	3	3	3	3	3	3	3
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	2	2	2	2	2	2	2	2	2	2	2	2

* Denotes EWN measure.

2.3.6.1. Socioeconomics

Alternative G would construct flood defense structures and floodproof buildings in Mission Bay, Islais Creek/Bayview area, and Embarcadero. The alternative involves building levees, floodwalls, seawalls, and closure structures, along with floodproofing and converting some areas to natural and nature-based features. With the first actions, the alternative aims to defend against 3.5 feet of sea-level rise and requires reconfiguration of transportation and infrastructure. With the Subsequent Actions, the alternative aims to construct a new levee to defend against up to 7 feet of sea-level rise and establish floodable open space zones. The plan also includes modifying zoning, investing in public access improvements along the creek, and expanding bridges into causeways. In the Embarcadero geography, this alternative involves building an elevated shoreline with a new seawall and short floodwall, reconstructing the Embarcadero roadway, and raising buildings to defend against sea-level rise. The shoreline would be elevated to defend against 7 feet of sea-level rise by 2090. Over the long term, it would establish new open spaces and wetlands and would require relocating or adapting some buildings and jobs within the retreated areas.

To support these sea-level-rise protection measures, an overall estimate of 8.4 million square feet of building footprints would be demolished and 27,270 linear feet of wharf would be replaced for Alternative G. Direct construction effects related to sea-level rise would be extensive as Alternative G involves a substantial building alteration effort, and as the LOD would move further landward relative to Alternative F with more buildings removed and demolished. Based on GIS data approximately 1,040 acres of land would experience construction activity with the First Actions and 1,629 acres with the Subsequent Actions.

Compared to future inundation conditions addressed in Section 2*, Existing and Future Without Project Conditions* in the final IFR/EIS, Alternative G provides adaptive measures to increase levee heights for the high sea-level-rise scenario inland locations such that coastal portions of the plan area (SoMa, Potrero Hill, and Bayview Neighborhoods) would experience inundation with 7 feet of sea-level rise.

2.3.6.1.1. Communities and Neighborhoods

Residual future flooding under Alternative G with the First Actions would cover 177 acres of land, compared to 345 acres under FWOP condition (for 2040 + 100-year flood). With respect to transit, it is expected that residual flooding would affect no MUNI routes or streets compared to 4 miles of MUNI routes and 10 miles of streets under FWOP conditions.

Residual future flooding under Alternative G would cover 710 acres of land, compared to 1,337 acres under FWOP condition (for 2090 + 100-year flood). With respect to transit, it is expected that residual flooding would affect 3 miles of MUNI routes and 16 miles of streets compared to 22 miles of MUNI routes and 42 miles of streets under FWOP conditions.

Managed retreat and an elevated LOD would have beneficial effects on communities and neighborhoods within the study area by preserving community features during flooding events.

Construction of Alternative G would be extensive to account for elevated roadways and structures, and as the shoreline moves landward along with the LOD. Retreat and required demolition under this alternative would not be limited to the shoreline, expanding shoreward and eliminating entire sections of communities and neighborhoods as a total of 8.4- million square feet of structure footprint would be removed through the Subsequent Actions. While this retreat may not specifically divide a community, it would eliminate some portions of the neighborhoods. Throughout required construction under Alternative G for both the first and Subsequent Actions, use of AMMs would serve to avoid and limit construction disturbance.

2.3.6.1.2. Displacement

With respect to inundation, by 2040 (with a 100-year storm), with the Alternative G first actions, flooding would affect 177 acres compared to 345 acres under FWOP conditions. However, due to acquisition and demolition under this alternative many of the uses in this area would already be removed. With respect to inundation, by 2090 (with a 100-year storm), Alternative G would experience residual inundation which would affect 1,337 acres compared to 1,337 acres under FWOP conditions. However, due to acquisition and demolition under this alternative many of the uses in this area would already be removed.

Under FWOP conditions, in 2040 (with a 100-year storm), flooding would affect residences, commercial and industrial businesses, and community and public facilities in each reach including 12,430 households, 8 affordable housing sites, 18 disadvantaged businesses, 55 acres of parks/open space and 25 public facilities (including Port facilities, community centers, fire and police facilities, libraries, health centers, clinics, and other City department buildings). With the Alternative G first actions, in 2040 (with a 100-year storm), flooding would affect a smaller set of residences, business, and community facilities including 271 households, no affordable housing sites, no disadvantaged businesses, 37 acres of parks/open space and no public facilities.

Under FWOP conditions, in 2090 (with a 100-year storm), flooding would affect residences, commercial and industrial businesses, and community and public facilities in each reach including 11,204 households, 32 affordable housing sites, 127 disadvantaged businesses, 134 acres of parks/open space and 237 public facilities (including Port facilities, community centers, fire and police facilities, libraries, health centers, clinics, and other City department buildings). With the Alternative G Subsequent Actions, in 2090 (with a 100-year storm), flooding would affect a smaller set of residences, business, and community facilities including 4,335 households, 10 affordable housing sites, 14 disadvantaged businesses, 74 acres of parks/open space and 111 public facilities.

This alternative proposes the demolition of residences and community and public facilities and would require alterations to commercial and industrial businesses along

wharf structures. As noted previously, retreat and required demolition under this alternative through the Subsequent Actions would remove approximately 8.4 million square feet of structure footprints. Implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic effects related to Alternative G for both the first and Subsequent Actions. These AMMs would be required for all future construction activity.

Overall, displacement would be less than that experienced under FWOP conditions.

2.3.6.1.3. Economics

Construction under this alternative would result in construction jobs-demand. The planned shoreline elevation and retreat would require the displacement of some businesses that would preserve existing employment along with City property and sales tax revenues, the managed retreat of the shoreline would result in a loss of land uses in the City that generate tax revenues. Overall, implementation of construction and relocation related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required to reduce socioeconomic impacts related to Alternative G construction. Based on the findings of the OSE Report, Alternative G through the Subsequent Actions would result in business interruption costs of $129 million, much less than under FWOP conditions and less than Alternative F.

2.3.6.1.4. Conclusion

Because Alternative G would support the preservation of many existing structures and infrastructure relative to FWOP conditions and long term, supports a more aggressive timeline for sea-level-rise defense, it would preserve substantially more features and values of the existing community relative to FWOP. However, to address this inundation, Alternative G includes extensive alterations to the existing community to support the managed retreat of the shoreline inland along the southern waterfront rather than defending at the existing shoreline. This preventive retreat-related demolition would fundamentally alter the community connectivity and character in their respective neighborhoods but would also ensure that flood events do not physically divide the waterfront neighborhoods. Long term, these protection measures would avoid the worse effects of the FWOP on employment, school district funding, or county and city property and sales tax revenues. Further, as noted under the *Economics* analysis above, the potential productivity losses under Alternative G through the Subsequent Actions ($129 million) are less than under the FWOP scenario ($2.17 billion). Additionally, implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM TR-5 (Annex D.1.4, *Transportation*, Section 2.4) would be required for all future construction activity under Alternative G for both the first and Subsequent Actions to reduce socioeconomic effects. This impact would be ***less than significant.***

2.3.6.2. Communities

As discussed previously, specific census blocks in the study area contain minority-populations and low-income populations. To identify the nature of the identified Alternative G effects on these populations, **Figure D.1.3-12** and **Figure D.1.3-13** show the minority and low-income census blocks, USACE reach boundaries, the Alternative G construction footprint, and pile-driving locations (note, there are none for Alternative G), and the future flood inundation in year 2040 and year 2090. Of the 45 census blocks in the study area, 7 comprise a minority or low-income population. **Table D.1.3-17** and **Table D.1.3-18** present the study area acreage relative to the environmental acreage along with related Alternative G residual inundation area and construction area.

Table D.1.3-17: Alternative G Inundation and Construction Areas, First actions

(Acres, 2040 + 100-year Flood)

	Total Area	Total Residual Inundation Area	Percentage (%) of Inundation to Total Area	Total Construction Area	Percentage (%) of Construction to Total Area
Alternative A Study Area (FWOP)	4,580	345	8%	0	0%
Alternative G Study Area	4,580	177	4%	1,040	23%
Identified Low-Income Census Block Groups	517	7	1%	85	16%
Identified Minority Census Blocks	516	63	12%	78	15%

Table D.1.3-18: Alternative G Inundation and Construction Areas, Subsequent actions

(Acres, 2090 + 100-year Flood)

	Total Area	Total Residual Inundation Area	Percentage (%) of Inundation to Total Area	Total Construction Area	Percentage (%) of Construction to Total Area
Alternative A Study Area (FWOP)	4,580	1,337	29%	0	0%
Alternative G Study Area	4,580	719	16%	1,629	36%
Identified Low-Income Census Block Groups	517	25	5%	119	23%
Identified Minority Census Blocks	516	100	19%	168	33%

2.3.6.2.1. Flooding- and Displacement-Related Effects

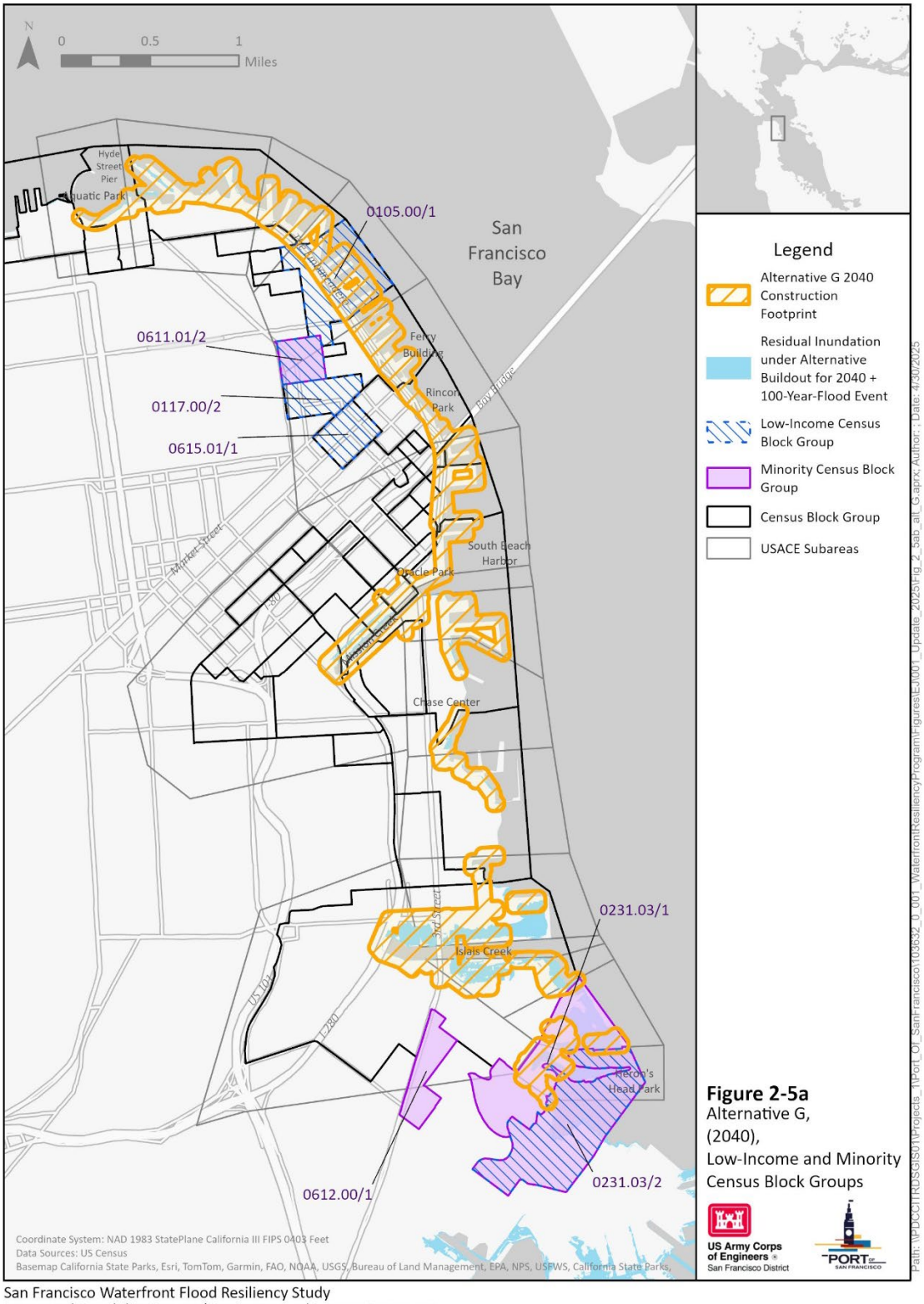
Less-than-significant effects after AMMs are implemented are identified related to future flooding and displacement under Alternative G for the topics of socioeconomics, transportation, and aesthetics.

Socioeconomic effects under Alternative G are determined to be less than significant after AMMs; Alternative G would result in fewer effects on divisions of an established community and alterations to community character than FWOP.

Future flooding under Alternative G with the First Actions for the 2040 + 100-year flood would be reduced from 345 acres under FWOP conditions to 177 acres, an overall reduction of 49 percent. In low-income census blocks, flooding would be reduced from 9 acres to 7 acres, a reduction of 22 percent. In minority census blocks, flooding would be the same as under FWOP conditions at 63 acres. Residual flooding would comprise 4 percent of the study area, 1 percent of low-income census blocks and 12 percent of minority census blocks.

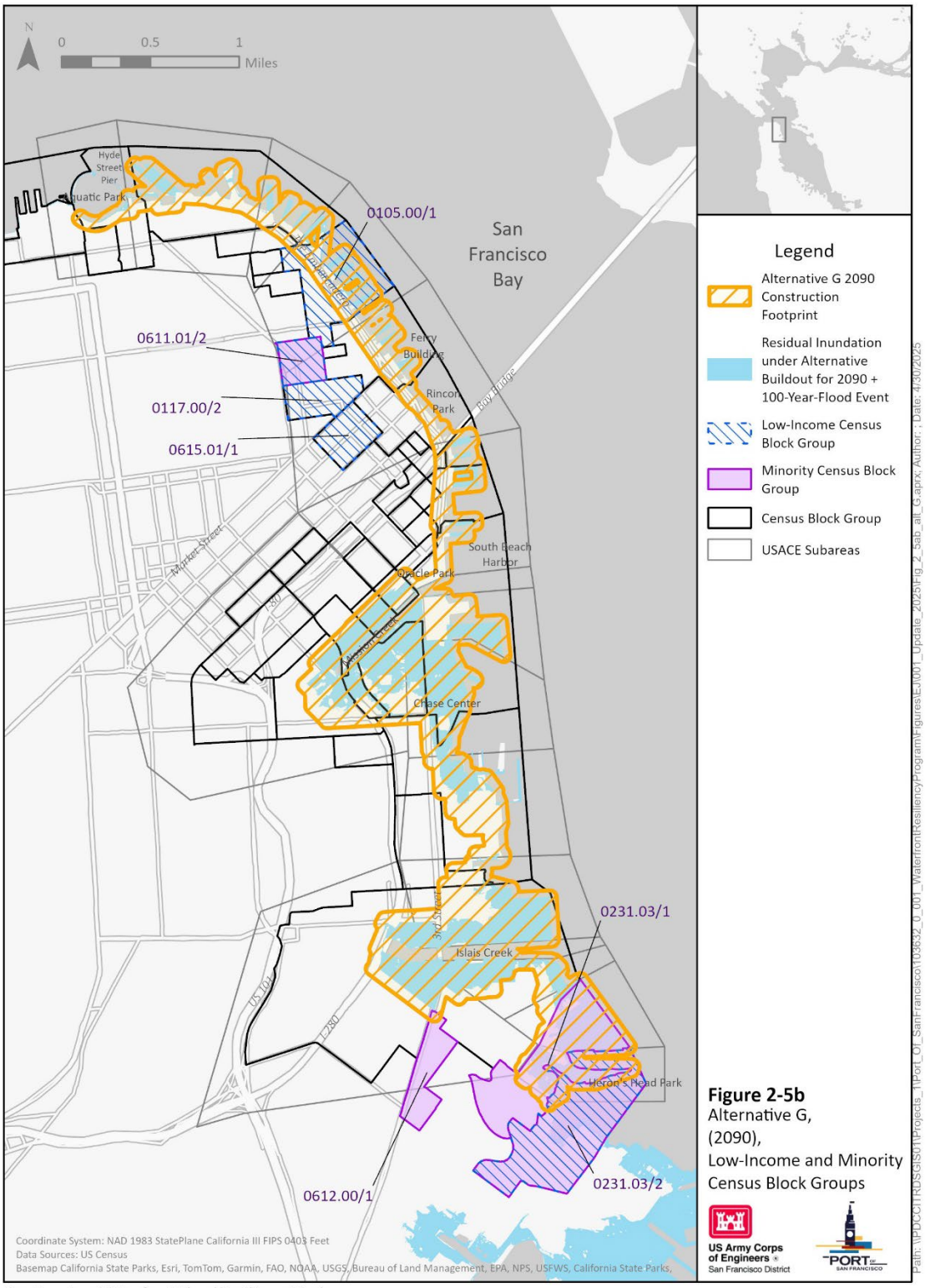
Future flooding under Alternative G with the Subsequent Actions for the 2090 + 100-year flood would be reduced from 1,337 acres under FWOP conditions to 719 acres, an overall reduction of 46 percent. In low-income census blocks, flooding would be reduced from 88 acres to 25 acres, a reduction of 72 percent. In minority census blocks, flooding would be reduced from 105 acres to 100 acres, a reduction of 5 percent. Residual flooding would comprise 16 percent of the study area, 5 percent of low-income census blocks and 19 percent of minority census blocks.

Given this distribution of flooding and displacement effects under Alternative G, the less-than-significant effect after AMMs are implemented under Alternative G for both the first and Subsequent Actions would apply to the project area as a whole.



San Francisco Waterfront Flood Resiliency Study
Integrated Feasibility Report / Environmental Impact Statement

Figure D.1.3-12: Alternative G Inundation, 2040 + 100 Year Flood Event



San Francisco Waterfront Flood Resiliency Study
Integrated Feasibility Report / Environmental Impact Statement

Figure D.1.3-13: Alternative G Inundation, 2090 + 100 Year Flood Event

As shown in **Table D.1.3-19** and **Table D.1.3-20** below, the reduction in flooding is nearly the same for employed vs. unemployed persons, white vs. minority persons, owner-occupied units vs. rental units, and total households vs. household in poverty for both the first and Subsequent Actions.

Table D.1.3-19: Alternative G Inundation Reduction Comparison, First actions

(2040 + 100Y Flood)

Metric	FWOP (Number)	Alternative G (Number)	Reduction (Percentage)	Delta
Employed	3,243	337	90%	
Unemployed	1,153	151	87%	-3%
White	2,150	200	91%	
Minority (Non-White)	2,795	433	85%	-6%
Owner-occupied units	776	63	92%	
Renter-occupied units	1,654	209	87%	-5%
Total households	2,430	271	89%	
Households in Poverty	254	43	89%	Same

Table D.1.3-20: Alternative G Inundation Reduction Comparison, Subsequent actions

(2090 + 100Y Flood)

Metric	FWOP (Number)	Alternative G (Number)	Reduction (Percentage)	Delta
Employed	14,358	5,926	60%	
Unemployed	5,644	2,100	63%	+3%
White	10,471	4,031	62%	
Minority (Non-White)	12,042	4,992	59%	-3%
Owner-occupied units	3,515	1,395	60%	
Renter-occupied units	7,690	2,941	62%	+2%
Total households	11,204	4,335	61%	
Households in Poverty	1,029	469	62%	+1%

The Alternative G First Actions would have lower effects on transportation than FWOP conditions for the 2040 + 100-year flood as Alternative G would only result in compromised capacity of transit associated with inundation of no MUNI routes and no street, compared to 4 miles of MUNI routes and 10 miles of streets under FWOP conditions. Alternative G would have lower effects on transportation than FWOP conditions for 2090 + 100-year flood as Alternative G would only result in compromised capacity of transit associated with inundation of 1.1 miles of Caltrain, 0.1 mile of BART,

and 3 miles of MUNI routes by 2090, which is less than the effects with FWOP conditions. While some communities may rely on affected transit systems more heavily than other populations, overall, the effects on the transportation system, as with socioeconomic effect would be distributed throughout the study area.

Shoreline elevation and retreat measures would remove and obstruct visual resources, but the area of visual resources removed due to flooding would be much less than with FWOP conditions. Similar to flooding effects under socioeconomics, the flooding effects on aesthetics would be experienced throughout the study area.

2.3.6.2.2. Construction-Related Effects

A mixture of significant and unavoidable effects and less-than-significant effects after AMMs are implemented are identified for construction-related activities under Alternative G for the topics of air quality and noise.

Air quality effects related to compliance with air quality plans are determined to be less than significant after AMMs and one MM are implemented. Air quality effects under Alternative G with respect to public health effects are determined to be significant and unavoidable related to localized exposure of sensitive receptors even with implementation of AMMs.

Noise effects under Alternative G are determined to be less than significant after AMMs are implemented with respect to construction noise and construction vibration. Like air quality effects, for each of these noise effects AMMs are required that would apply to future construction activities and would reduce negative effects.

Construction under Alternative G with the First Actions would cover roughly 1,040 acres. Of this area, 85 acres would be within low-income census blocks and 78 acres would be within minority census blocks. The total construction footprint would comprise 23 percent of the study area, 16 percent of low-income census blocks and 15 percent of minority census blocks. Construction under Alternative G with the Subsequent Actions would cover roughly 1,629 acres, of which 119 acres would be within low-income census blocks and 168 would be within minority census blocks. The total construction footprint would comprise 36 percent of the study area, 23 percent of low-income census blocks and 33 percent of minority census blocks.

As shown in **Figure D.1.3-13**, there would be no pile driving associated with this alternative. Based on relatively even distribution of construction effects throughout study area census blocks, construction-related effects would be distributed throughout the study area.

Alternative G through the Subsequent Actions would result in the demolition and displacement of 8.4 million square feet of structure footprint due to construction. The identified construction-related effects would be distributed throughout the study area. Given the wide distribution of construction effects under Alternative G for both the first

and Subsequent Actions, the above air quality, noise, socioeconomic, and transportation effects and related AMM's would apply across the project area.

2.3.6.2.3. Conclusion

Overall, while Alternative G would generate adverse effects, as discussed above, the distribution of these effects (displacement, flooding, and construction) would be dispersed throughout the study area. Therefore, the adverse environmental effects generated under Alternative G for both the first and Subsequent Actions would apply across the project area; the effect would be ***less than significant***.

3.0 Mitigation

The following avoidance, minimization, and mitigation measures would be required for all alternatives.

AMM-CIA-1: EIS Outreach and Communication

Outreach and communication of impacts throughout the design and construction phases during the following stages: (1) Consideration of adverse effects and potential project design modifications; (2) Identification of substantial effects, and; (3) Development of mitigation. The Port and/or USACE will also conduct additional outreach and communication to unhoused persons during the design and construction phases. An outreach plan for unhoused persons will be developed, in coordination with local agencies and non-profit organizations that work with underserved communities and those experiencing homelessness.

AMM-CIA-2: *Note: Redundant with AMM TR-1, TR-2, TR-3, and TR-4 (see Annex D.1.4, Transportation). Reference kept to maintain numbering, but text deleted.*

AMM-CIA-3: Construction Loading Zones

Loading areas within active construction zones will be relocated as close to the construction zone as practical. Temporary loading zones may be possible under some circumstances.

AMM-CIA-4: Access Change Notices and Coordination

Advanced notice and coordination with emergency service providers and school officials will minimize potential temporary impacts from access changes, routing and scheduling. USACE and the City will coordinate with service providers as design and phasing is further developed.

AMM-CIA-5: Utility Relocation and Notification

Utility lines will be relocated by the utility companies, in coordination with the City. Potentially affected utility customers will be notified of potential service disruptions before relocation.

AMM-CIA-6: Targeted Outreach

Targeted outreach to businesses in the project area will take place to accommodate the loading/unloading needs of each business.

AMM-CIA-7: Homeless Outreach

The City will conduct targeted outreach to homeless persons within the construction area to notify them at least three days in advance of construction activities.

AMM-CIA-8: Property Acquisition

Where project construction requires displacement, the City will ensure fair and equitable treatment of affected persons related to relocation assistance and real property acquisition per the Uniform Relocation Assistance and Real Property Acquisition Policies Act.

AMM-CIA-9: Relocation Implementation Plan

If required, a relocation implementation plan will be prepared to support affected property owners in the event of real property acquisition (could apply to utilities).

4.0 Cumulative and Other Impacts

The 2090 plan-date is the cumulative study timeframe for socioeconomics and communities impact analysis, and the City is the study area. While there are various land use plans and policies to address regional planning for the future sea-level-rise conditions in the City (refer to Annex D.1.7, Land Use), at present, there are no actionable items to the scale as the Alternatives B, F, and G, and the Recommended Plan. FWOP conditions in the cumulative environment would result in significant and unavoidable affects to socioeconomics, while Alternatives B, F, G, and the Recommended Plan, with implementation of the nine AMMs would reduce avoidable affects. However, given the range of possible future flood inundation and the possible changes in occupancy and land uses between existing conditions and 2090 unrelated to the alternatives, it is not possible to specifically quantify cumulative effects, and thus the cumulative impact is presumed to be significant and unavoidable.

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.1.4 TRANSPORTATION

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Attachments

Transportation Attachment 1: Figures and Parking Facility Table

Acronyms and Abbreviations

Acronym	Definition
ABAG	Association of Bay Area Governments
AC Transit	Alameda-Contra Costa Transit District
BART	Bay Area Rapid Transit
Caltrans	California Department of Transportation
CTMP	Construction Traffic Management Plan
EWN	Engineering with Nature
FWOP	Future Without Project
GGT	Golden Gate Transit
HSR	High Speed Rail
MME	Muni Metro East
MPO	Metropolitan Planning Organization
MTC	Metropolitan Transportation Commission
MUNI	Municipal Railway
PCJPA	Peninsula Corridor Joint Powers Authority
SamTrans	San Mateo County Transit
SFCTA	San Francisco County Transportation Authority
SFMTA	San Francisco Municipal Transportation Agency
SGI	Seismic Ground Improvements
SoMa	South of Market
WETA	Water Emergency Transportation Authority

1.0 Introduction

This section will address transportation in the area of the project including temporary (construction) and permanent effects on movement of vehicles (major arterials, highway access), train, light rail and bus transit, ferry, pedestrian and bicycle use and access.

2.0 Affected Environment

2.1 Regulatory Framework

2.1.1 Federal Regulations

There are no federal transportation regulations applicable to the Project.

2.1.2 Regional Regulations and Plans

2.1.2.1 Plan Bay Area 2050

At the state level, the Sustainable Communities and Climate Protection Act of 2008 mandated the coordination of transportation and land use planning efforts for each metropolitan planning organization (MPO) in California. Under this act, MPOs must adopt a “sustainable communities strategy” as part of their regional transportation plan, including strategies for land use, housing and transportation to reduce greenhouse gas emissions. The San Francisco Bay Area’s MPO, a combined partnership of the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG), initiated Plan Bay Area 2050 in summer 2019 (SFMTA, 2021).

Plan Bay Area 2050 is the Bay Area’s 30-year regional plan long-range plan adopted by the MTC and ABAG. The plan was developed in collaboration with Bay Area residents, partner agencies, and nonprofit organizations. It lays out a $1.4 trillion vision for a more equitable and resilient future for Bay Area residents. Thirty-five strategies make up the heart of the plan to improve housing, the economy, transportation and the environment across the Bay Area’s nine counties.

Plan Bay Area 2050 serves as the Bay Area’s Regional Transportation Plan, as required by federal regulations, and the Sustainable Communities Strategy, as required by state statute. Locally near the San Francisco Waterfront, the Transportation Plan discusses adding new bus routes to service future development sites in Hunters Point and Candlestick Point; a new transbay crossing between Oakland and downtown San Francisco; the Caltrain extension into downtown San Francisco; and investments in regional trails including the Bay Trail.

2.1.2.2 Water Emergency Transportation Authority’s Water Transportation System Management Plan

The Water Emergency Transportation Authority (WETA) is a regional agency authorized by the State to operate a comprehensive San Francisco Bay Area public water transit

system. In 2009, the WETA adopted the Water Transportation System Management Plan, which complements and reinforces other transportation emergency plans that will enable the Bay Area to restore mobility after a regional disaster.

2.1.2.3 San Francisco Bay Trail Plan

The Association of Bay Area Governments administers the San Francisco Bay Trail Plan. The San Francisco Bay Trail is a multi-purpose recreational trail that, when complete, will encircle San Francisco Bay and San Pablo Bay with a continuous 500-mile network of bicycling and hiking trails; to date, 338 miles of the alignment have been completed (Association of Bay Area Governments 2020).

2.1.3 Local Regulations and Plans

2.1.3.1 City and County of San Francisco General Plan

The Transportation Element of the General Plan is composed of objectives and policies that relate to the eight aspects of the citywide transportation system: General Regional Transportation, Congestion Management, Vehicle Circulation, Transit, Pedestrians, Bicycles, Citywide Parking, and Goods Management. The Transportation Element references San Francisco's Transit-First Policy in its introduction. It contains objectives and policies, including objectives related to locating development near transit investments, encouraging transit use, and regulating traffic signal timing to emphasize transit, pedestrian, and bicycle traffic as part of a balanced multimodal transportation system.

The San Francisco Municipal Transportation Agency (SFMTA) is a department of the City and County of San Francisco responsible for the management of all ground transportation in the city. The SFMTA has oversight over the Municipal Railway (Muni) public transit, as well as bicycling, paratransit, parking, traffic, walking, and taxis. SFMTA operates the City's transportation systems and prepared the SFMTA Strategic Plan 2021-2024 (SFMTA 2021).

2.1.3.2 Transit-First Policy

In 1998, San Francisco voters amended the City Charter (Charter Article 8A, Section 8A.115) to include a Transit-First Policy, which was first articulated as a City and County of San Francisco (City) priority policy by the Board of Supervisors in 1973. The Transit-First Policy is a set of principles that underscore the City's commitment that travel by transit, bicycle, and foot be given priority over the private automobile. These principles are embodied in the policies and objectives of the Transportation Element of the City General Plan (General Plan).

2.1.3.3 San Francisco Bicycle Plan

The San Francisco Bicycle Plan (Bicycle Plan) describes a City program to provide the safe and attractive environment needed to promote bicycling as a transportation mode. The Bicycle Plan identifies the citywide bicycle route network and establishes the level

of treatment (i.e., Class I, Class II, or Class III facility) on each route. The Bicycle Plan also identifies near-term improvements, long-term improvements, and minor improvements that would be implemented to facilitate bicycling in San Francisco.

2.1.3.4 Better Streets Plan

The San Francisco Better Streets Plan (Better Streets Plan) focuses on creating a positive pedestrian environment through measures such as careful streetscape design and traffic-calming measures to increase pedestrian safety. The Better Streets Plan includes guidelines for the pedestrian environment, which it defines as the areas of the street where people walk, sit, shop, play, or interact.

2.1.3.5 Construction Regulations Blue Book

The San Francisco MTA published the Regulations for Working in San Francisco Street, also named the “Blue Book”. This provides direction for agencies working in the City, utility crews, private contractors and other organizations that work on city streets. These regulations set the requirements for working with pedestrian, bicycle, transit, and other traffic to cost the least interference (SFMTA 2023a).

2.1.3.6 Blue Greenway

The Port of San Francisco produced the Blue Greenway document to identify a trail and associated recreational and green infrastructure through the implementation of the San Francisco Bay Trail, Bay Area Water Trail, and neighborhood green corridors to advocate for waterfront access. The Blue Greenway parallels the southern waterfront from Mission Creek to the San Francisco city limits south of Hunters Point (Port of San Francisco, 2012).

2.2 Existing Condition

This section describes the existing transportation conditions within the project area or construction area, encompassing 7.5 miles from Aquatic Park to Heron’s Head Park and providing a variety of transportation facilities and services, both on the water and throughout the City. Transportation, including all the ways people travel in San Francisco, is overseen primarily by the San Francisco Municipal Transportation Agency, with additional responsibilities overlapping with San Francisco Public Works, the San Francisco County Transportation Authority, and the Port of San Francisco. Additional regional transportation providers provide service to, from, and within San Francisco, including Alameda-Contra Costa Transit District (AC Transit), Bay Area Rapid Transit (BART), Caltrain, Golden Gate Transit (GGT), WETA, and San Mateo County Transit (SamTrans). The transportation network consists of roadways, local and regional transit facilities, and bicycle and pedestrian networks. Descriptions of these facilities are provided below.

2.2.1 Roadway Network

The following includes a discussion of existing roadway systems in the project area, including roadway designations, the number of lanes, and traffic flow directions. The roadway network includes freeways, major arterials, transit preferential streets, secondary arterials, recreational streets, collector and local streets, primary emergency priority routes, and freight truck routes. Detailed descriptions of these functional classifications are provided in the Transportation Element of the General Plan (City and County of San Francisco 2014). The Transportation Attachment 1, Figures 1 through 11 for each Alternative, includes a map of roadways throughout the Project area.

The project area is served by three highways: Interstates 80 and 280, and U.S.101.

Interstate 80 (I-80) connects San Francisco and the East Bay in an east–west direction via the San Francisco-Oakland Bay Bridge. In San Francisco, the highway connects to U.S. 101 in the Mission Creek subarea.

U.S. 101 links San Francisco to the Peninsula/South Bay and to the North Bay via the Golden Gate Bridge. Local access to I-80 from the project area is provided via access ramps located on Fremont Street in the Ferry Building subarea, Harrison and Brannan streets in the South Beach subarea, and Seventh and Eighth streets in the Mission Creek subarea. The Embarcadero feeds several Bay Bridge access routes.

Interstate 280 (I-280) serves San Francisco and the Peninsula/South Bay. The northern terminus of I-280 is located at King and Brannan streets in the Mission Creek subarea. I-280 runs south from there to San Jose. In San Francisco, the highway connects to U.S. 101 in the Islais Creek subarea. Local access to I-280 from the project area is provided via access ramps located on Pennsylvania Avenue, 18th Street, and Mariposa Street in the Mission Creek subarea; at Pennsylvania Avenue and Cesar Chavez in the Islais Creek subarea; and at Indiana Street in the Pier 80 subarea.

2.2.2 Local Access

The roadway network in the project area is generally an east–west and north–south grid. Local access is generally provided by arterial and local roadways in proximity to the project area. Descriptions of these roadways are presented below. Roadways are assumed to have no on-street parking or bicycle facilities unless otherwise noted.

The Embarcadero is a major north–south roadway that connects San Francisco's Fisherman's Wharf subarea with the South Beach subarea where it becomes King Street. The roadway also runs through the Ferry Building, Northeast Waterfront, and Pier 31 to 35 subareas, providing direct access to port facilities, including the Ferry Building Terminal and James R. Herman Cruise Terminal. The Embarcadero operates with two-way traffic, with generally two travel lanes in each direction between Second and Howard streets, three lanes in each direction between Howard Street and Don Chee Way, three northbound lanes and two southbound lanes between Don Chee Way and Broadway, two lanes in each direction between Broadway and North Point Street, two northbound lanes and one southbound lane between North Point Street and Powell Street, and one lane in each direction between Powell Street and the road's northern terminus at Fisherman's Wharf***.*** The Embarcadero has Class II bike lanes in both

directions between North Point Street and King Street. Between Broadway and Folsom Street on the east side of the Embarcadero, there is a Class IV separated bikeway. The Promenade along the Embarcadero is a Class I bike lane. Muni light rail and streetcar routes operate in the center median with raised center-island transit stops along the corridor. The roadway is designated as a Primary Arterial Street, Transit Preferential Street, and Freight Truck Route in the General Plan (City and County of San Francisco 2014) and a Primary Emergency Priority Route in the San Francisco Emergency Response Plan (City and County of San Francisco 2017).

Jefferson Street is an east–west roadway that connects Hyde Street and te Embarcadero through the Aquatic Park and Fisherman's Wharf subareas. This roadway provides direct access to Aquatic Park and the Hyde Street Pier. The roadway operates with two-way traffic, with generally one travel lane in each direction. The roadway is designated as a Recreational Street in the General Plan.

Beach Street is an east–west roadway that connects Polk Street and the Embarcadero through the Aquatic Park and Fisherman's Wharf subareas. This roadway provides direct access to Aquatic Park and the Maritime Museum. The roadway operates with two-way traffic, with generally one travel lane in each direction between Polk and Powell streets and generally two travel lanes in each direction between Powell Street and the Embarcadero. The roadway generally has on-street parallel parking on both sides. The roadway is designated as a Recreational Street in the General Plan.

Broadway is an east–west roadway that connects Lyon Street and the Embarcadero through the Northeast Waterfront subarea. The roadway operates with two-way traffic, generally with two travel lanes in each direction and on-street parallel parking on both sides. The roadway is designated as an Arterial Street in the General Plan and a Primary Emergency Priority Route in the San Francisco Emergency Response Plan.

Washington Street is an east–west roadway that connects Steiner Street to the Embarcadero through the Ferry Building and Northeast Waterfront subareas. In the vicinity of the project area, the roadway operates with two-way traffic, with generally two lanes in each direction between the Embarcadero and Drumm Street; however, the roadway also operates with one-way traffic westbound, with one travel lane between Drumm and Battery streets. On-street parallel and 45-degree angled parking is intermittently provided on both sides of the street. The roadway is designated as an Arterial Street in the General Plan and a Primary Emergency Priority Route in the San Francisco Emergency Response Plan.

Harrison Street is an east–west roadway in the vicinity of the Primary Construction Zone that connects Cesar Chavez and the Embarcadero through the Ferry Building, South Beach, and Mission Creek subareas. This roadway provides access to I-80 and the Bay Bridge from the project area. In the vicinity of the project area, the roadway operates with two-way traffic, with generally one eastbound travel lane and three westbound travel lanes between Essex Street and the Embarcadero. The roadway is designated as an Arterial Street in the General Plan and a Primary Emergency Priority Route in the San Francisco Emergency Response Plan.

Bryant Street is an east–west roadway in the vicinity of the Primary Construction Zone that connects Cesar Chavez and the Embarcadero through the Mission Creek and

South Beach subareas. This roadway provides access to I-80 and the Bay Bridge from the project area. Near the project area, Bryant Street operates with two-way traffic, with generally one westbound and two eastbound travel lanes as well as 45-degree diagonal on-street parking on both sides.

Third Street is a north–south roadway that connects Market Street and Bayshore Boulevard through the Ferry Building, South Beach, Mission Rock, Mission Bay, Pier 70, Pier 80, Cargo Way, and Islais Creek subareas. Transit operates in the median south of Channel Street. This roadway provides primary north–south access for port facilities at Piers 48, 50, 52, 54, 70, 80, 90, 92, and 94 to 96. Third Street includes the Lefty O'Doul Bridge in China Basin and Third Street Bridge in Islais Creek. The roadway operates with one-way traffic northbound, with generally four travel lanes between Market and King streets; however, the roadway also operates with two-way traffic, with generally two travel lanes in each direction between King Street and Bayshore Boulevard. On-street parking is intermittently provided on both sides of the street. The roadway has a designated Class III bike route between Cargo Way and Bayshore Boulevard through the Islais Creek subarea and Class IV bikeways crossing over Lefty O'Doul Bridge. The roadway is designated as an Arterial Street and Transit Preferential Street in the General Plan and a Primary Emergency Priority Route in the San Francisco Emergency Response Plan.

Fourth Street is a north–south roadway that connects Market and 16th streets through the South Beach, Mission Creek, and Mission Rock subareas and incudes the Peter R. Maloney Bridge in China Basin. Transit operates in the median between Harrison and Channel Streets. Near the project, the roadway operates with two-way traffic, with generally one northbound lane and two southbound lanes between Bryant and Channel streets and generally one lane in each direction between Channel and 16th streets. Fourth Street is a Class II bike route between Channel and 16th streets and Class IV bikeway between Mission Bay Boulevard North and Mission Bay Boulevard South. The roadway is designated as an Arterial Street in the General Plan and a Primary Emergency Priority Route in the San Francisco Emergency Response Plan.

Terry A. Francois Boulevard is a north–south roadway that connects the San Francisco Bay Trail to Illinois Street through the Mission Rock and Mission Bay subareas. This roadway provides direct access to port facilities at Piers 48, 50, 52, and 54. The roadway operates with two-way traffic, with generally two travel lanes in each direction. The roadway has a Class IV separated bikeway along the east side of the street.

Cesar Chavez is an east–west roadway that connects Noe Street and Maryland Street through the Islais Creek and Pier 80 subareas. This roadway provides direct access to port facilities at Pier 80. The roadway operates with two-way traffic, generally two travel lanes in each direction between Guerrero and Third streets and generally two eastbound and one westbound travel lane between Third and Maryland streets. The roadway generally has on-street parallel parking on both sides. It also has Class IV separated bike lanes in each direction between Kansas and Mississippi streets, Class II bike lanes in each direction between Indiana and Third streets, and a Class III bike route between Third and Illinois streets. The roadway is designated as an Arterial Street in the General Plan and a Primary Emergency Priority Route in the San Francisco Emergency Response Plan.

Cargo Way is an east–west roadway that connects Third and Jennings streets through the Cargo Way and Pier 94 to 96 subareas. This roadway serves as a primary access route to port facilities at Piers 90, 92, and 94 to 96. The roadway operates with generally two travel lanes in each direction and has a Class IV two-way cycle track along the south side of the street between Illinois and Jennings streets and Class II bike lanes in each direction between Third and Illinois streets.

Evans Avenue is an east–west roadway that connects Cesar Chavez and Hunters Point Boulevard through the Islais Creek and Heron's Head subareas and provides direct access to Heron's Head Park. The roadway operates with two-way traffic, with generally two travel lanes in each direction and intermittent on-street parallel parking on both sides. The roadway has Class II bike lanes in both directions between Third Street and Keith Street, Class III bike routes from Cesar Chavez Street to Third Street, and a Class IV bikeway between Keith Street and through Hunters Point Boulevard to Hawes Street. The roadway is designated as an Arterial Street in the General Plan and a Primary Emergency Priority Route in the San Francisco Emergency Response Plan.

Amador Road is an east–west and north–south roadway that connects Cargo Way/Illinois Street and Jennings Street through the Cargo Way and Pier 94 to 96 subareas and provides direct access to Pier 92 and Pier 94 to 96. The roadway operates with two-way traffic, with generally one travel lane in each direction.

Illinois Street is a north–south roadway that connects 16th Street and Cargo Way through the Mission Bay, Pier 70, Pier 80, Islais Creek, and Cargo Way subareas. This roadway provides primary north–south access to port facilities at Piers 70 and 80. The roadway operates with two-way traffic, with generally one travel lane and Class II bike lanes in each direction. Illinois Street includes the Illinois Street Bridge over Islais Creek.

2.2.3 Transit Network

The Project area is well served by San Francisco Municipal Railway (Muni) local public transit service, with 11 Muni bus and rail routes. Regional service is provided by Caltrain and the San Francisco Bay Ferry operated by WETA. The Transportation Attachment 1 includes a map of transit lines operating within the Project area for each alternative.

2.2.3.1 San Francisco Municipal Railway

Muni operates buses, cable cars, and light rail services within the City. Two light rail lines, two heritage streetcars, and seven Muni bus routes traverse the project area. Muni lines, maintenance facilities, and general transit utilities serving the project area are described below (SFMTA, 2023b).

Muni Routes

T-Third is a local light rail and subway service that operates from 6 a.m. to 12 a.m. (midnight) on weekdays with 10-minute headways during the a.m. peak period and the p.m. peak period. This route operates along Third Street, and Fourth Street, through the Islais Creek, Cargo Way, Pier 80, Pier 70, Mission Bay, Mission Rock and South Beach subareas. The new T-Third light rail extension to downtown operates on Fourth Street in

the Mission Creek subarea before going underground via the new Central Subway tunnel portal near the intersection of Fourth and Bryant streets.

N-Judah is a local light rail service that operates from 6 a.m. to 12 a.m. (midnight) on weekdays with 10-minute headways during the a.m. and p.m. peak periods. This route operates along King Street and the Embarcadero through the South Beach and Ferry Building subareas before going underground at the Embarcadero near Howard Street via the Muni Folsom tunnel portal and continuing below Market Street with stops at Embarcadero Station.

L-Taraval is a local light rail service that operates from 6 a.m. to 12 a.m. (midnight) on weekdays with 10- to 12-minute headways on weekdays during the a.m. and p.m. peak periods. This route serves Market Street underground and continues onto Taraval Street to the San Francisco Zoo. The western terminus is Embarcadero Station.

J-Church is a local light rail that serves the Market Street corridor and south on Church Street, followed by San Jose Avenue until the train reaches its terminus at Balboa Park. This light rail route operates between 5 a.m. to 12 a.m. (midnight) on weekdays with 15- to 17-minute headways during the a.m. and p.m. peak periods.

M-Ocean View is a local light rail service that operates from 6 a.m. to 12 a.m. (midnight) with 10 to 15 minutes frequencies on weekdays during the a.m. and p.m. peak periods. This route terminates at Embarcadero Station and Balboa Park. The train exits the Market Street tunnel at West Portal and continues on 19th Avenue to Randolph Avenue, Broad Street, and San Jose Street to reach Balboa Park.

K-Ingleside is a local light rail service that operates from 6 a.m. to 12 a.m. (midnight) on weekdays with 10- to 15-minute headways on weekdays during the a.m. and p.m. peak periods. This route serves Market Street underground, starting at Embarcadero Station, and continues onto Ocean Avenue to Balboa Park.

F-Market & Wharfs is a local heritage streetcar service that operates from 7 a.m. to 10 p.m. with 17-minute headways during the a.m. peak period and 13-minute headways during p.m. peak periods. This route operates along Market Street, Steuart Street, Don Chee Way, the Embarcadero, Jefferson Street, Jones Street, and Beach Street through the Ferry Building Northeast Waterfront, Pier 31 to 35, and Fisherman's Wharf subareas. **15-Bayview Hunters Point Express** is a local bus service that operates from 5 a.m. to 10 p.m. on weekdays with 10- to 15-minute headways and weekends from 8 a.m. to 10 p.m. with 12- to 20-minute headways. This route operates along Bayview neighborhood streets including Palou Avenue, Ingalls Street, Northridge Road, Kiska Road, Kirkwood Avenue, Jerrold Avenue, and Hudson Avenue before continuing along 3rd Street and 4th Street to the Financial District.

19-Polk is a local bus service that operates from 5 a.m. and 10 p.m. with 15-minute headways during the a.m. and p.m. peak periods. This route operates along Polk, Beach, and North Point streets through the Aquatic Park subarea and along Evans Avenue in the Islais Creek subarea.

22-Fillmore is a local bus service operating 24 hours per day with approximately six-minute headways during the a.m. and seven-minute headways during the p.m. peak

periods. This route operates along 18th, Tennessee, 20th, and Third streets in the Pier 70 subarea.

39-Coit is a local bus service that operates from 9 a.m. to 7 p.m. with 20-minute headways during the p.m. peak period. This route operates along Powell Street, North Point Street, the Embarcadero, and Jefferson Street in the Fisherman's Wharf subarea.

44-O'Shaughnessy is a local bus service operating 24 hours per day with 10-minute headways during the morning and midday weekday and 15-minute headways during the evening weekdays. The route operates along Evans Avenue, Middle Point Road and Palou Avenue in Reach 4 and continues northwesterly along Silver Avenue, O'Shaughnessy Boulevard, 7th Avenue, 9th Avenue, 6th Avenue and terminating on California Street.

48-Quintara/24th Street is a local bus service operating 24 hours per day with generally 15-minute headways during the a.m. and p.m. peak periods. This route operates along 22nd, Tennessee, and Illinois streets in the Pier 70 subarea.

49-Van Ness/Mission is a local bus service that operates from 5 a.m. to 12 a.m. (midnight) with approximately 6 minutes headways during the a.m. and p.m. peak periods. This route operates on Van Ness Avenue in the Aquatic Park subarea.

55-16th Street is a local bus service that operates from 5 a.m. to 10 p.m. with approximately 15-minute headways during the a.m. and p.m. peak periods. This route operates along 16th Street, Third Street, Mission Boulevard, and Merrimac Street through the Mission Creek and Mission Bay subareas and provides service between the Mission Bay neighborhood and the 16th Street BART station.

Maintenance and Operation Facilities

In addition to the many different Muni routes along the waterfront, Muni also operates different maintenance and operation facilities to support buses and light rail services.

Kirkland Yard is a 72-year-old bus yard located in the northern waterfront near Fisherman's Wharf and Pier 39. It currently has three maintenance bays, an outdoor bus wash, and bus parking.

Tunnel Portals provide access to the underground transit features and include the **Ferry Portal (also called the Folsom Portal)** near Folsom Street and Embarcadero that serves as the eastern entrance to the Muni Metro Tunnel, and **Central Subway Portal** near 4th Street and Bryant Street.

Embarcadero Station is a key station that connects BART and Muni service and is the closest station to the Ferry Building.

Third Street Bridge over Mission Creek is a roadway bridge that is also part of the San Francisco Bay Trail.

Fourth Street Bridge over Mission Creek is a roadway bridge that carries railroad tracks for the T-Third light rail line and access for other light rail vehicles to the Muni Metro East Maintenance Facility.

Mission Bay Loop is a light rail track for the T-Third line that provides turn around capabilities for special events and during peak periods. The Mission Bay Loop is in Reach 3.

Muni Metro East Maintenance Facility (MME) is a 16.9-acre site owned by SFMTA to service and store light rail vehicles. This facility is located in Reach 4.

1399 Marin Facility is a 3.2-acre site that serves as a bus acceptance yard, rail track shop, and streetcar storage facility for Muni in Reach 4. This facility is leased by the SFMTA from the Port and is proposed to be renovated to accommodate maintenance needs for electric trolley buses.

Islais Creek Motor Coach Facility is a maintenance and operations yard for Muni bus service and provides additional storage space for hybrid motor coaches. This facility is located in Reach 4.

Third Street Bridge over Islais Creek is a roadway bridge that carries railroad tracks for the T-Third light rail line. This facility is located in Reach 4.

Illinois Street Bridge over Islais Creek is a roadway bridge that is also part of the San Francisco Bay Trail and includes a bike lane. This facility is located in Reach 4.

Burke Storage Facility *is* for bus and trolley parts and supplies. This facility is located in Reach 4.

Substations, includes King, Phelps, and Illinois, located throughout the Muni system to supply uninterrupted power to light rail network, transit vehicles and facilities.

Special Trackwork and Vent Work

Various track crossovers and tail tracks are located throughout the system along the Embarcadero, Third Street, and King Street.

Fourth & King Special Trackwork is located in Reach 3 near the Fourth & King Caltrain Station and Fourth Street Bridge.

Don Chee Way trackwork is located near the Ferry Building in Reach 2 and intersects with the Embarcadero rail.

6th & King Pocket Track and Operator Rest Station is located in Reach 3 near the I-280 roadway and on- and off-ramps and utilized by Caltrain.

Muni Metro Turnback (MMT) is located east of the Embarcadero Station in Reach 2. This structure allows rail cars to turn back and connects the Market Street subway rail with the rail to Mission Bay.

Vent Structure for Muni Metro Turnback Facility is underground east of the existing Embarcadero Station in Reach 2.

Pull-in/Pull-out tracks located at 25th Street and Third Street and Cesar Chavez Street and Third Street in Reach 4.

Transit Infrastructure and Utilities

Critical components of transit infrastructure are not limited to infrastructure that is above the surface. There are specific transit utilities that are required to efficiently operate a

robust public transit system. The SFMTA maintains and operates several different systems to operate the railroad and bus trolley system. The easily visible physical components include the railroad tracks, traction power system (includes the overhead contact system), switches, signal equipment and drainage infrastructure. Emergency systems such as blue light equipment, emergency light systems, and fire protection and monitoring systems are required for safety during emergency events. The train control system, power system, and communication radios include both hardware and software for everyday operations. The transit infrastructure and utilities are present at several locations throughout the SFMTA systems and specific locations are not identified in this document. (SFMTA, 2017)

2.2.3.2 Regional Transit Providers

BART provides regional commuter rail service between the East Bay/South Bay (from Antioch, Richmond, Dublin/Pleasanton, and Berryessa/North San Jose), San Mateo County (from San Francisco International Airport and Millbrae), and San Francisco, with operating hours normally from 5 a.m. to midnight on weekdays, 6 a.m. to midnight on Saturdays, and 8 a.m. to midnight on Sundays and major holidays. In the vicinity of the Project area, BART operates underground in the Transbay Tube across San Francisco Bay, crossing under the seawall near the Ferry Building and continuing below Market Street through the Ferry Building subarea where it makes stops at Embarcadero Station. BART's Transbay Tube ventilation facilities are also located near the Ferry Building within the Ferry Building subarea. BART owns the shared MUNI and BART tunnel under Market Street.

Caltrain provides passenger rail service on the Peninsula between San Francisco and downtown San Jose, with stops in San Mateo and Santa Clara counties. Within San Francisco, Caltrain service currently terminates at the Fourth/King station in the Mission Creek subarea. However, the Caltrain Downtown Extension Project, renamed the Portal, would extend Caltrain service and add future underground high-speed rail service to the Salesforce Transbay Terminal below Townsend and Second streets through the South Beach and Ferry Building subareas. Caltrain leases the 4th and King Station and 6th and Townsend pocket tracks from Prologis.

Caltrain is governed by the Peninsula Corridor Joint Powers Authority (PCJPA) which also owns the railroad right-of-way to downtown San Jose. The PCJPA also allows limited freight traffic from Union Pacific Railroad to operate on the peninsula railroad tracks (see Section 2.1.6 for more details about freight rail traffic).

Golden Gate Transit (GGT) is operated by the Golden Gate Bridge, Highway, and Transportation District and provides bus and ferry service between the North Bay (Marin and Sonoma counties) and San Francisco. GGT operates 8 commuter bus routes into San Francisco. GGT bus service operates on North Point Street, The Embarcadero, and Van Ness Avenue through the Northeast Waterfront, Pier 31 to 35, Fisherman's Wharf, and Aquatic Park subareas. GGT also operates ferry service between the North Bay and San Francisco between 7 a.m. and 8 p.m. on weekdays, with headways between 30 and 90 minutes, depending on the time of the day and day of the week. The

ferry service connects Larkspur and Sausalito with the Ferry Building in the Ferry Building subarea.

Alameda-Contra Costa Transit (AC Transit) operates Transbay bus service between the East Bay and San Francisco's Salesforce Transit Center in the Ferry Building subarea. AC Transit operates 20 Transbay bus lines with up to 140 buses at peak hour during weekdays. AC Transit uses a dedicated bus bridge that provides direct access to the Salesforce Transit Center's Level 3 bus deck from I-80 and the Bay Bridge.

San Mateo County Transit (SamTrans) provides bus service throughout San Mateo County and portions of San Francisco. SamTrans operates four bus routes in San Francisco that operate primarily along Mission Street, with some routes also operating on The Embarcadero, Washington Street, Drumm Street, Market Street, Steuart Street, Ninth Street, and 10th Street in the Ferry Building and Mission Creek subareas.

WETA operates the San Francisco Bay Ferry service from San Francisco at Pier 41, the Ferry Building, Oracle Park ferry terminal and Pier 48 ½ ferry terminals.

Pier 41 ferry terminal is located in the Fisherman's Wharf subarea in Reach 1 at the intersection of Powell Street and The Embarcadero, providing ferry service to Alameda, Oakland, Vallejo, and Mare Island.

The ***Ferry Building ferry terminal*** is located in the Ferry Building subarea in Reach 2, providing ferry service to Alameda, Harbor Bay, Oakland, Richmond, Vallejo, and Mare Island.

The ***Oracle Park ferry terminal*** is located in the South Beach subarea at Oracle Park in Reach 3, providing ferry service to Alameda, Oakland, Vallejo, and Mare Island.

The **Pier 48 ½ *ferry terminal*** is located in the Mission Bay subarea in Reach 3 along Terry A. Francois Boulevard near the Chase Center. This terminal provides daily ferry service to Oyster Point in South San Francisco and special event service from Oakland and Alameda to event and games at the Chase Center.

In addition, Pier 1½ is located in the Ferry Building subarea at the intersection of Washington Street and The Embarcadero, providing public boat access and water taxi service. Pier 33 is located in the Pier 31 to 35 subarea near the intersection of Bay Street and The Embarcadero, providing ferry service to Alcatraz Island.

2.2.4 Bicycle Facilities

The following includes a discussion of city-designated on-street bicycle facilities in the Project area that are part of the San Francisco Bicycle Network. On-street bicycle facilities include Class I bikeways (bike paths with an exclusive right-of-way for use by bicyclists or pedestrians), Class II bike lanes (bike lanes striped within the paved areas of roadways and established for the preferential use of bicyclists), Class III bikeways (signed bike routes that allow bicycles to share travel lanes with vehicles), and Class IV cycle tracks (areas for exclusive use by bicyclists that include physical separation from motor vehicle traffic). The Transportation Attachment 1 includes figures with the bicycle network within the Project area.

2.2.4.1 Class I Bike Paths

The San Francisco Bay Trail (Bay Trail), also known as the Blue Greenway from the ballpark south, runs along the entire project area. The Bay Trail is a planned 500-mile hiking and biking path that will encircle San Francisco and San Pablo Bays and follow the shoreline of nine counties. Several paved and street segments of the Bay Trail are complete within the Project area along the waterfront, joining Aquatic Park to Heron's Head Park, except for two segments that are planned between Aquatic Park and Fisherman's Wharf and in the Mission Rock subarea (San Francisco Bay Trail 2023). The Blue Greenway is a City project to improve the southerly portion of the Bay Trail as well as the newly established Bay Area Water Trail and associated waterfront open space system. The alignment of the Blue Greenway generally follows the alignment of the Bay Trail and Bay Area Water Trail from Mission Creek on the north to the county line on the south.

2.2.4.2 Class II Bike Lanes

The Embarcadero has Class II bike lanes in both directions between North Point Street and King Street through Pier 31 to 35, Northeast Waterfront, Ferry Building, and South Beach subareas. Between Broadway and Folsom Street on the east side of the Embarcadero, there is a Class IV separated bikeway.

North Point Street has Class II bike lanes in both directions between Larkin Street and The Embarcadero through the Aquatic Park, Fisherman's Wharf, and Pier 31 to 35 subareas.

Illinois Street has Class II bike lanes in both directions between Terry A. Francois Boulevard and 18th Street, 19th and Marin Street up to the Illinois Street Bridge. Class II bike lanes are also found after the Illinois Street Bridge to Cargo Way.

Fourth Street has Class II bike lanes between Channel and 16th streets.

Brannan Street eastbound, is designated as a Class II bike lane between Colin P Kelly Jr. Street and The Embarcadero through the South Beach subarea. ***Evans Avenue*** has Class II bike lanes in both directions between Third Street and Keith Street.

2.2.4.3 Class III Bike Routes

Broadway is designated as a Class III bike route between Mason Street and The Embarcadero through the Northeast Waterfront subarea.

Market Street is designated as a Class III bike route between Eighth and Steuart streets through the Ferry Building subarea.

Steuart Street is designated as a Class III bike route between Market and Mission streets through the Ferry Building subarea.

Mission Street is designated as a Class III bike route between Steuart Street and The Embarcadero through the Ferry Building subarea.

Brannan Street westbound, is designated as a Class III bike route between Colin P Kelly Jr. Street and The Embarcadero through the South Beach subarea.

Townsend Street is designated as a Class III bike route between Second Street and The Embarcadero through the South Beach subarea.

Third Street is designated as a Class III bike route between Cargo Way and Bayshore Boulevard through the Islais Creek subarea.

Evans Avenue has Class III bike routes from Cesar Chavez Street to Third Street.

2.2.4.4 Class IV Separated Bikeways

The Embarcadero has a Class IV bikeway between Broadway and Folsom Street on the east side of the Embarcadero.

Howard Street has a Class IV bikeway in the westbound direction between Main Street and The Embarcadero through the Ferry Building subarea.

Folsom Street has a Class IV bikeway in the eastbound direction between Essex Street and The Embarcadero through the Ferry Building subarea.

Evans Avenue has a Class IV bikeway between Keith Street and through Hunters Point Boulevard to Hawes Street.

Illinois Street has Class IV bikeways between 18th and 19th and across the Illinois Street Bridge.

Third Street has a Class IV bikeway crossing over Lefty O'Doul Bridge through the South Beach and Mission Rock subareas.

Fourth Street has a Class IV bikeway between Mission Bay Boulevard North and Mission Bay Boulevard South.

Terry A. Francois Boulevard has a Class IV two-way cycle track along the east side of the street between San Francisco Bay Trail and Illinois Streets through the Mission Rock and Mission Bay subareas.

16th Street has Class IV separated bike lanes in both directions between Terry A. Francois Boulevard and Illinois Street, and between Third Street and Owens Street through the Mission Bay subarea.

Cargo Way has a Class IV two-way cycle track along the west side of the street between Illinois and Jennings streets.

2.2.5 Parking Facilities

The project area includes many areas designated for parking or buildings with parking facilities near the waterfront. The San Francisco County Transportation Authority (SFCTA) conducted a parking census which estimated undocumented parking spaces. Off-street, nonresidential parking spaces citywide, with undocumented spaces, were extrapolated to be 172,000. These parking spaces can be located in either private or public lots, or parking garages. Within a narrower study area, labelled the Northeast Quadrant which includes Reaches 1, 2 and 3, the total off-street, nonresidential parking spaces are estimated to be 87,400 including undocumented parking spaces. Of those 87,400 parking spaces in the study area, approximately 34,000 spaces are within three

high-congestion neighborhoods, the Financial District and Union Square in Reach 2 and East SoMa, in Reach 3. On-street parking spaces are in addition to the above and number 28,800 metered on-street spaces citywide. (SFCTA, 2016)

In addition, there are many Port-owned parking locations located near the waterfront or on pier structures. Overall, these parking locations contain approximately 12,300 spaces and will be analyzed for potential parking losses. Some of the Port's larger parking facilities include the Pier 39 parking garage (1,110 parking spaces) in Reach 1 and Pier 30 (1,130 parking spaces) in Reach 3. Pier 80 with 6,806 general parking spaces is a 70-acre site currently utilized for distribution of cars from overseas located in Reach 4 (Pasha, 2016). A more detailed table of Port-owned parking locations is included in the Transportation Attachment 1. The Port-owned parking will be reviewed for potential impacts (Port, 2023b).

2.2.6 Freight Rail

There is limited freight traffic along the San Francisco Waterfront. The only freight rail operator is Union Pacific Railroad that utilizes the PCJPA-owned tracks in the early morning hours prior to Caltrain passenger rail service. This freight traffic serves Union Pacific Railroad customers along the San Francisco Peninsula.

The Port of San Francisco also owns a freight rail line that branches off the PCJPA-owned tracks via Quint Street. This branch serves the Port's properties including the Intermodal Cargo Transfer Facility (ICTF) located along Cargo Way; Pier 80-96 cargo facilities; Pier 80 via the Illinois Street bridge; Pier 90 via Amador Street; and Piers 94 and 96 via the south side of the ICTF. Union Pacific Railroad can make freight train movements for the Port for a limited number during mid-day and has more availability during the early morning hours.

2.3 Environmental Consequences

2.3.1 Assessment Method

The basis for the transportation analysis will analyze the existing transportation infrastructure and systems and proposed transportation improvements in the Project area. The existing transportation infrastructure is based on data collected from City of San Francisco, SFMTA, BART, MTC, Caltrain and WETA. Anticipated transportation improvements will be included that appear to be reasonably foreseeable by 2040 with the expectation that the transportation network will be updated to meet new areas of demand.

The transportation projects that are reasonably foreseeable include raising the Third Street Bridge over Islais Creek, the extension of existing rail and proposed high-speed rail (HSR) service from Fourth and King Station to the Salesforce Transit Center by the Portal project, and the Mission Bay ferry terminal. The Environmental Impact Report for the Third Street Bridge over Islais Creek was published on November 29, 2023, by the San Francisco Planning Department. The proposed replacement bridge would accommodate new transit tracks, travel lanes for private vehicles, two pedestrian/bicycle paths, and would be resilient to predicted sea-level rise. Construction

would be approximately 24 months and is anticipated to begin in January 2027 (SFPUC, 2025). During construction, detours for T-Third Street light rail, vehicles, and pedestrians would be in place between Marin Street and Cargo Way. For transit passengers on the T-Third Street light rail a bus shuttle would be used and bus route 15 – Bayview Hunters Point Express would be detoured around the project site. (SF Planning, 2023). The Portal project is managed by the Transbay Joint Powers Authority (TJPA) and would extend existing Caltrain service from the current terminus at Fourth and King Station approximately 1.3 miles to the Salesforce Transit Center. This project would be a tunnel and would connect with the existing train box located beneath the multimodal hub, the Salesforce Transit Center. Once future high-speed rail service develops in California, the Portal would also serve to extend service to downtown San Francisco. The Portal is anticipated to be in service in 2032 and high-speed rail service is anticipated to reach San Francisco in 2033 (TJPA, 2023 and California HSR Authority, 2022). The Mission Bay ferry terminal is expected to begin service in 2027 and would have the capability for two ferry boats to berth simultaneously to serve the Chase Center area in Reach 3 (UCSF, 2025). This ferry terminal is located at Pier 64 ½, near Terry Francois Boulevard and 16th Street, and would replace the temporary ferry terminal at Pier 48½. Therefore, the temporary Pier 48 ½ ferry terminal was not evaluated for impacts since all existing ferry traffic would transition to the Mission Bay ferry terminal when completed. These three transportation projects are anticipated to be complete by the First Actions in 2040 (Port, 2021 and Port, 2023a).

Future Planned Projects

The projects and plans described below are under consideration for future development near the project area. The projects and plans described below are less concrete than the reasonably foreseeable projects with approved environmental documents and possible funding. However, the projects and plans listed are worth including since the Waterfront Coastal Flood Study plans improvements occur over several decades along the Waterfront.

ConnectSF Transit Strategy and Streets and Freeways Study:

Connect SF forms the basis of San Francisco's long range transportation plan. The Transit Strategy focuses on four pillars: 1. Make the system work better, 2. Deliver a five-minute network, 3. Renew and modernize our rail system and, 4. Build more rail to San Francisco's busiest places (Connect SF, 2021) The Transit Strategy identifies and describes major capital programs and projects to help the transit system meet current and future needs. The final Strategies for Transit, Streets and Freeways report was released in July 2022, ConnectSF is currently developing the Transportation Element of the General Plan (Est. completion, 2027) and completed the first round of community outreach in 2023.

Link21:

Link21 is a program meant to facilitate passenger rail connections across Northern California starting with a new connection between Oakland and San Francisco. (Link 21, 2024) Link21 is sponsored by BART and Capitol Corridor and partners closely with the state of California and freight railroads. The goal of Link21 is to provide a reliable, convenient and equitable train network to improve the ability to move around the 21-

county Northern California Megaregion. Link21 is currently in the Project Identification phase, obtaining stakeholder input, conducting analyses, and following a Business case Framework (Link 21, 2024). The program has presented multiple concepts for what type of gauge tracks the new Bay crossing should have (BART exclusive, or standard gauges for all trains) and is currently working though concept assessment guided by the Link21 Business Case framework (Link 21, 2024). Once the program reaches a decision on which train technology to use in the crossing and identifies a Proposed Project, it will advance to the next phase of work, Environmental Review.

SF Railyards Project:

Railyards will transform the Caltrain railyards at 4th and King to a regional transit center hosting added Caltrain services, a new rail station and a neighborhood complete with housing, office, and public spaces (San Francisco Planning Department, 2024). There are two efforts collaborating to complete the Railyards Project: Caltrain/Prologis "Business Case" and SF Railyards.

The draft timeline states that the SF Railyards project concluded concept development in 2023 and has moved on to Environmental review (San Francisco Planning Department, 2024).

Pennsylvania Extension (PAX):

The PAX project is located along underground trains Seventh Street and Pennsylvania Avenue. Its goal is to increase connectivity, improve safety, enable efficiency, and improve quality of life through the provision of a range of conceptual alignment alternatives (SFCTA, 2024a) (reflecting different tunnel lengths, construction methods and potential future station locations). The project initiation was completed between 2020-2022 and the Pre-Environmental Bridging Study refined alternatives, conducted public stakeholder engagement, and identified an implementation approach in 2023-2024 (SFCTA, 2024a). Future steps include environmental review, preliminary and final design, procurement, and construction.

Muni Metro Modernization Central Subway Extension:

The SFMTA is preparing an Alternatives Study and is currently in the planning/outreach phase (San Francisco Metropolitan Transportation Agency, 2024a). The Project is evaluating potential expansion of the Central Subway past the Chinatown Station terminal towards North Beach and Fisherman's Wharf.

Geary/19th Avenue Subway Study:

This subway study focuses on identifying benefits and costs for the project; exploring technical feasibility, work program, and governance which will be used to develop alternatives for future analysis; identify delivery strategy and funding sources; and undertake technical coordination and policy discussions with local and regional agencies (SFCTA, 2024b). The final report is scheduled to be published in 2025.

SF Biking and Rolling Plan: Active Communities

The San Francisco Biking and Roll Plan: Active Communities is a new plan for active mobility for San Francisco. The Plan has been developed by SFMTA and adopted by the SFMTA Board, and it identifies investments in rolling and biking networks, support

facilities, programs, and policies for the next decade (SFCTA, 2025). The Plan goals include supporting equitable transportation, road safety for all users, low-carbon transportation options (through a shift towards biking and other active modes), accessible transportation through the provision of electric mobility devices and low-stress streets, secure funding and rapidly deliver projects and developing new approaches to project development and identification models The community outreach phase began in January 2023 and was completed in March 2024, and the final plan was adopted in March 2025 (SFCTA, 2025).(SFCTA, 2025).

MUNI Service Equity Strategy:

On April 16, 2024, the MUNI Service Equity Strategy was adopted ahead of the 2025-2026 fiscal year (SFMTA, 2024b). The outcomes of this strategy will be a biannual service evaluation and prioritization for service and improvements across the transit network—these working groups will include membership from all nine Equity Strategy neighborhoods to propose upcoming MUNI service changes, planning and prioritization (SFMTA, 2024b).

Embarcadero Enhancement:

The Embarcadero Enhancement Program (EEP) is a program which focuses on improving safety, building connectivity between the Embarcadero and its surrounding neighborhoods, access, economic recovery, and mobility with a focus on active modes. The Program included three quick-build projects: Pier 35, Ferry Terminal and the Rincon Restaurant Zone which were completed in 2021 (SFMTA, 2024c). The projects included a two-way protected bikeway and are a preview of proposed changes with the larger EEP. The Central Embarcadero Safety Project is currently in the detailed design phase, aims to extend the protected bikeway, enhance pedestrian and rail safety, and add wayfinding measures, with construction expected to start in early 2026.

SFMTA 20 Year Capital Plan:

The 20 Year Capital Plan is a document which outlines a list of potential capital needs to achieve SFMTA's Strategic Plan over the next 20 years (FY 2025-FY2024). The 20 Year Capital Plan is updated every 2 years, and the most current version is an update from 2023 (SFMTA, 2023). The purpose of the Capital Plan is to Identify long-range capital needs to provide a pathway to meet our strategic goals, use as an advocacy tool for our long-range capital needs, summarize and forecast our long-range capital needs in one place to help coordinate the implementation of SFMTA plans, provide a comprehensive list of capital investment needs which can inform development of the 5-year Capital Improvement Program and Transportation 2050, and to communicate our long-term capital needs comprehensively to create accountability and build trust with different stakeholders. (SFMTA, 2023).

SF Transportation Plan 2050:

The SF Transportation Plan is a blueprint for the city's transportation system development and investment. It is part of ConnectSF's long-range planning program and consistent with Plan Bay Area 2050; The SF Transportation Plan is updated every 2 years and was last published in 2022 (ConnectSF, 2022). The Transportation Plan includes an investment plan to allocate $80 billion in existing and anticipated revenue

through 2050, a Vision Plan to guide allocation of potential new revenue through 2050, policy initiatives for implementation of both the Investment Plan and Vision Plan and guidance for implementation and monitoring (ConnectSF, 2022).

BCDC/MTC Sea Level Rise Investment Framework:

The Sea Level Rise Adaptation Funding and Investment Framework is a research project which identified near-term sea level adaptation needs and studied possible funding opportunities around the Bay (MTC, 2023). The final report was published in July 2023. Some key findings from the report include the identification of existing available funding and gaps to funding, the cost burden across the Bay depending on which areas will be exposed to flooding first and concluding that a regional approach is critical (MTC, 2023).

Beach Street Quick-Build Project:

The Beach Street Quick-Build Project seeks to address safety issues near Fisherman's Wharf area. Beach Street experiences a higher rate of the city's severe injuries and fatalities related to traffic. The quick-build project would install curb ramps between Van Ness Avenue and Hyde Street, a two-way separate bikeway, parking adjustments and other pedestrian safety improvements that are planned for construction in 2025. The project has already completed construction (as of May 2025) on upgraded crosswalks, daylighting, and advanced limit lines on between Jones Street and Embarcadero on Beach Street. (SFMTA, 2025)

Islais Creek Bridge Replacement Project:

The Third Street drawbridge over Islais Creek would be replaced with a fixed bridge and accommodate the light rail tracks, two travel lanes in each direction, and pedestrian/ bicycle path on both the eastern and western sides of the bridge. The bridge would be closed for approximately 24 months during construction to all traffic. The project is anticipated to start in Fall 2026 and complete in Spring 2029. (SFPUC, 2025)

2.3.2 Basis of Significance

This section will address transportation in the area of the project including temporary (construction) and permanent effects of each alternative on movement of vehicles (major arterials, highway access), train, light rail and bus transit, ferry, pedestrian and bicycle use and access. Impacts will be determined by looking at:

- Short-term or long-term disruptions of existing transportation services
- Relocation or prolonged flooding of major transportation infrastructure
- Introduction of substantial long-term detours for different modes of transportation
- Substantial loss of parking spaces

2.3.3 Effects

Existing transportation infrastructure and systems and anticipated changes to these under each alternative are evaluated in this section for each of the alternatives.

Construction Impact Summary

In the absence of flood-control actions under the FWOP condition, direct and indirect transportation impacts would still occur. Direct transportation impacts would be related to construction in response to flooding and emergency repairs. Indirect transportation impacts would be as areas become inundated more frequently and unplanned retreat begins. As areas become more inundated, retreat would occur in a less systematic or planned fashion, creating unplanned transportation impacts. Without planning for increasing inundation frequency and intensity, there could be transportation disruptions and damage to critical assets, corridors and facilities that result in long detours or reduced frequency for transit. Prolonged or intermittent flooding of transportation corridors due to storm events, independently or in combination with high tide events, would lead to traffic shifting to alternative routes either as directed by emergency construction detours or as the travelling public seeks more consistent and safer routes less prone to flooding. This would result in longer routes for the travelling public and add vehicles to potentially over-capacity traffic corridors further from the San Francisco Waterfront.

With implementation of the project alternatives, both direct and indirect impacts to transportation -would occur temporarily during construction. Permanent impacts would be associated with roadway, bike path, sidewalk, and transit redesign, and re-routing in areas of raised elevation or narrowing of roadways to accommodate the levees and walls.

Temporary Transportation Impacts

Temporary impacts to transportation and disruption of normal commute patterns would occur in retreat areas due to inundation and demolition in inland areas from construction of the measures to protect the waterfront from inundation. Construction of the measures would have mutli-layered temporary impacts which include increased construction traffic, transportation corridor closures for construction staging areas and while construction measures are being built, among other temporary impacts discussed below.

In areas of retreat and inundation under each alternative, traffic would be temporarily disrupted due to inundation causing road, bike path, and sidewalk closures until such time as retreat or floodproofing are complete. Access to transit, bus stops, and rail stations may be inundated periodically as flooding becomes more frequent. Measures may be insufficient to protect facilities from inundation, requiring frequent closures or repairs. Transit facilities and related infrastructure are susceptible to damage from flooding and critical to operating the full transit system. The existing transit systems require uninterrupted power and reliable infrastructure at track level to operate effectively and many of these transit utility components have a high vulnerability to fail when exposed to flooding. Replacement of failed equipment may take several weeks to months to restore function. These impacts would diminish once flood control measures are implemented, other than in the identified retreat areas before retreat is complete. Compared to the FWOP, less area would be inundated with implementation of the measures, so that flooding frequency, duration, and intensity would be lower with implementation of alternatives, a beneficial impact of the construction alternatives.

For the areas that are being protected by the measures, temporary impacts to transportation would occur directly from construction staging and construction-related traffic and construction detours and lane/road/sidewalk/path closures. Indirect impacts would include disruption of existing travel patterns and increased potential congestion on other roadways as traffic (vehicular, transit, bicycles and pedestrian traffic) are routed around or away from construction areas.

Installation of seismic ground improvements would disrupt vehicle, bike, pedestrian and transit traffic for the durations of the seismic improvement work in any given location. It would require movement of equipment and along those areas where ground improvements would occur, restricting transportation and access as work proceeds.

Water-based construction activities including some pile driving and work from barges can restrict access or create the need for detouring recreational and commercial boating. Construction on the Bay is coordinated with the Port and Coast Guard and certain activities would require presence of monitoring boats to keep safe work areas for on-water work. In general, these impacts are ***less than significant with mitigation.***

In addition to the direct effects of road and/or lane and sidewalk and trail closures, construction-related traffic would temporarily directly increase traffic in areas near construction and along haul routes. Construction-related traffic includes trucks bringing materials (such as concrete, steel, lumber), fill, and equipment to work sites and staging areas; construction worker commutes to work sites; and off-hauling of construction debris, excavation, and demolition debris. Construction haul trucks to and from sites would likely take major roads and arterials to the major highways including I-80, I-280, and US 101, increasing traffic and congestion at intersections and on roadways. The duration of construction at any given site would depend on design and construction plans to be prepared in later project phases.

Since the San Francisco waterfront, especially in the northern reaches, is already heavily urbanized, there are few potential staging areas close to the work zones; staging would require parking lot and road or lane closures. Work within the roadways would require detours for vehicles, bicycles, transit, and pedestrians during the period of construction at any given location. The precise areas and duration of closures, detours, and traffic disruption would not be known until later in planning phases and are not known at this time. Access to buildings and facilities may be hampered by placement of materials and equipment, construction activity, or active movement of machinery.

Construction activities would indirectly affect transportation by increasing construction-related traffic near construction areas and along haul routes; involve lane, road, transit, bikeway, and sidewalk closures at various stages of construction to allow work to process safely; and affect access by restricting parking and creating detours for transportation facilities. Construction detours are expected to be established as roads and lanes are closed, and may include vehicular traffic, relocation of bus or transit stops, and in extreme cases, rerouting of transit rail. Construction detours for rail (in particular along the Embarcadero and 4th Street bridge) would be more disruptive as the rail systems have few redundancies or potential detour routes which would have direct impacts to transit routes and indirect impacts by restricting access to maintenance facilities such as the Muni Metro East Maintenance Facility. Commuters and travelers

may change routes to avoid construction areas, increasing congestion on other streets, or changing modes of travel or avoiding areas entirely. Close communication of construction schedules, durations, road, trail, sidewalk, transit, and parking closures and detours would be needed.

Staging and work areas would be established for each construction project. Road, lane, sidewalk, bike lane closures, relocation of bus stops, and possible disruption of access to transit stations may occur depending on precise locations and construction access required. Construction Traffic Management Plans would be coordinated with the City and transit agencies as described in avoidance and minimization measures (AMMs), specifically AMM-TR-1. Although, this may reduce the level of impacts to minor or moderate in most cases, the larger measures, such as where ground improvements or roadway changes are occurring along the Embarcadero or Third Street, near major arterials and access to highways, this impact would remain substantial.

Depending on the precise location and duration of construction restrictions, these temporary impacts may be short- or long-term, localized or more regional, and would range from minor to substantial. Minimization measures described in this section including preparation of Construction Traffic Management Plans and close coordination with transportation providers, the City, Caltrans, Port, and the public would reduce the severity of temporary direct and indirect impacts to transportation.

Permanent Transportation Impacts

Permanent impacts would result from transportation system redesign around new levees, walls, some areas of raised elevations, and retreat areas. Certain measures would have permanent impacts on existing transportation facilities and roadways such as narrowing of roadways to accommodate raising roads and buildings, and transportation system changes such as removing bridges, installing tide gates, and creation of levees that would permanently block access to some areas. Transit and transportation re-routing around retreat areas and constructed facilities would be required in some cases.

Construction of levees and raising building and wharf elevations can not only affect access during construction but new elevations and slopes may change slopes within intersections and roadway approaches, change driveway and trail slopes and accessibility. Rail lines and light rail tracks are particularly susceptible to changes in elevation and slopes and may not be able to cross these new elevated areas and levees.

The design of levees and slopes in relation to roadways, bikeways, transit routes, and sidewalks can create barriers and impede movement due to the slopes and geometrics of the measures. Roadway intersections such as along the Embarcadero or near the I-280 on- and off-ramps near Islais Creek would need to accommodate raised elevations or be redesigned and raised as needed to incorporate the new geometry. Pedestrian, bicycle, and ADA compliant access along some areas of the waterfront would require well-planned ramps to allow continued access.

Residual flooding would impact existing transportation services by flooding transportation infrastructure causing these transportation modes to be either

permanently or intermittently unusable. Transit services especially light rail, subway, and the electric trolley network would require advanced work to relocate the associated infrastructure and modify transit routes not protected by the given alternatives.

Permanent transportation impacts would cause major disruptions in transportation circulation from changes in elevation and inundation in retreat areas. With implementation of AMMs, specifically AMM-TR-8, these impacts would be coordinated and planned for re-design to maintain adequate circulation near the San Francisco Waterfront. In general, permanent transportation impacts would range from minimal to substantial depending on the importance of the transportation corridor.

Operational Impact Summary

Measures may not protect against all flood risks including those from inland flooding, requiring periodic closures due to flooding and flood repair activities. Once measures are implemented and construction completed, roadway and facility maintenance would require regular inspections and repairs, but in general would be within the types of operations and maintenance currently taking place for the Port, City, and transit agencies. In general, these impacts would be ***less than significant.***

Use of deployable flood barriers along bridges and roadways, however, can interrupt traffic and disrupt access for hours and days, and would be of **greater significance**.

2.3.3.1 Recommended Plan

Impacts to transportation from the Recommended Plan are provided in **Table D.1.4-1** below.

Table D.1.4-1: Summary of Transportation Impacts Associated with the Recommended Plan

Recommended Plan Transportation Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Closure Structure Flood Gate	Roadway Impact	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (First Action)	*3*	*3*	*3*	*2*	*4*	*1*	*3*	*3*	*3*	*1*	*1*	*1*	*1*	*1*
Construction/Footprint (Second Action)	*3*	*1*	*3*	*1*	*4*	*1*	*3*	*1*	*3*	*1*	*1*	*1*	*1*	*1*
O&M Assumptions	*1*	*1*	*1*	*4*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Mitigated Rating	*3*	*3*	*3*	*3*	*4*	*1*	*3*	*3*	*3*	*1*	*1*	*1*	*1*	*1*

* Indicates Engineering with Nature Methods

2.3.3.1.1 Short-term or Long-term Disruptions of Existing Transportation Services

The adverse impacts to transportation from the Recommended Plan range from low to high depending on the measures and location. The Recommended Plan could cause disruptions to existing transportation systems from installing seawalls, T-walls, and levees along the Embarcadero in Reaches 2 and 3 and Terry Francois Boulevard in Reach 3 during the First Actions (see **Table D.1.4-2** and **Table D.1.4-3**). The most severe impacts would be from disruption of the Embarcadero during implementation of seismic ground improvements and raising the main buildings in Reach 2 and disruptions related to closure structure operations for rail traffic along the Embarcadero and Fourth Street bridge. During the Subsequent Actions, seawalls would be installed along the Embarcadero in Reaches 1 and 3, and Terry Francois Boulevard in Reach 3. The Terry Francois Boulevard during both actions would impact sections of the Bay Trail during construction. These wall installations during both first and Subsequent Actions would add bay fill behind the walls within the existing roadway corridor. Conducting the seismic ground improvements, completing wall installation and adding bay fill to these areas would be a multi-phased construction project that could take several years to complete. The Recommended Plan First Action and Second Action construction is anticipated to take 10 years each to complete. In contrast, addition of Engineering with Nature measures would have relatively short-term and minor impacts to transportation, with import of fill and pile-driving work expected to take place from the water.

In addition, the Fourth Street bridge serves as the only connection for rail vehicles from the northern service areas to the Muni Metro East Maintenance Facility in Reach 3 and an alternative access route would also need to be identified for rail vehicle service and maintenance. While Muni Metro East is not the largest SFMTA maintenance facility, it serves as storage and maintenance for the T-Third line and new Central Subway that serves City disadvantaged neighborhoods and alleviates overcrowding in the system.

During operations, the closure structures would be activated during major flooding events. Deployment of this infrastructure would last hours or days during storm surge and/or high tide events as sea levels rise. This would cause major interruptions to transportation services that are fixed in place with limited options for detours. Either permanent new routes would need to be identified and/or constructed or temporary routes that are protected from flooding events and easy to implement would need to be identified and/or constructed.

Closure structures would be installed at the Embarcadero near Pier 27, Terry Francois Boulevard near Pier 50, the Third Street, Fourth Street and Illinois Street bridges with the Recommended Plan during the first action. Constructing the closure structure barriers at two roadway locations and on the three bridges would likely require temporary closures of these roadways and bridges during construction and operations. The Embarcadero and bridge closure structures would have the greatest impact and are discussed in more detail in the paragraphs below. The closure structure area for Terry Francois is utilized by roadway traffic and the Bay Trail. Temporary detours would be possible for the Bay Trail for the Embarcadero, Third Street Bridge, Terry Francois Boulevard and Illinois Street Bridge by adding additional mileage to utilize the adjacent bridges at Mission and Islais Creeks.

For the Embarcadero Closure Structure near Pier 27, this infrastructure includes parts of the MUNI rail line system, roadway traffic, and the Bay Trail. For the Embarcadero during the first action, the closure structure would only be utilized during storm surge or high tide events. Therefore, the roadway and rail tracks beyond this point would be unusable, 1.1 miles of roadway would be impassable, and 0.9 miles of rail service would be suspended. In addition, a roadway turnaround and rail turnback would need to be constructed prior to installation of the closure structure for those elements that need to re-route. For the Embarcadero during the Subsequent Actions, seawall and T-wall measures would be constructed north of the closure structure to Aquatic Park which would help protect the Embarcadero and could minimize the use of the closure structure.

The Third Street, Fourth Street, and Illinois Street bridges are critical connections points along the waterfront. Muni light rail tracks traverse the Fourth Street bridge at Mission Creek and the Third Street bridge at Islais Creek. The Bay Trail traverses the Third Street bridge at Mission Creek and Illinois Street bridge at Islais Creek along with roadway traffic on all bridges. However, temporarily relocating the Muni rail tracks from the Fourth Street bridge would require an alternative route over or around Mission Creek potentially along Townsend Street and 7th Street. In addition to daily passenger traffic, the Fourth Street bridge serves as the only, critical connection for rail vehicles citywide to the Muni Metro East Maintenance Facility and an alternative access route would also need to be identified for rail vehicle service and maintenance. Rail traffic could be moved to the adjacent Third Street bridge, if structurally suitable, and the associated utility infrastructure to support light rail service. Alternatively, a bus bridge could be used but would cause a major inconvenience and increased transit time to light rail line riders. These transit impacts would more severely impact residents and businesses in Reaches 3 and 4 as the Muni Third Street light rail connects the southern reaches with the many employment opportunities in downtown San Francisco. Disruptions are expected for rail traffic that would be longer term, potentially up to one year, while the closure structures are constructed and short term, such as hours to days, when the closure structures are implemented during high tides, storm events or both.

In conclusion, the impacts to the Embarcadero and Terry Francois Boulevard and the Third Street, Fourth Street, and Illinois Street bridges would have a **significant and unavoidable** impact to roadway users and businesses in Reach 1, 2, and 3 and to transit riders and Bay Trail users in all reaches.

Detailed impacts for the Recommended Plan for roadway construction and transit facility impact tables are provided below (**Table D.1.4-2** and **Table D.1.4-3**.

Table D.1.4-2: Recommended Plan Roadway Construction Impacts by Reach

Reach	Roadway	Construction Measure	Length (miles)
First Actions			
2	Embarcadero	Closure Structure	0.01
2	Embarcadero	Seawall/ SGI	0.73 & 0.04

Reach	Roadway	Construction Measure	Length (miles)
3	Embarcadero	Seawall/ SGI	0.52
3	Third Street Bridge	Closure Structure	0.04
3	Fourth Street Bridge	Closure Structure	0.04
3	Terry Francois Boulevard	Closure Structure	0.01
3	Terry Francois Boulevard	T-wall/ SGI/ EWN	0.08
3	Terry Francois Boulevard	Planted Levee/ SGI/ EWN	0.07
3	Illinois Street	Paved Levee/ SGI	0.02
4	Illinois Street Bridge	Closure Structure/ SGI	0.02 & 0.02
Subsequent Actions			
1	Jefferson Street	T-Wall/ Wall Impact/ SGI	0.06 & 0.11
1	Embarcadero	Seawall/ SGI	0.75
3	Embarcadero	Seawall/ Bay Fill	0.54
3	Terry Francois Boulevard	Seawall/ Bay Fill	0.44

Note: EWN = Engineering with Nature, SGI = Seismic Ground Improvements

Table D.1.4-3: Recommended Plan Transportation Facility Construction Impacts by Reach

Reach	Facility	Construction Measure	Length (miles)	Service
First Actions				
1	Pier 41 ferry terminal	Curb Extension/ Floodproofing Buildings	NA	WETA
2	Embarcadero rail lines (F Line)	Closure Structure	0.01	MUNI
2	Embarcadero rail lines	Seawall/ SGI	0.73	MUNI
2	Bay Trail (Embarcadero)	Seawall/SGI	0.73 & 0.04	MTC
2	Bay Trail (Embarcadero)	Seawall/ Planted Levee/ SGI	0.18	MTC
e	Ferry Building ferry terminal	Rebuilt Wharf/Elevate Buildings/ Bay Fill	NA	WETA
3	Embarcadero Rail Lines	Seawall/ SGI	0.52	MUNI
3	Bay Trail (Embarcadero)	Seawall/ SGI	0.52	MUNI
3	Bay Trail (Embarcadero)	Seawall/ Rebuilt Wharf/ SGI	0.22	MTC
3	Oracle Park ferry terminal access	Seawall/ Rebuilt Wharf/SGI	NA	WETA
3	Bay Trail (Giants Ballpark)	Curb Extension	0.18	MTC

Reach	Facility	Construction Measure	Length (miles)	Service
4	Bay Trail (Third Street Bridge)	Closure Structure/SGI	0.04	MTC
3	Rail lines along Fourth Street	Closure Structure/SGI	0.04	MUNI
3	Bay Trail (Terry Francois)	Closure Structure/SGI	0.01	MTC
3	Bay Trail (Terry Francois)	T-wall/ SGI/ EWN	0.08	MTC
3	Bay Trail (Terry Francois)	Planted Levee/ SGI/ EWN	0.11	MTC
3	Bay Trail (Terry Francois)	Paved Levee/SGI	0.07	MTC
3	Bay Trail (Illinois Street)	Paved Levee/ SGI	0.02	MTC
4	Bay Trail (Illinois Street Bridge)	Closure Structure/ SGI	0.02 & 0.02	MTC
Subsequent Actions				
1	Jefferson Street rail lines	T-Wall/ Wall Impact/ SGI	0.09	MUNI
1	Bay Trail (Embarcadero)	Seawall/ SGI	0.75	MTC
1	Embarcadero rail lines	Seawall/ SGI	0.55	MUNI
1	Pier 41 ferry terminal	Wharf Rebuild/ Seawall/ SGI	NA	WETA
3	Embarcadero rail lines	Seawall/ Bay Fill	0.54	MUNI
3	Bay Trail (near King Street)	Seawall/ Bay Fill/ Planted Levee	0.22	MTC
3	Bay Trail (Giants Ballpark)	Seawall/ Bay Fill	0.18	MTC
3	Oracle Park ferry terminal access	Seawall/ Planted Levee/ Bay Fill	NA	WETA
3	Bay Trail (Terry Francois)	Seawall/ Bay Fill	0.17	MTC
3	Bay Trail (Terry Francois)	EWN / SGI	0.10	MTC
4	Bay Trail (Illinois Street Bridge)	Closure Structure	0.09	MTC

Note: EWN = Engineering with Nature, SGI = Seismic Ground Improvements

2.3.3.1.2 Relocation or prolonged flooding to major transportation infrastructure

The Recommended Plan would stabilize the existing waterfront shoreline and rely on Closure Structures to protect bridges and two roadways at their current elevation. A total of five buildings would be demolished during the First action all in Reach 4. During the Second action, seven buildings in Reach 1 and four buildings in Reach 4 would be demolished; none would be demolished in either Reaches 1 or 2. These areas with demolished buildings do not include any major transportation infrastructure. The Recommended Plan would have minimal impact on transportation infrastructure along the waterfront compared to the FWOP.

SFMTA did review a slightly modified version of the Recommended Plan as it is comprised of parts of other alternatives (Alternatives E, F, and G) and those evaluated facilities were included in the **Table D.1.4-4**. However, some facilities were not

evaluated as part of Alternative D which comprise part of the Recommended Plan. For the SFMTA facilities that were evaluated for this alternative, the Second action was shown to have a 50% reduced capacity at the Marin and 20% reduced capacity to the Islais Facility during construction and no impact during operations compared to conditions today.

The use of closure structures at several locations along the waterfront would disrupt traffic and expose roadway and bridges to prolonged flooding. When closure structures are in place, seawater, freshwater, or brackish water would flood the existing infrastructure on the bay-side or creek-side of these structures. This would lead to bridges and portions of roadways that would be submerged for hours up to possibly days until the high water event has concluded. While permanent relocation of these transportation corridors for vehicle traffic, transit, or bicycle and pedestrian traffic has not been identified as part of the Recommended Plan, alternative corridors would be identified part of the implementation plan. The corridors on the water-side of the closure structures would be exposed to water that could more rapidly degrade roadways, cement, railroad tracks and supporting transportation components that would shorten the lifespan of these facilities.

The Recommended Plan would implement AMM-TR-4: Include Transit Access in CTMP, AMM-TR-8 for Alternatives where roadway access is changed substantially, and AMM-TR-9 for Alternatives where railroad access and related infrastructure are changed substantially along with AMM-TR-1 to minimize impacts. The Recommended Plan would cause minimal disruptions to transportation infrastructure near the waterfront especially compared to the FWOP or Alternative B, and result in a **less than significant impact with mitigation** for all reaches.

Table D.1.4-4: Expected Reduced Capacity by Transportation Facility and Asset in Year 2090*

Reach	Transportation Infrastructure	2090	
		Construction	Operation
1	Kirkland Yard	None	None
2	Folsom Portal	None	None
3	Central Subway Portal	None	None
3	Fourth & King Special Trackwork	None	None
3	King Substation	None	None
3	Third Street Bridge over Mission Creek	N/E	N/E
3	Fourth Street Bridge over Mission Creek	None	None
3	6th & King Pocket Track and Operator Rest Station	None	None
3	Mission Bay Loop	None	None
3	Illinois Substation	None	None
4	Muni Metro East	None	None
4	Marin Facility	50%	None
4	Islais Creek Facility	20%	None
4	Third Street Bridge over Islais Creek	None	None
4	Illinois Street Bridge over Islais Creek	N/E	N/E
4	Burke Storage Facility	None	None
4	Phelps Substation	None	None

Source: Waterfront Resiliency Transportation Assessment (SFMTA, 2022)

* This table was assembled based on SFMTA analysis for Alternatives A, E, F and G. Portions of Alternatives E and G are part of the Recommended Plan alternative. Some facilities were not evaluated for the Recommended Plan alternative and are marked as "N/E = Not Evaluated." This analysis does not include the addition of the Independent Measures presented in the Draft EIS. Select Independent Measures, described in the Draft EIS, were added to the improvements as part of the Recommended Plan alternative.

Note: Cells with SFMTA analysis in grey are a greater impact than Alternative A or the FWOP condition. Only operations could be evaluated for this purpose since Alternative A has no construction. N/E = Not Evaluated. For the recommended plan, no cells were highlighted grey since none of the infrastructure had a greater impact than Alternative A.

2.3.3.1.3 Introduction of Substantial Long-Term Detours for Different Modes of Transportation

The Recommended Plan would introduce substantial temporary, in some cases long-term (one year or more in duration), detours for all Reaches and across different modes of transportation. This alternative would affect major roadways; rail vehicle traffic that utilizes the Embarcadero in Reaches 1, 2 and 3; the bridges for Third Street and Fourth Street over Mission Creek in Reach 3; and the Illinois Street over Islais Creek in Reach

4. The bridges would implement closure structures during the First Action at the Embarcadero near Pier 27, Terry Francois Boulevard near Pier 50, Third Street, Fourth Street, and Illinois Street bridges. Also, the reduction in space for the Embarcadero could also lead to the potential minimization or removal of the Bay Trail, roadway, and rail tracks in Reaches 2 and 3 during the First Action, and Reaches 1 and 3 during the Second Action. Also in Reach 2, some ferry operations would be disrupted by rebuilding the Ferry terminal wharf, previously included as Independent Measure 2A in the Draft EIS. In Reach 3, improvements to Terry Francois Boulevard would also impact the roadway and Bay Trail in both the First Action and Second Action. This significant retreat would also disrupt existing transportation infrastructure and services that pass through these areas.

The impacts to the Embarcadero and the associated systems (roadway, Bay Trail, ferries, and rail transit), Terry Francois Boulevard (roadway and Bay Trail), and the three bridges (roadway, Bay Trail, and rail transit) would result in long-term, temporary detours during construction and potentially operations. Since the Draft EIS, this Recommended Plan impact has become more intensive and likely longer term with the addition of Independent Measures Living Seawall, 2A, and 2B from the Draft EIS. With implementation of AMM-TR-1, AMM-TR-2, AMM-TR-3, AMM-TR-4, and AMM-TR-5, and AMM-TR-8, the Recommended Plan would result in **less than significant impact with mitigation** across all reaches by the Second Action.

2.3.3.1.4 Substantial Loss of Parking Spaces or Access

The Recommended Plan would result in roadway impacts to the Embarcadero in both First action and Second action. Approximately 1.12 miles of the Embarcadero in Reach 2 would be impacted under First action, and 0.75 miles in Reach 1 and 0.52 miles in Reach 3 of the Embarcadero would be impacted under Second action. The Recommended Plan minimizes flooding to the Embarcadero by raising the street, reducing the width of the Embarcadero, or both. Construction would be disruptive to the waterfront area, and ground improvements would require lane, parking, bike path and sidewalk closures, and some travelers may avoid the area or find alternative methods to avoid parking or access issues. Overall, the Recommended Plan would not result in permanent direct impacts to parking or loss of parking. However, indirect impacts from reduced parking activity and access could impact parking lot usage and revenues.

Pier parking would be impacted by construction for the Recommended Plan and waterfront land-based parking may have access changes during construction. The Recommended Plan would include roadway impacts to the Embarcadero near Pier 27 during Recommended Plan First action and Pier 30 during Recommended Plan Second action. The Pier 39 parking garage would remain accessible through existing entrances and exits located on nearby streets but would likely need to close the Embarcadero exit driveway. The Recommended Plan minimized flooding to the Embarcadero by raising the street, which in some places would reduce the width of the Embarcadero. Embarcadero construction would be disruptive and could result in temporarily closing access to the pier and pier parking lots and drivers avoiding the area during construction. Pier 80 in Reach 4 would be preserved by a curb extension and seismic

ground improvements in Recommended Plan First action and rebuilding the wharf, seawall and levee installation in Recommended Plan Second action.

The Recommended Plan would have both direct impacts to parking from closures during construction and indirect impact to parking under first and Subsequent Actions from construction in the area anticipated to last up to 10 years each. With implementation of AMM-TR-1, which would minimize impacts from parking losses and access during construction, the impact would be ***less than significant impact with mitigation***.

2.3.3.2 Alternative B: Nonstructural

2.3.3.2.1 Short-Term or Long-Term Disruptions of Existing Transportation Services

Alternative B includes floodproofing, demolition, and raising in place or relocating buildings and infrastructure to reduce coastal flooding risk. Most of the Alternative B improvements would be floodproofing buildings and infrastructure which would include a short-term disruption to construct the floodproofing measures and could be re-opened as a transportation facility in the same location. Transportation services are expected to remain in place while some buildings and piers may be demolished. If transportation facilities are impacted, those facilities would be floodproofed under Alternative B. Short-term transportation disruptions may occur as the public shifts to new temporary routes.

Although many transportation facilities would remain in their existing location, these are critical corridors for transit (both bus and rail), vehicle traffic, ferries, bicyclists and pedestrians that would be disrupted during construction. The Embarcadero in Reaches 1 and 2 will be fully floodproofed in phases as 2115 approaches as seen in **Table D.1.4-6** and **Table D.1.4-7**. This floodproofing will need to provide temporary routes for all modes of travel during construction. Floodproofing the Embarcadero is expected to be a multi-year effort in a high-density corridor for transportation services. In addition, Third Street is an important corridor for Reaches 3 and 4 as it provides one of the two crossing points for both Mission and Islais Creek. The Third Street corridor also has Muni light rail connecting the southern neighborhoods of San Francisco with downtown. Implementation of AMM-TR-1, AMM-TR-2, AMM-TR-3, and AMM-TR-4 and AMM-TR-5 would minimize these disruptions but are not expected to fully mitigate for this impact. The floodproofing of Embarcadero and Third Street are expected to be multi-year construction efforts that would disrupt the nearby waterfront communities. With implementation of AMM-TR-1 through AMM-TR-5, the impact would be **significant and unavoidable with mitigation** in all reaches.

Table D.1.4-5 and **Table D.1.4-6** below show the impacts to roadways that would occur under this scenario.

Table D.1.4-5: Alternative B Roadway Impacts by Reach (Year 2040 and 2065)

Reach	Roadway	Construction Measure	Length (miles)

Year 2040			
2	Embarcadero	Floodproofing	0.77
3	Third Street	Floodproofing	0.46
3	Fourth Street	Floodproofing	0.18 and 0.34
3	Terry A Francois Boulevard	Floodproofing	0.47
3	I-280 On and Off-ramps	Floodproofing	0.23 & 0.16 & 0.04
3	Illinois Street	Floodproofing	0.08
4	Third Street	Floodproofing	0.17 & 0.29
4	Cesar Chavez Street (partially or fully obstructs access to I-280)	Floodproofing	0.26 miles
4	Evans Avenue	Floodproofing	0.38
4	Amador Road	Floodproofing	0.39
Year 2090			
1	Jefferson Street	Floodproofing	0.29
2	Embarcadero	Floodproofing	0.34 & 0.18
2	Broadway	Floodproofing	0.11
3	Harrison Street	Floodproofing	0.06
3	I-80 On-ramps at 5th Street	Floodproofing	0.07 & 0.07
3	Terry A. Francois Boulevard	Floodproofing	0.10 & 0.09
4	Evans Avenue	Floodproofing	0.17 & 0.18
4	Third Street	Floodproofing	0.12 miles

Table D.1.4-6: Alternative B Roadway Impacts by Reach (Year 2090 and 2115)

Reach	Roadway	Construction Measure	Length (miles)
Year 2090			
1	Jefferson Street	Floodproofing	0.23
1	Beach Street	Floodproofing	0.61
1	Embarcadero	Floodproofing	0.67
2	Washington Street	Floodproofing	0.10
3	Embarcadero	Floodproofing	0.49
3	Washington Street	Floodproofing	0.02
3	Bryant Street	Floodproofing	0.12 & 0.03 & 0.04
3	Third Street	Floodproofing	0.09 & 0.19
3	Fourth Street	Floodproofing	0.38 & 0.03

Reach	Roadway	Construction Measure	Length (miles)
3	I-280 substructure	Floodproofing	0.18
3	Terry A. Francois Boulevard	Floodproofing	0.20
4	Cargo Way	Floodproofing	0.02
Year 2115			
3	Harrison Street	Floodproofing	0.01
3	I-280 Off-ramps	Floodproofing	0.02 & 0.06
3	Bryant Street	Floodproofing	0.07
3	Embarcadero/King Street	Floodproofing	0.27
3	I-280 Substructure	Floodproofing	0.02
3	Fourth Street	Floodproofing	0.04
3	Third Street	Floodproofing	0.05
3	Illinois Street	Floodproofing	0.05
4	Illinois Street	Floodproofing	0.03
4	Cargo Way	Floodproofing	0.04
4	Evans Way	Floodproofing	0.08
4	Third Street	Floodproofing	0.07

Table D.1.4-7 below shows the transportation facilities that would be impacted under Alternative B projected for year 2040, 2065, 2090 and 2115.

Table D.1.4-7: Alternative B Transportation Facility Construction Impacts by Reach (Year 2040, 2065, 2090 and 2115)

Reach	Facility	Construction Measure	Length (miles)	Service
Year 2040				
1	Bay Trail (Embarcadero)	Floodproofing	0.07	MTC
1	Pier 41 ferry terminal access	Retreat	NA	WETA
2	Bay Trail (Embarcadero)	Floodproofing	0.86	MTC
2	Embarcadero light rail tracks	Floodproofing	0.77 miles	MUNI
2	Ferry Building ferry terminal	Floodproofing	NA	WETA
3	Fourth & King Yard	Floodproofing	~15 acres	Caltrain
3	T-Third light rail tracks (Third Street)	Floodproofing	0.44 & 0.18 acre	MUNI
3	Future Mission Bay ferry terminal	Floodproofing/ Retreat	NA	WETA

Reach	Facility	Construction Measure	Length (miles)	Service
3	Bay Trail (Terry Francois Boulevard)	Floodproofing	0.50 miles	MTC
3	Bay Trail (Illinois Street)	Floodproofing	0.04 miles	MTC
4	T-Third light rail tracks (Third Street)	Floodproofing	0.17 & 0.29	MUNI
4	Bay Trail (Illinois Street & Cargo Way)	Floodproofing	0.12 & 0.12	MTC
Year 2065				
1	Jefferson Street rail tracks	Floodproofing	0.28	MUNI
1	Bay Trail (Embarcadero)	Floodproofing	0.05 & 0.04	MTC
1	Pier 41 ferry terminal access	Floodproofing	NA	WETA
2	Embarcadero light rail tracks	Floodproofing	0.34 & 0.18	MUNI
2	Bay Trail (Embarcadero)	Floodproofing	0.36 & 0.06	MTC
3	Bay Trail (near Giants Ball Park)	Floodproofing	0.21	MTC
3	Future Mission Bay ferry terminal	Floodproofing	NA	WETA
3	Bay Trail (Terry Francois Boulevard, Illinois Street)	Floodproofing	0.11	MTC
4	T-Third light rail tracks (Third Street)	Floodproofing	0.12 miles	MUNI
4	Caltrain Railroad tracks	Floodproofing	0.22	Caltrain
4	Bay Trail (Cargo Way)	Floodproofing	0.08	MTC
Year 2090				
1	Jefferson Street	Floodproofing	0.23	MUNI
1	Pier 41 ferry terminal access	Floodproofing	NA	WETA
1	Beach Street	Floodproofing	0.61	MUNI
1	Embarcadero	Floodproofing	0.67	MUNI
1	Bay Trail (Embarcadero)	Floodproofing	0.69	MTC
3	Embarcadero	Floodproofing	0.49	MUNI
3	Bay Trail (Embarcadero)	Floodproofing	0.49	MTC
3	Fourth Street	Floodproofing	0.38	MUNI
3	Caltrain tracks	Floodproofing	0.21	Caltrain
3	Third Street	Floodproofing	0.19	MUNI
4	Third Street	Floodproofing	0.17 & 0.30	MUNI
4	Caltrain tracks	Floodproofing	0.03	Caltrain
4	Bay Trail (Cargo Way)	Floodproofing	0.02	MTC
Year 2115				
3	Embarcadero/King Street	Floodproofing	0.27	MUNI
3	Caltrain Tracks	Floodproofing	0.02	Caltrain

Reach	Facility	Construction Measure	Length (miles)	Service
3	Bay Trail (near Giants Ball Park)	Floodproofing	0.40	MTC
3	Third Street	Floodproofing	0.05	MUNI
4	Third Street	Floodproofing	0.07	MUNI
4	Caltrain Tracks	Floodproofing	0.02	Caltrain
4	Bay Trail (Illinois Street)	Floodproofing	0.03	MTC
4	Bay Trail (Cargo Way)	Floodproofing	0.05	MTC

2.3.3.2.2 Relocation or Prolonged Flooding to Major Transportation Infrastructure

For Alternative B, the transportation facilities would be floodproofed to limit travel disruptions from flooding. Infrequent flooding may occur during high tide events or storm surges interrupting transportation services during these times. This flooding is anticipated to be short-term as in hours or days of disruption. As the sea level rises, the transportation infrastructure would be floodproofed to minimize disruptions for all modes of travel from flooding. By floodproofing transportation facilities, there will be more reliable flood protection compared to the FWOP.

Retreat zones would be identified and phased as infrequent flooding occurs. Critical city infrastructure, such as transportation corridors, subject to infrequent flooding would be floodproofed to prevent physical damage but would incur periodic disruptions. As businesses and residences are evacuated from these infrequent flooding areas, or retreat zones, the transportation systems serving those areas may become obsolete and these transportation corridors would be part of the retreat. In these cases, relocations of transportation infrastructure may occur.

Relocation may occur as part of the planned construction for Alternative B. These impacts related to construction were included as part of the Effect TR-1 Alternative B discussion above. The impact would be **less than significant** for all reaches.

2.3.3.2.3 Introduction of substantial long-term detours for different modes of transportation

For Alternative B, no long-term detours would be planned as part of floodproofing, raising in place, or retreat. Critical city systems, including transportation systems, could be identified for floodproofing or relocation. As these transportation systems are modified to meet Alternative B, temporary long-term detours could be created to accommodate construction or relocation of a transportation facility. Any areas identified as a retreat zone would plan for temporary detours and work to identify and implement new permanent routes for all users. Substantial long-term detours are likely for the Embarcadero and Third Street corridors. For both the Embarcadero and Third Street, transit riders, auto drivers, bicyclists and pedestrians would be required to potentially endure substantial long-term detours. Bicycle and pedestrian traffic for the Embarcadero would include those that utilize the Embarcadero sidewalks along with the

Bay Trail. Implementation of AMM-TR-1, AMM-TR-2, AMM-TR-3, AMM-TR-4 and AMM-TR-5 would minimize these disruptions but are not expected to fully mitigate for this impact. Alternative B would have a **less than significant impact with mitigation,** compared to FWOP, by introducing substantial long-term detours.

2.3.3.2.4 Substantial Loss of Parking Spaces

Alternative B would result in retreat in frequently inundated areas, displacing some buildings inland to avoid flooding. The associated parking for the relocated buildings and on-street parking is likely to be substantially less than the parking spaces removed. Several buildings would begin to be demolished in 2090 in Reaches 3 and 4, and the same would occur in Reaches 1 and 2 by 2115. The pier parking would remain in place by floodproofing the piers with parking, including Pier 27, Pier 30 and Pier 80. There would be a substantial loss of parking spaces. TR-AMM-1 would be implemented to limit parking space losses during Alternative B construction. With implementation of TR-AMM-1, the impact is ***significant and unavoidable*** for Reaches 3 and 4 in 2090 and Reaches 1 and 2 in 2115.

2.3.3.3 Alternative F: Manage the Water, Scaled for Higher Risk

Impacts to transportation from Alternative F are provided in **Table D.1.4-8** below.

Table D.1.4-8: Summary of Transportation Impacts associated with Alternative F

Alternative F **Transportation Impact Rating by Measure**	**Bay fill**	**Levee**	**Bulkhead wall/Seawall**	**Roadway Impact**	**Tide Gate**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Marsh Enhancement***
Construction Footprint	*4*	*4*	*3*	*4*	*3*	*3*	*3*	*2*	*2*	*2*	*2*
O&M Assumptions	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Mitigated Rating	*4*	*4*	*3*	*4*	*3*	*3*	*3*	*2*	*2*	*2*	*2*

2.3.3.3.1 Short-term or long-term disruptions of existing transportation services

Alternative F would maintain most of the existing waterfront and reinforce or raise the existing infrastructure while extending the waterfront Bayward with 50 feet of fill in place. However, in transportation corridors close to the San Francisco Bay, construction impacts will occur at the Embarcadero northbound roadway lane and rail lines as it is raised with bay fill and nearby pier buildings are elevated and moved to accommodate rising sea levels in 2040 in Reaches 1, 2, and 3. Also in the same construction phase, levees will be put in place along the Bay Trail and Terry Francois Boulevard, a tide gate will be added to McCovey Cove, and Engineering with Nature features installed at Heron's Head Park. In 2090, the Bay Trail will be impacted from construction for a paved levee in Reach 1; planted levee in Reach 3 near Oracle Park and Terry Francois Boulevard and Illinois Street; and engineering with nature in Heron's Head Park in Reach 4. Both moderate and substantial direct and indirect transportation impacts are anticipated due to the extended work areas and duration of construction along the Embarcadero.

During 2040 and 2090, the ferry terminals along the San Francisco Waterfront would all be impacted and service would likely need to be modified or temporarily relocated while construction is ongoing. In 2040, all the ferry terminals, Pier 41, Ferry Building, Oracle Park, and Mission Bay, would be disrupted by building walls, adding bay fill, or tide gates built in the vicinity of the existing ferry terminals. The tide gate at McCovey Cove would bisect the existing Oracle Park ferry terminal and the ferry terminal would need to be relocated to maintain service. In 2090, construction is expected near the Ferry Building and Oracle Park ferry terminals. The ferry terminals are located in Reach 1, 2, and 3 and are expected to have impacts from Alternative F. No ferry terminals are located in Reach 4. AMM-TR-5: Include water traffic management in CTMP would be implemented to help minimize the impacts to the ferry terminals.

For both Alternative F phases, construction is estimated to take 10 years to complete. The construction work along the Embarcadero will disrupt several different transportation modes including vehicular traffic, bike paths, and sidewalks as well as some transit disruptions, and water traffic via ferry will disrupted from construction near the ferry terminals. Implementation of AMM-TR-1, AMM-TR-2, AMM-TR-3, AMM-TR-4 and AMM-TR-5 would minimize these disruptions but are not expected to fully mitigate for this impact. Overall, Alternative F would incur a ***significant and unavoidable impact*** with implementation of avoidance and minimization measures due to impacts in Reaches 1, 2, and 3.

The extent of these disruptions are shown below in **Table D.1.4-9**.

Table D.1.4-9: Alternative F Roadway Construction Impacts by Reach

Reach	Roadway	Construction Measure	Length (miles)
Year 2040			
1	Embarcadero	T-wall/ SGI	0.44

Reach	Roadway	Construction Measure	Length (miles)
1, 2, 3	Embarcadero	Seawall/ SGI	2.00
3	Terry Francois Boulevard	SGI	0.21 & 0.08
4	Amador Street	SGI/Paved Levee	0.39
Year 2090			
1	Embarcadero	Paved Levee	0.18
3	Terry Francois Boulevard	Levee	0.41
3	Illinois Street	Planted Levee	0.20
4	Amador Street	Paved Levee	0.39

Notes: SGI = Seismic Ground Improvements

2.3.3.3.2 Relocation or Prolonged Flooding to Major Transportation Infrastructure

Alternative F would allow much of the existing waterfront features to remain in place and rely on water pumps to remove floodwaters. This alternative would have minimal to moderate impact on transportation corridors along the waterfront. In 2090, several buildings would be demolished in Reach 3 and 4 due to anticipated sea-level rise. These areas with demolished buildings do not include any major transportation infrastructure.

SFMTA reviewed Alternative F with their existing facilities and found four facilities would be impacted, as shown in **Table D.1.4-10**. In 2040, Islais Creek facility (a motor coach maintenance and operations facility) would be impacted at 20% and Marin facility (a Muni motor coach acceptance yard, rail track shop, and street car storage facility) would be impacted at 50% from construction. Mission Bay Loop (a turn-around light rail loop) would be impacted at 100% during construction and operations and Muni Metro East (a light rail vehicle maintenance and storage yard) would be impacted at 50% during construction in 2090. No other SFMTA facilities were identified as impacted during construction or operations for Alternative F.

Table D.1.4-10 below shows the transportation facilities that would be impacted under Alternative F.

Table D.1.4-10: Alternative F Transportation Facility Construction Impacts by Reach

Reach	Facility	Construction Measure	Length (miles)	Service
Year 2040				
1	Embarcadero rail lines	T-wall/SGI	0.25	MUNI
1	Bay Trail (Embarcadero)	T-wall/ SGI	0.44	MTC
1	Pier 41 Ferry Terminal	Curb Extension	NA	WETA
2	Ferry Building ferry terminal	Bay Fill/Seawall	NA	WETA

Reach	Facility	Construction Measure	Length (miles)	Service
1, 2, 3	Embarcadero rail lines	Seawall/ SGI	2.00	MUNI
1, 2, 3	Bay Trail (Embarcadero)	Seawall/ SGI	2.24	MTC
3	Bay Trail (Giants Ballpark)	Planted Levee/SGI	0.22	MTC
3	Oracle Park Ferry Terminal	Tide Gate	NA	WETA
3	Bay Trail (Terry Francois)	Levee/SGI	0.18	MTC
3	Bay Trail (Terry Francois)	Planted Levee/SGI	0.08	MTC
4	Bay Trail (Heron's Head Park)	EWN/SGI	0.09	MTC
Year 2090				
1	Bay Trail (Embarcadero)	Paved Levee/Curb Extension/Wall Impact	0.44	MTC
2	Ferry Building ferry terminal	Curb Extension/Wall Impact	NA	WETA
3	Bay Trail (near Giants Ballpark)	Planted Levee	0.22	MTC
3	Oracle Park Ferry Terminal	Tide Gate/Pump Station	NA	WETA
3	Future Mission Bay Ferry Terminal	Planted Levee	NA	WETA
4	Bay Trail (Terry Francois and Illinois Street)	Planted Levee	0.58	MTC

Note: EWN = Engineering with Nature, SGI = Seismic Ground Improvements

Other SFMTA assets that would be impacted include the T-Third light rail line operating at reduced capacity and the Illinois Street bridge at reduced capacity by the end of the century. The SFMTA facilities, Islais Creek, Marin and Muni Metro East, described in the above paragraph provide critical facilities to maintain and operate the Muni buses and light rail including the T-Third Light Rail line. The Mission Bay loop provides increased reliability by allowing the light rail to turn around for special events and during peak service periods to provide additional service. Comparing to the FWOP, these same facilities would be impacted, although additional facilities would be impacted under FWOP as shown in **Table D.1.4-11**. The T-Third light rail is a critical service to connect the communities in Reach 3 and 4 to the central business district. Due to these impacts, SFMTA determined that transit degradation would be a low impact during mid-century and medium impact by the end of the century during construction.

During operations, Alternative F would result in no impact by mid-century and a medium impact across all geographies by end of century. This compares to Alternative A with a low-impact by mid-century and a high-impact by end of century without storm surge and high for the FWOP condition with storm surge for both phases.

Alternative F would need to implement AMM-TR-4: Include Transit Access in CTMP and AMM-TR-9 for Alternatives where railroad access and related infrastructure are changed substantially along with AMM-TR-1 to minimize impacts. Alternative F would

cause disruptions to transportation infrastructure due to relocating infrastructure, although much less relocations and flooding would occur compared to Alternative A. Therefore, Alternative F would have a ***less than significant impact*** compared to FWOP for transit by the end of the century for all reaches. This impact would most acutely be felt in Reach 3 and 4 from impacts to the T-Third line.

Table D.1.4-11: Alternative F Expected Reduced Capacity by Transportation Facility and Asset

Transportation Infrastructure	Reach	2040		2090	
		Construction	Operation	Construction	Operation
Kirkland Yard	1	None	None	None	None
Folsom Portal	2	None	None	None	None
Central Subway Portal	3	None	None	None	None
Fourth & King Special Trackwork	3	None	None	None	None
King Substation	3	None	None	None	None
Third Street Bridge over Mission Creek	3	N/E	N/E	N/E	N/E
Fourth Street Bridge over Mission Creek	3	None	None	None	None
6th & King Pocket Track and Operator Rest Station	3	None	None	None	None
Mission Bay Loop	**3**	None	None	**100%**	**100%**
Illinois Substation	3	None	None	None	None
Muni Metro East	4	None	None	**50%**	None
Marin Facility	**4**	**50%**	None	None	None
Islais Creek Facility	**4**	**20%**	None	None	None
Third Street Bridge over Islais Creek	4	None	None	None	None
Illinois Street Bridge over Islais Creek	4	N/E	N/E	N/E	N/E
Burke Storage Facility	4	None	None	None	None
Phelps Substation	4	None	None	None	None

Source: Waterfront Resiliency Transportation Assessment (SFMTA, 2022)

Cells with SFMTA analysis in grey are a greater impact than Alternative A or the FWOP condition. Only operations could be evaluated for this purpose since Alternative A has no construction. N/E = Not Evaluated

2.3.3.3.3 Introduction of Substantial Long-Term Detours for Different Modes of Transportation

Alternative F has most of the San Francisco Waterfront remaining in place to the extent possible that will accommodate sea-level rise, by extending the waterfront into the Bay and reducing some of the transportation effects during construction compared to other alternatives. Several building demolitions would occur near Pier 45 in Reach 1 and two building demolitions would occur near Pier 68 in Reach 3. During the 2090 phase, approximately four buildings would be demolished near Pier 45 and approximately 35 on piers or properties at the waterfront in Reach 3 and 4. Accessing locations near the demolition sites may become more difficult during this activity, however this is not anticipated to generate substantial long-term detours. No new impacts were identified that would introduce substantial long-term detours for different modes of transportation outside those described above for construction and flooding.

There will be disruptions related to construction along the Embarcadero, Terry Francois Boulevard, T-Third light rail, ferry service and Bay Trail. However, bridges crossing Mission and Islais Creek would remain open during implementation of this alternative. The Embarcadero, Terry Francois Boulevard, Amador Street and portions of Illinois Street would be elevated during the construction phases for Alternative F. The process to elevate these roadways, relocate ferry service, the Bay Trail and associated utility infrastructure would be a long-term construction effort. This construction would result in detours to avoid these streets. Although these detours are anticipated to be multi-year and, therefore, long-term, these detours are not anticipated to be substantial in length. Alternative F would protect most of the existing San Francisco Waterfront infrastructure in place and nearby alternative routes would be feasible. While relocating transit routes, especially light rail, would take advanced planning and movement of related utilities, it would be expected to be in close proximity to the existing route.

Alternative F would maintain much of the transportation corridors and facilities in place. Construction to elevate transportation corridors would introduce new long-term detours but these are not expected to be substantial in length. With implementation of AMM-TR-1, AMM-TR-2, AMM-TR-3, AMM-TR-4, and AMM-TR-5, Alternative F would result in **less than significant with mitigation** for all reaches.

2.3.3.3.4 Substantial Loss of Parking Spaces and Access

Alternative F would maintain most of the existing San Francisco Waterfront and keep many of the existing uses in place. Construction for 2040 and 2090 is estimated to be 10 years for each phase. For 2040, the northbound lane of the Embarcadero would be reconstructed with seismic ground improvements and the wharf area extended into the Bay, with likely lane bike and sidewalk closures during ground improvement. This along with the improvements to the wharves and piers to add walls and floodproof the buildings would require space for construction equipment staging and working parking. The construction work would temporarily lower the number of parking spaces available for public use near the Embarcadero in Reach 1, 2, and 3 as well as disrupt pedestrian and bike access as the Embarcadero walkway and piers and wharves are elevated. The same effect may occur from the paved levee construction and floodproofing buildings in

Reach 4 near Islais Creek but to a lesser extent. Overall, no major parking space losses are anticipated but nearby construction may reduce the volume of available parking spaces to the public.

Pier parking would not be abandoned until 2090 for Alternative F. Overall, waterfront land-based parking, such as the Pier 39 parking garage, may have access changes during both construction phases and require new or modified access points but their facilities would largely remain intact. For pier parking in 2040, Pier 27 and Pier 30 may be difficult to reach due to waterfront construction of T-walls and seawalls, seismic ground improvements to the northbound Embarcadero lane, extending of the waterfront on fill, and floodproofing wharf buildings. This multi-phased construction could take years to complete and drivers and bicyclists, transit users, and pedestrians may avoid Reaches 1, 2, and 3, and vehicles may avoid parking in the area. Pier 80 would have similar concerns, although less extensive, from construction of a paved levee and floodproofing two buildings on the pier. Since Pier 80 is used for private commercial use, the tenant may need to reduce or modify operations during construction of these features. By 2090, construction in Reaches 1, 2, and 3 would be reduced to installation of curb extensions and wall impacts. There could still be difficulty accessing Pier 27 and Pier 30 but overall construction in the area would be significantly reduced compared to 2040. Pier 80 would be susceptible to sea-level rise and the Pier 80 buildings would be demolished leading to likely abandonment of Pier 80 and reducing commercial parking in Reach 4.

Construction would limit the number of parking spaces and disrupt pedestrian and bicycle access available to the public at various locations for approximately 10 years during 2040 and 2090 phases. The abandonment of Pier 80 would reduce the number of parking spaces in Reach 4, although Pier 80 parking is currently for private commercial use. Implementation of AMM-TR-1 would minimize these parking losses for this impact. The impact to parking and access would be ***less than significant impact with mitigation***.

2.3.3.4 Alternative G: Partial Retreat, Scaled for Higher Risk

Impacts to transportation from Alternative G are provided in **Table D.1.4-12** below.

Table D.1.4-12: Summary of Transportation Impacts associated with Alternative G

Alternative G **Transportation Impact Rating by Measure**	**Levee**	**Bridge raise**	**Vertical wall**	**Bulkhead wall/seawall**	**T-wall**	**Wharf**	**Ecological armoring***	**Embankment shoreline***	**Marsh***	**Coarse beach***	**Ecotone levee***

Construction/Footprint	*4*	*5*	*3*	*4*	*4*	*3*	*4*	*4*	*4*	*4*	*4*
O&M Assumptions	*1*	*3*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Mitigated Rating	*4*	*4*	*3*	*4*	*4*	*3*	*4*	*4*	*4*	*4*	*4*

2.3.3.4.1 Short-Term or Long-Term Disruptions of Existing Transportation Services

Alternative G would raise several critical transportation corridors while retreating in many of the lower lying areas by 2090 along the waterfront, creating a need to redesign the transportation system in these areas. The Bay Trail and Embarcadero roadway and rail lines would be reinforced by installing a seawall and seismic ground improvements that would disrupt much of Reach 1, 2 and part of Reach 3 with substantial construction in the 2040 phase. In Reach 3 during the 2040 construction phase, both 3rd Street and Fourth Street bridges and their approaches would be elevated to accommodate sea-level rise. This would also impact the T-Third light rail line that crosses the Fourth Street bridge and Bay Trail that crosses the Third Street bridge. In Reach 4 during 2040, the Illinois bridge and its approaches and the Third Street bridge approaches over Islais Creek would need to be constructed. The Third Street bridge over Islais Creek would be elevated as part of a separate project. The Third Street bridge carries the T-Third light rail line and the Illinois Street bridge carries the Bay Trail. In 2040, the ferry terminals would have more minor impacts, compared to Alternative F, as the curb extensions are installed along the piers. Roadway and Transportation facility impacts are summarized in **Table D.1.4-13** and **Table D.1.4-14**.

In 2090, there would be minor impacts to Embarcadero areas in Reach 1, 2 and 3 from construction. Substantial impacts to the transportation system in the Mission Bay area would occur as the existing systems in the area are abandoned during retreat and re-routing would be needed for T-Third light rail, neighborhood roadway connections, Bay Trail, future Mission Bay ferry terminal, and Caltrain services. Areas near Islais Creek would also be abandoned in 2090 and would require re-routing of the T-Third light rail line, Bay Trail, Caltrain services, and roadway connections. Re-routing these transportation connections would be one of the first activities to occur prior to demolition of the buildings and would likely become a permanent re-routing of these services. Transit degradation during construction is anticipated to be at a 'medium' level for SoMa (Reach 2), Mission Bay (Reach 3) and South Bayshore (Reach 4) by 2040 and at a 'high' level for all waterfront geographies by 2090. Additional work may be required at the Caltrans I-280 ramps and at Cesar Chavez.

Alternative G construction for both phases is estimated to take 10 years each. The construction work during 2040 along the Embarcadero and the demolition in 2090 of the Mission Bay and Islais Creek areas will disrupt several different transportation modes, ranging from moderate to severe impacts. Implementation of AMM-TR-1, AMM-TR-2, AMM-TR-3, AMM-TR-4 and AMM-TR-5 would minimize these disruptions but are not expected to fully mitigate for this impact. Overall, Alternative G would incur a ***significant and unavoidable*** impact with implementation of avoidance and minimization measures.

Table D.1.4-13: Alternative G Roadway Construction Impacts by Reach

Reach	Roadway	Construction Measure	Length (miles)
Year 2040			
1	Jefferson Street	T-Wall/ Wall Impact/ SGI	0.06 & 0.11
1, 2, 3	Embarcadero	Seawall/ SGI	2.52
3	Third Street (Bridge and Approaches)	Bridge Elevation	0.26
3	Fourth Street (Bridge and Approaches)	Bridge Elevation	0.35
4	Illinois Street	Bridge Elevation/Planted Levee/SGI	0.32
4	Amador Street	Bridge Elevation/Planted Levee/SGI	0.06
4	Cargo Way	Bridge Elevation/Planted Levee/SGI	0.20
4	Cesar Chavez Street	Bridge Elevation/Planted Levee/SGI	0.29
4	Third Street	Planted Levee/SGI	0.16 & 0.12
Year 2090			
3	Third Street	Planted Levee/SGI	0.09
3	Third Street	EWN	0.01 & 0.66
3	Third Street	Planted Levee/SGI	0.20
3	Fourth Street	EWN	0.11 & 0.55
3	I-280 and Off and On-ramps	EWN	0.49
3	Terry Francois Boulevard	EWN	1.01
4	Illinois Street	Paved Levee/ SGI	0.18
4	Illinois Street	Planted Levee/EWN/Bridge Demolition	0.32
4	Cesar Chavez Street	EWN	0.59
4	I-280 Off and On-ramps	EWN	0.10 & 0.12
4	Third Street	EWN / Roadway Impact	0.18 & 0.30
4	Cargo Way	EWN / Roadway Impact	0.14
4	Amador Street	EWN	0.33
4	Evans Avenue	EWN	0.42

Note: EWN = Engineering with Nature, SGI = Seismic Ground Improvements

Table D.1.4-14: Alternative G Transportation Facility Construction Impacts by Reach

Reach	Facility	Construction Measure	Length (miles)	Service
Year 2040				
1	Jefferson Street rail lines	Sheetpile Wall/ SGI	0.09	MUNI
1, 2, 3	Embarcadero rail lines	Seawall/ SGI	2.32	MUNI
1, 2, 3	Bay Trail (Embarcadero)	Seawall/SGI	2.50	MTC
2	Bay Trail (Embarcadero)	Seawall/ Planted Levee/ SGI	0.18	MTC
2	Ferry Building ferry terminal	Rebuilt Wharf/Elevate Buildings/ Curb Extension	NA	WETA
3	Bay Trail (near King Street)	Planted Levee/SGI	0.22	MTC
3	Bay Trail Giants Ballpark)	Curb Extension/Wall Impact/ SGI	0.18	MTC
3	Oracle Park ferry terminal access	Curb Extension/Wall Impact/ SGI	NA	WETA
3	Bay Trail (Third Street Bridge)	Bridge Elevation	0.06	MTC
3	Third Street Light Rail	Bridge Elevation	0.25	MUNI
3	Bay Trail (Terry Francois)	T-Wall/ Wall Impact/ SGI	0.15	MTC
3	Bay Trail (Terry Francois)	Planted Levee/SGI	0.11	MTC
3	Bay Trail (Terry Francois)	Curb Extension/ Wall Impact/ SGI	0.14	MTC
4	Bay Trail (Illinois Street)	Bridge Elevation/Planted Levee/SGI	0.32	MTC
4	Bay Trail (Cargo Way)	Bridge Elevation/Planted Levee/SGI	0.15	MTC
4	Caltrain Railroad tracks	Planted Levee/SGI	0.16	Caltrain
4	Third Street Light Rail	Planted Levee/SGI	0.16 & 0.12	MUNI
Year 2090				
1, 2, 3	Bay Trail (Embarcadero)	Curb Extension/ Wall Impact	2.68	MTC
1	Pier 41 ferry terminal access	Curb Extension/ Wall Impact	NA	WETA
2	Ferry Building ferry terminal access	Curb Extension/ Wall Impact	NA	WETA
3	Bay Trail (near King Street)	Planted Levee	0.22	MTC
3	Bay Trail (Giants Ballpark)	Curb Extension/ Wall Impact	0.18	MTC
3	Oracle Park ferry terminal access	Curb Extension/ Wall Impact	NA	WETA
3	MUNI Rail tracks on King Street	Planted Levee/SGI	0.51	MUNI
3	Caltrain Railroad tracks	EWN	0.45	Caltrain

Reach	Facility	Construction Measure	Length (miles)	Service
3	Bay Trail (Mission Bay)	EWN	0.69	MTC
3	Future Mission Bay ferry terminal	EWN	NA	WETA
3	Third Street Light Rail	EWN	0.11 & 0.65	MUNI
3	Third Street Light Rail	Planted Levee/SGI	0.20	MUNI
3	Bay Trail (Illinois Street	Curb Extension/Wall Impact	0.09	MTC
4	Third Street Light Rail	Paved Levee/SGI	0.18 & 0.30	MUNI
4	MUNI Metro East Facility	EWN	16.9 acres	MUNI
4	Bay Trail (Illinois Street)	Paved Levee/SGI	0.18	MTC
4	Bay Trail (Illinois Street)	Planted Levee/EWN/Bridge Demo	0.32	MTC
4	Bay Trail (Cargo Way)	EWN / Roadway Impact	0.14	MTC
4	Caltrain Railroad Tracks	EWN	0.29	Caltrain

Note: EWN = Engineering with Nature, SGI = Seismic Ground Improvements

2.3.3.4.2 Relocation or Prolonged Flooding to Major Transportation Infrastructure

Alternative G includes a larger retreat than the other alternatives, with flooding and demolishing portions of the project area. The majority of these demolitions would occur in the 2090 construction phase. During 2040, approximately eight buildings in Reach 1, two buildings in Reach 3, and four buildings in Reach 4 would be demolished. The existing transportation infrastructure to these buildings would remain open after demolition. There are several areas that include Engineering with Nature measures but none are planned for areas with ground-level transportation corridors in 2040.

By 2090, the Mission Bay and Islais Creek area will be experiencing inundation and planned retreat would take place as the 2090 construction phase begins. The Mission Bay community and Islais Creek area would be left to retreat flood and buildings would be demolished. For Mission Bay, this would result in the flooding of portions of Fourth Street, T-Third Street light rail, Third Street, Terry Francois Boulevard, I-280 substructure, Illinois Street, Bay Trail and Caltrain railroad tracks in Reach 3. In addition, the future Mission Bay ferry terminal would be inaccessible. Near Islais Creek, portions of Illinois Street, Third Street, T-Third Street light rail, Bay Trail, Cesar Chavez Street, Caltrain railroad tracks, I-280 substructure and off- and on-ramps, Evans Avenue, Cargo Way, Amador Road.

For transportation facilities, SFMTA identified several locations that would be impacted by Alternative G. As shown in **Table D.1.4-15**, this would have a periodic effect on transit operations in 2040 from the Fourth Street bridge over Mission Creek. After 2090, the following facilities would be impacted during operations Islais Creek Facility, Marin Facility, Fourth & King special trackwork, 6th & King Pocket Track & Operator Rest Station, Mission Bay Loop, Illinois Substation, and Fourth Street Bridge over Mission Creek. For network effects by the end of the century, the Embarcadero would operate at

reduced capacity with no rail lines, I-80 Fourth & King Ramps would operate at reduced capacity, Mission Bay streets, Third Street bridge, Fourth Street bridge, T-Third light rail, Illinois Street Bridge, and I-280 off- and on-ramps would be impacted. Two areas would experience more severe impacts than under Alternative A FWOP: Fourth & King special trackwork would experience 100 percent impact compared to periodic impact under Alternative A, and Mission Bay Loop would experience 100 percent impact compared to frequent impact under Alternative A. From these impacts, transit degradation is anticipated to be at a low impact level in all waterfront neighborhoods by mid-century after construction is complete. By the end of century, all communities along the waterfront will be impacted at a high level for transit degradation after construction is complete for Alternative G. These transit degradation impacts are the same as the FWOP or Alternative A without storm surge.

Table D.1.4-15: Alternative G Expected Reduced Capacity by Transportation Facility and Asset

Transportation Infrastructure	Reach	2040		2090	
		Construction	Operation	Construction	Operation
Kirkland Yard	1	None	None	None	None
Folsom Portal	2	None	None	None	None
Central Subway Portal	3	None	None	None	None
Fourth & King Special Trackwork	3	None	None	100%	100%
King Substation	3	None	None	None	None
Third Street Bridge over Mission Creek	3	N/E	N/E	N/E	N/E
Fourth Street Bridge over Mission Creek	3	Periodic	Periodic	100%	100%
6th & King Pocket Track and Operator Rest Station	3	None	None	100%	100%
Mission Bay Loop	3	None	None	100%	100%
Illinois Substation	3	None	None	100%	100%
Muni Metro East	4	None	None	50%	None
Marin Facility	4	50%	None	100%	100%
Islais Creek Facility	4	20%	None	100%	100%
Third Street Bridge over Islais Creek	4	None	None	None	None
Illinois Street Bridge over Islais Creek	4	N/E	N/E	N/E	N/E
Burke Storage Facility	4	None	None	None	None
Phelps Substation	4	None	None	None	None

Source: Waterfront Resiliency Transportation Assessment (SFMTA, 2022)

Note: Cells with SFMTA analysis in grey are a greater impact than Alternative A or the FWOP condition. Only operations could be evaluated for this purpose since Alternative A has no construction. N/E = Not Evaluated

Alternative G is expected to have a significant and unavoidable impact due to transportation infrastructure from flooding the communities of Mission Bay in Reach 3 and Islais Creek in Reach 4, and relocation of transportation facilities to serve the public at a similar level. However, compared to FWOP, Alternative G would plan for relocations and accommodating flooding and implement AMM-TR-1, AMM-TR-2, AMM-TR-3, AMM-TR-4, and AMM-TR-5. AMM-TR-8 and AMM-TR-9 would also be implemented to avoid disruptions to roadways and railroads with advanced design refinements. With mitigation, Alternative G would have a ***less than significant with mitigation*** impact compared to Alternative A.

2.3.3.4.3 Introduction of Substantial Long-Term Detours for Different Modes of Transportation

Alternative G would introduce substantial detours for all Reaches and across different modes of transportation. This alternative would affect major roadways and rail impacts to vehicles that utilize the Embarcadero in Reaches 1 and 2; the Reach 3 approaches and bridges for Third and Fourth Street over Mission Creek; and the Reach 4 Islais Creek bridge approaches for Third Street and Illinois Street, and the Illinois Street bridge by 2040. The reduction in space for the Embarcadero could also lead to the potential minimization or removal of the Bay Trail in Reaches 1 and 2.

By 2090, significant portions of neighborhoods are proposed for retreat and demolition starting at Mission Creek and extending to south of Islais Creek in Reaches 3 and 4. This significant retreat would also disrupt existing transportation infrastructure and services that pass through or exist in these retreat areas and require redesign of major transportation systems. The project impacts in 2090 would require new permanent detours to be identified for I-80 King Street off- and on-ramps, MTA Third Street Light Rail in Reaches 3 and 4, and I-280 Cesar Chavez Street interchange and ramps in Reach 4. The retreat areas would also lead to impacts to the Bay Trail and Blue Greenway along Terry Francois Boulevard and Illinois Street in Reaches 3 and 4.

The SFMTA analysis identified several areas of their infrastructure impacted by Alternative G by 2090 (**Table D.1.4-15**). Starting in Reaches 1, 2, and 3, the Embarcadero would require reduced capacity and there would be limited space for rail for public transit. In Reach 3, the I-80 King Street off- and on-ramps would be reduced capacity, and Third Street and Fourth Street Bridges, Mission Bay Streets, SFMTA Third Street Light Rail would be impacted for operations. In Reach 4, Caltrain and the Third Street bridge over Islais Creek would be impacted during construction, and Illinois Street Bridge over Islais Creek and I-280 approaches near Islais Creek would be impacted during operations. After construction is complete for Alternative G, transit degradation would be ‘low’ for all geographies by 2040 and ‘high’ for all geographies by 2090.

Overall, the impacts to the Embarcadero, approaches and bridges over Mission Creek and Islais Creek, Terry Francois Boulevard, and I-280 would result in substantial and potentially permanent detours for different transportation modes. However, compared to FWOP, these detours and associated infrastructure could be moved with advanced planning. Alternative G would have a **less than significant impact** across all reaches.

2.3.3.4.4 Substantial Loss of Parking Spaces and Access

Alternative G would result in sea-level rise flooding impacting inland areas in 2090 within Reaches 3 and 4. By 2040, approximately 12 buildings would be demolished in Reaches 1, 3, and 4. Overall, Alternative G for Year 2040 would only minimally disrupt the parking space supply and utilization except for ground improvements and construction along the waterfront in Reaches 1 and 2. For 2090, numerous buildings in Reaches 3 and 4 would be demolished to accommodate sea-level rise. Flooding would having substantial impacts to on-street parking and parking lots in these reaches. However, there would also be a reduction in parking need as nearby buildings and destinations are subject to increased inundation and retreat is implemented, displacing uses in a large area. Overall, there would be a reduction in parking in all reaches by 2090 in Alternative G but that may also be coupled with reduction in need for parking as areas of the city are abandoned.

Pier and some land-based parking would be impacted by the further inland line of defense for Alternative G. This alternative would floodproof the buildings on Pier 80 in Reach 4 in 2040 currently utilized for auto distribution from overseas. In 2090, the buildings on Pier 80 would be demolished and pier structure would be converted to Engineering with Nature measures. Pier 27 with 125 parking spaces in Reach 2 and Pier 30 with 1,130 parking spaces in Reach 3 would have curb extensions installed around the piers and roadway impacts in 2040 which may directly impact the parking locations for the pier parking or access to parking from the Embarcadero during construction. Pier 27 and Pier 30 parking would remain in place for 2090 with a curb extension and wall impact along the Embarcadero. The Pier 39 parking garage would remain largely intact while access changes may be required during construction. Whether the new curb along the Embarcadero would prevent cars from parking on piers would need to be determined.

Alternative G would result in less parking spaces available by 2090 with the combination of sea-level rise flooding reducing the need for parking in waterfront areas. The impact to parking would be a ***significant and unavoidable impact***.

2.4 Mitigation

In order to avoid or minimize impacts to transportation during construction and operations, the following measures would be implemented as part of the project alternatives. The design, construction sequencing, and operations and maintenance of the project would be revisited during the preconstruction, engineering, and design phase (PED), which develops detailed designs to prepare the project for construction, to determine if the potential impacts were considered and disclosed in the Final Environmental Impact Statement from the study, and that mitigation measures were

developed appropriately. If it is determined during PED that any new reasonably foreseeable environmental effects could occur as a result of the project, supplemental National Environmental Policy Act (NEPA) analysis may be required.

AMM-TR-1: Prepare Construction Transportation Management Plans (CTMP) for construction of the Project.

A series of CTMPs would be prepared as the actions are planned, in consultation with appropriate agencies (City of San Francisco, SFMTA, WETA, Caltrans, BART, SamTrans, Golden Gate Transit, Muni, Caltrain and HSR) to determine safe access to and movement through the Project area during construction for all transportation uses. Mitigation for traffic and transit disruption will be developed under coordination with the impacted agencies. As the project is further refined and advanced, implementation and responsible agencies would be identified. These plans will be prepared based on the specific location, duration, and work space needed for a given project activity. Plans will include a communication plan for agencies and public. The communication plan would include details for notifying persons adjacent to construction activities, construction duration, mitigations implemented, persons to call for questions or complaints, and should be multilingual.

The CTMP would include project-specific information on expected hours of construction, duration of construction at a given location, and will include measures such as:

- compliance with SFMTA blue book for Regulations for Working in San Francisco Streets
- identification of road and/or lane, bike path, sidewalk closures; bus and transit route or stop modification, if any; bus bridges if needed for rail transit; and identification of any detour routes or temporary infrastructure for different travel modes
- emergency services alternative routes for essential services
- delivery vehicle access to local businesses
- coordination with San Francisco Unified School District and other local schools to ensure safe access to school for students, faculty, and the public
- identify construction truck haul routes for transport of construct materials, waste disposal for heavy construction vehicles
- identify off-street parking for construction related vehicles
- coordination with SFMTA and other City agencies on the development of a robust public outreach plan
- when detours for transit, other vehicles, and/or pedestrians and bicyclists are implemented, require that police officers or parking control officers monitor critical locations along the detour to promote unobstructed travel by vehicular traffic, transit, and people walking and bicycling as needed

- require contractors to provide carpool, bicycle, walk and transit access for construction workers that meets Americans with Disabilities Act (ADA) requirements; and
- the construction contractor(s) shall submit a project corridor segment-specific emergency access response plan as part of compliance with bid specifications. This plan shall include fire department and emergency service access to construction areas and maintain access for emergency services such as fire hydrants.

Please see AMM-CIA-3 regarding Construction Loading Zones; AMM-CIA-4 regarding Access Change Notices and Coordination; and AMM-CIA-6 for Targeted outreach to local businesses in Annex D.1.3, *Socioeconomics*.

AMM-TR-2: Include Pedestrian Access in CTMP

Maintain access on existing sidewalks and trails in the waterfront area. Provide suitable detour routes if construction will obstruct pedestrian routes. Any pedestrian detours would need to comply with Americans with Disabilities Act (ADA). Coordinate with SFMTA on pedestrian access and potential obstructions to pedestrian movement. Coordinate with MTC on Bay Trail access and potential detours. A performance standard would be developed with SFMTA to evaluate whether adequate pedestrian access is provided during construction.

AMM-TR- 3: Include Bicycle Access in CTMP

Maintain access on existing bike lanes and pathways through the Project area during construction or provide a satisfactory detour for bicycles. Coordinate with SFMTA on bicycling routing and any potential detours. Coordinate with MTC on Bay Trail access and potential detours. A performance standard would be developed with SFMTA to evaluate whether adequate bicycle access provides is provided during construction.

AMM- TR- 4: Include Transit Access in CTMP

Maintain access or provide alternative route and stops to transit within the waterfront area. Coordinate with SFMTA, BART, SamTrans, Golden Gate Transit, Muni, and any other local transit service providers. The public will be notified of any changes in transit routes or access during construction. A performance standard would be developed with SFMTA to evaluate whether alternative transit access, including paratransit access, provides adequate service to transit users of the affected routes during construction.

AMM- TR-5: Include water traffic management in CTMP

Maintain access or provide temporary locations to docks and piers utilized for boarding and operations of public ferries, public recreational vessels, private vessels, and freight boats. Include coordination with relevant parties including WETA, Golden Gate Ferry, and San Francisco Bay Ferry.

AMM- TR-6: Restrict Construction Hours

Limit construction work that must occur between 8:00 p.m. and 7:00 a.m. Any work that is needed between these times will need to comply with applicable noise and vibration measures.

AMM-TR-7: Coordinate with the City of San Francisco for major public events

Coordinate with the City of San Francisco on major public events that may reduce or restrict construction to allow efficient transportation for larger crowds.

AMM-TR-8: Coordinate with the City of San Francisco and Transit Agencies for roadway access

This measure could include coordination on elements that increase redundancy in the transportation network, such as expanding transit, bike and pedestrian infrastructure.

For Alternatives where transit and roadway access has changed substantially, the USACE and the Port will coordinate closely with the City and transit agencies on the need for modifications to the City's transportation system in response to areas that might otherwise be isolated by construction of the measures. During the PED phase, design engineers will coordinate with transportation agencies and where minor changes can be made to minimize impacts, these will be incorporated into the design. This could include, for instance, minor modifications to alignment of levees to one side of an existing road so as not to affect traffic once constructed. Prior to implementation of any measures that cause permanent changes or lengthy construction disruptions to the roadway system, coordination will occur to identify modifications to the transit and roadway system and incorporate planning for these measures into the future City and Caltrans transportation network. Examples of areas to be evaluated would include areas such as reconfiguration of the I-280 on/off ramps at Cesar Chavez Street, or to the approaches to the Bay Bridge, as well as changes to circulation patterns with narrowing of the Embarcadero or incorporation of changes to Terry Francois Blvd, or the bridges over Mission and Islais Creeks.

AMM-TR-9: Coordinate with the City of San Francisco and rail agencies for rail access

For Alternatives where railroad access and related infrastructure are changed substantially, the USACE and the Port will coordinate closely with the City and agencies that utilize railroad tracks throughout the project area. These agencies include, but are not limited to, SFMTA, Caltrain, BART, and Union Pacific Railroad. During the PED phase, design engineers will coordinate with the appropriate transportation agencies and where minor changes can be made to minimize impacts, these will be incorporated into the design. These design changes should aim to increase redundancy in the transportation network for rail, bicycle and pedestrian infrastructure to avoid significant impacts during construction. This coordination will include transit route and operations and maintenance facility access. Operations and maintenance facilities could include railroad access to vehicle storage yards, maintenance-of-way infrastructure, vehicle service and cleaning facilities. The Kirkland Yard and Muni Metro East (MME) facility access are of particular importance to service vehicles and infrastructure. This coordination would also include minor changes to designs to minimize impacts to related transit infrastructure, such as communication systems, electrical supply, and safety systems, among other transportation infrastructure, for existing transit operations.

2.5 Cumulative and Other Impacts

Indirect impacts could occur to neighborhoods beyond the construction areas from changes to transit and transportation systems. Modifications to the Muni system could affect transit users outside the project's area including residents or businesses in North Beach, Chinatown, Financial District, Mission Bay, Hunter's Point and Bayview neighborhoods as an example. Those affected could potentially extend to any neighborhood within San Francisco. Cumulative impacts of other construction projects that could be taking place when constructions starts and cumulative effects to transit or transportation users will be considered as part of the construction and traffic management plans to be prepared for elements of the project as work progresses as described in the mitigation section.

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TRANSPORTATION ATTACHMENT 1 FIGURES AND PARKING FACILITY TABLE

Alternative B 2040

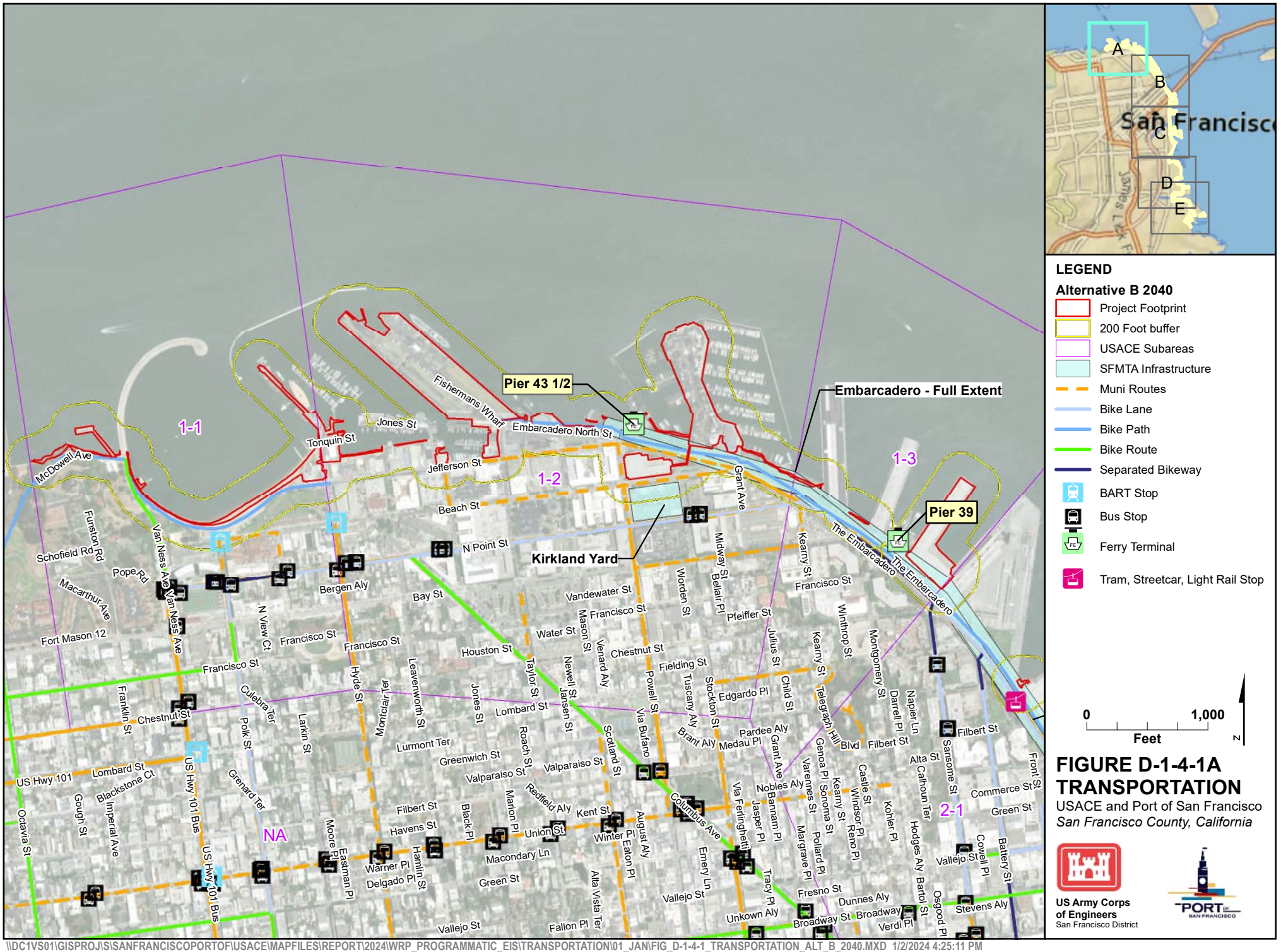


FIGURE D-1-4-1A
TRANSPORTATION

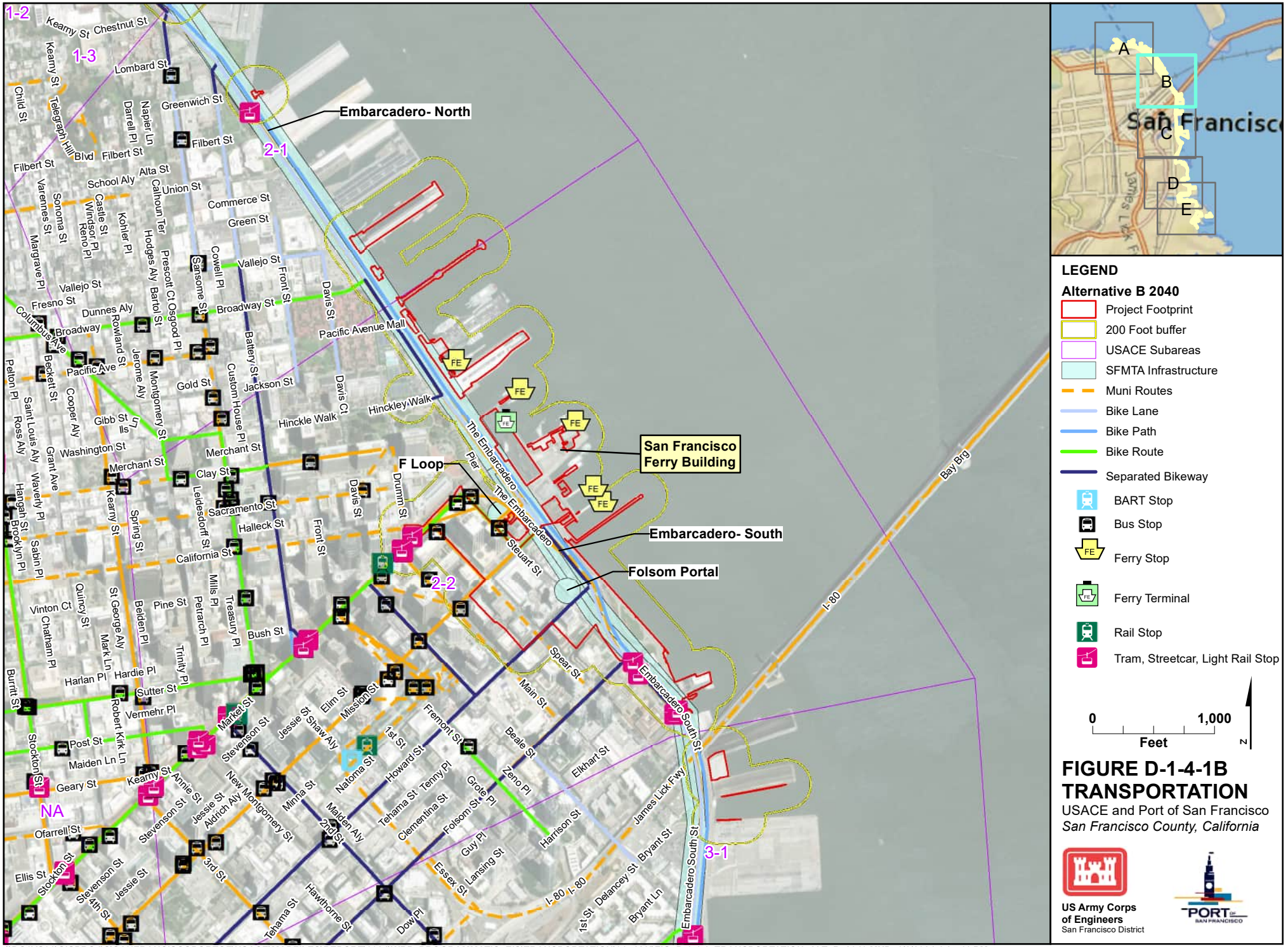
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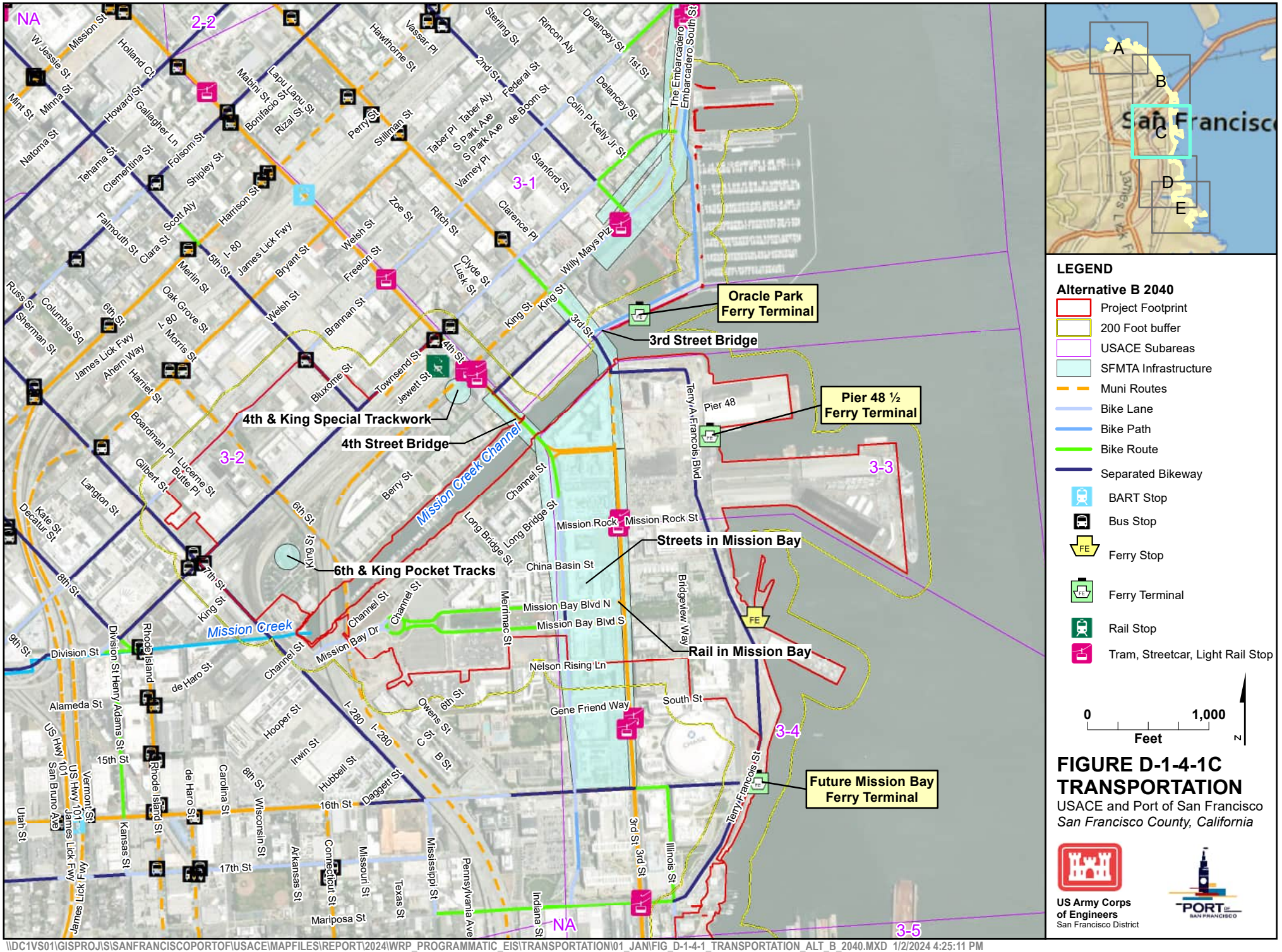


FIGURE D-1-4-1C TRANSPORTATION

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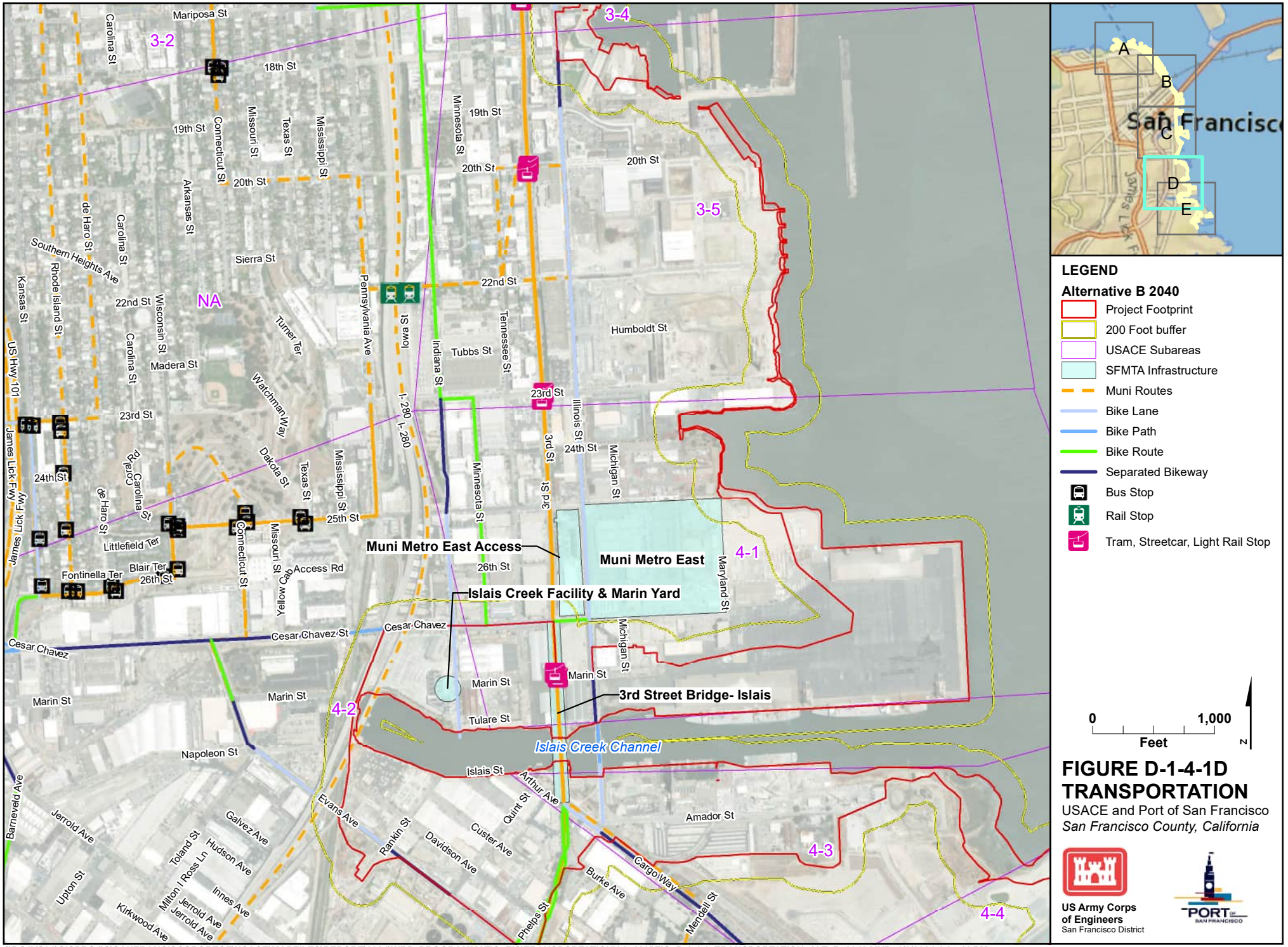


FIGURE D-1-4-1D TRANSPORTATION

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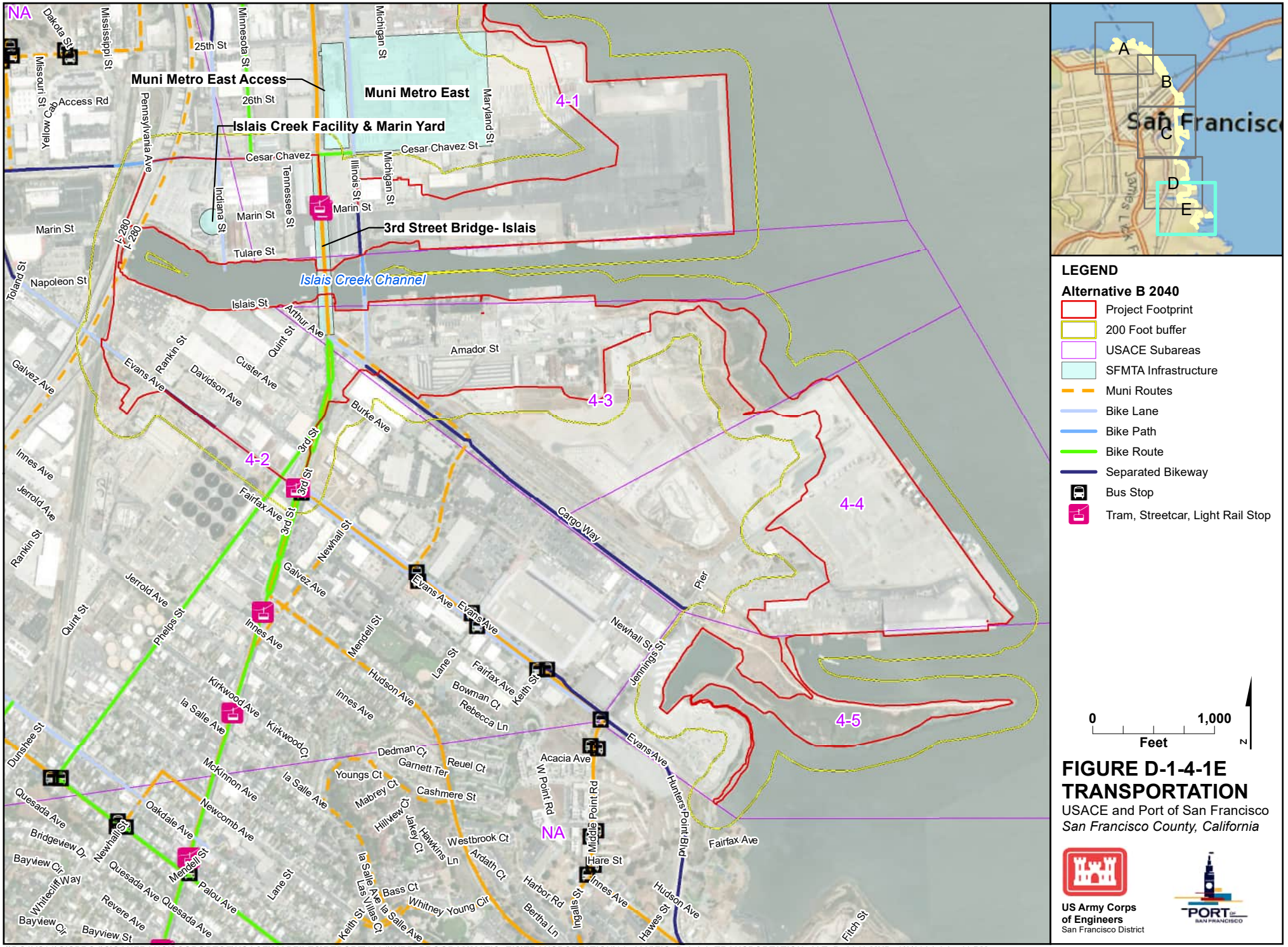


FIGURE D-1-4-1E TRANSPORTATION

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Alternative B 2065

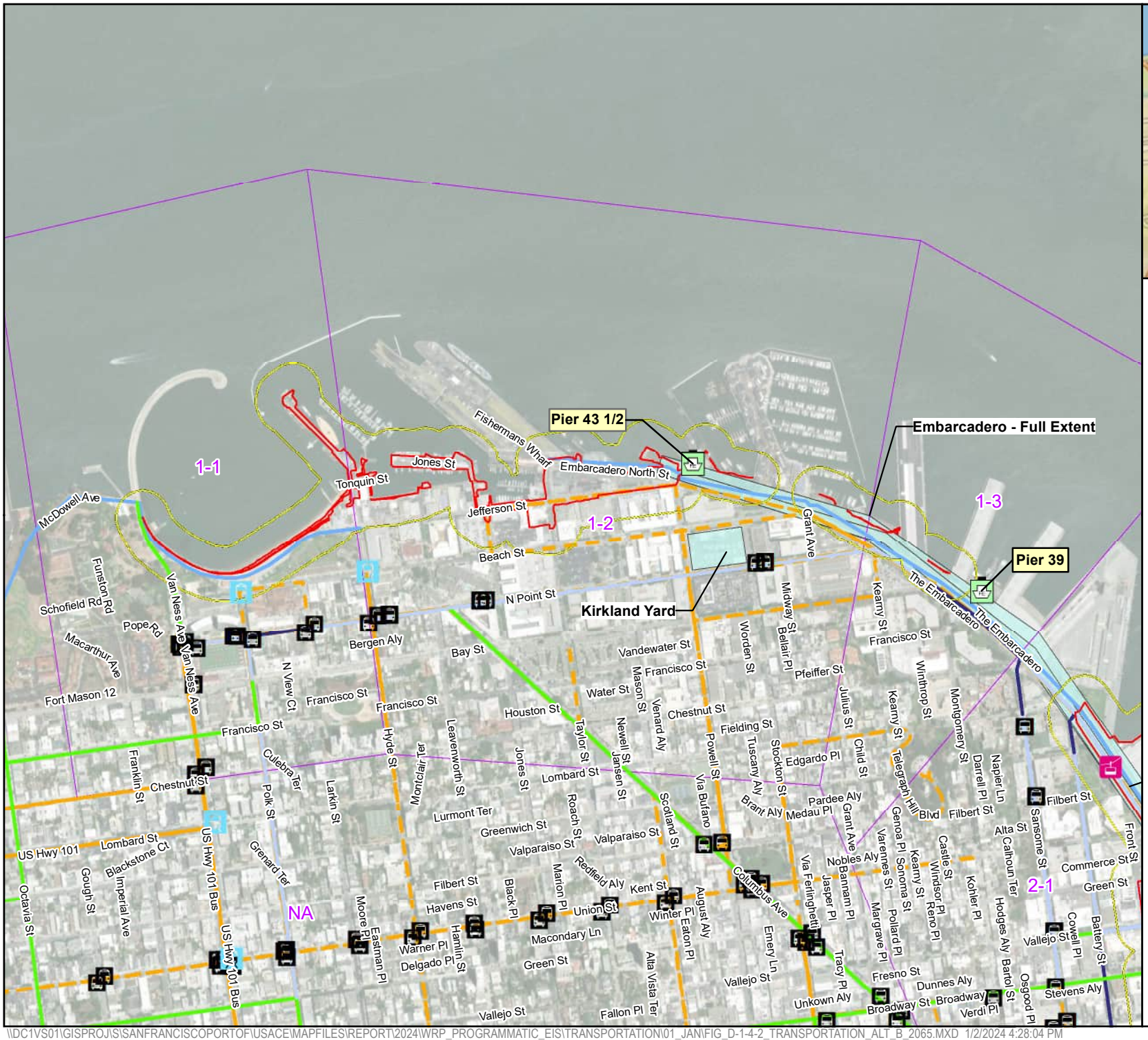


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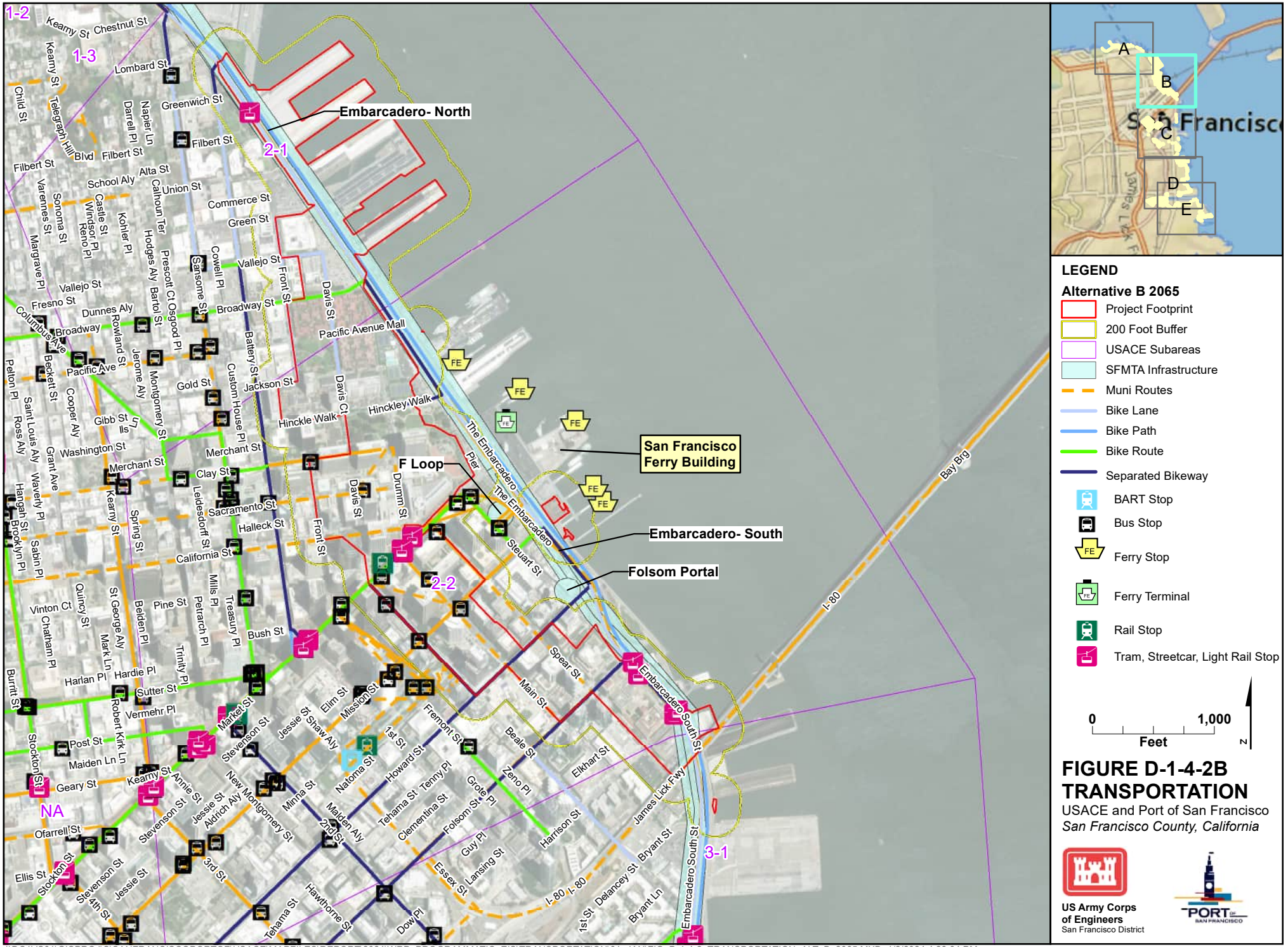
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1-2
1-3
2-1
2-2
3-1
NA
Embarcadero- North
San Francisco Ferry Building
F Loop
Embarcadero- South
Folsom Portal
Kearny St
Chestnut St
Lombard St
Greenwich St
Filbert St
Union St
Green St
Vallejo St
Broadway St
Pacific Avenue Mall
Jackson St
Hinckley Walk
Merchant St
Clay St
Sacramento St
California St
Pine St
Bush St
Sutter St
Post St
Geary St
Ofarrell St
Ellis St
Market St
Mission St
Howard St
Folsom St
Harrison St
Bryant St
Main St
Spear St
Beale St
Fremont St
1st St
2nd St
3rd St
4th St
Stockton St
Powell St
Jones St
Taylor St
Hyde St
Leavenworth St
Jackson Sq
Telegraph Hill Blvd
Pacific Ave
Washington St
Broadway
Columbus Ave
Battery St
Front St
Davis St
Drumm St
The Embarcadero
Pier
Steuart St
Embarcadero South St
James Lick Fwy
I-80
Bay Brg
Maiden Ln
Minna St
Natoma St
Tehama St
Clementina St
Tenny Pl
Grove Pl
Folsom St Pl
Zeno Pl
Elkhart St
Delancey St
Bryant Ln
Lansing St
Guy Pl
Essex St
Hawthorne St
Dow Pl
Aldrich Alley
New Montgomery St
Jessie St
Annie St
Jessie St Shaw Alley
Elim St
Natoma St
Trinity Pl
Harlan Pl
Hardie Pl
Vermehr Pl
Robert Kirk Ln
Maiden Ln Ln
Mark Ln
St George Alley
Belden Pl
Quincy St
Vinton Ct
Chatham Pl
Burritt St
Brooklyn Pl
Sabin Pl
Hangah St
Waverly Pl
Grant Ave
Ross Alley
Saint Louis Alley
Pelton Pl
Beckett St
Cooper Alley
Gibb St
Ills
Gold St
Custom House Pl
Jerome Alley
Montgomery St
Rowland St
Dunnes Alley
Fresno St
Columbus Ave
Broadway
Vallejo St
Margrave Pl
Varennes St
Sonoma St
Windsor Pl
Castle St
Reno Pl
Kohler Pl
Hodges Alley
Calhoun Ter
Prescott Ct
Osgood Pl
Bartol St
Sansome St
Cowell Pl
Commerce St
School Alley
Alta St
Darrell Pl
Napier Ln
Child St
Filbert St
Kearny St
Telegraph Hill Blvd
Filbert St
Leidesdorff St
Halleck St
Spring St
Mills Pl
Petrarch Pl
Treasury Pl
Davis Ct
Hinckle Walk
Davis St
Front St
Battery St
Custom House Pl
Jackson St
Gold St
Montgomery St
Jerome Alley
Rowland St
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Pacific Ave
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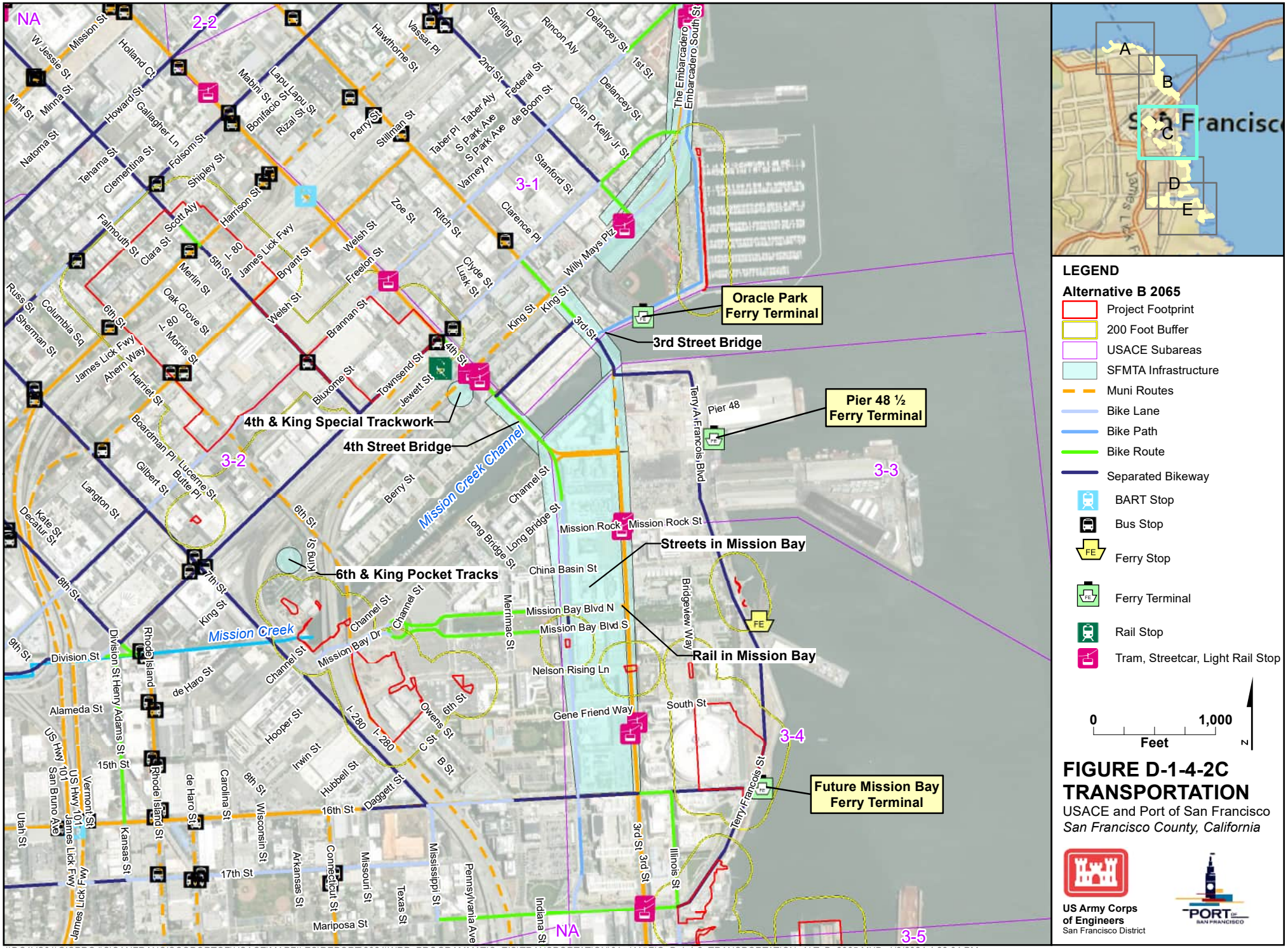


FIGURE D-1-4-2C TRANSPORTATION

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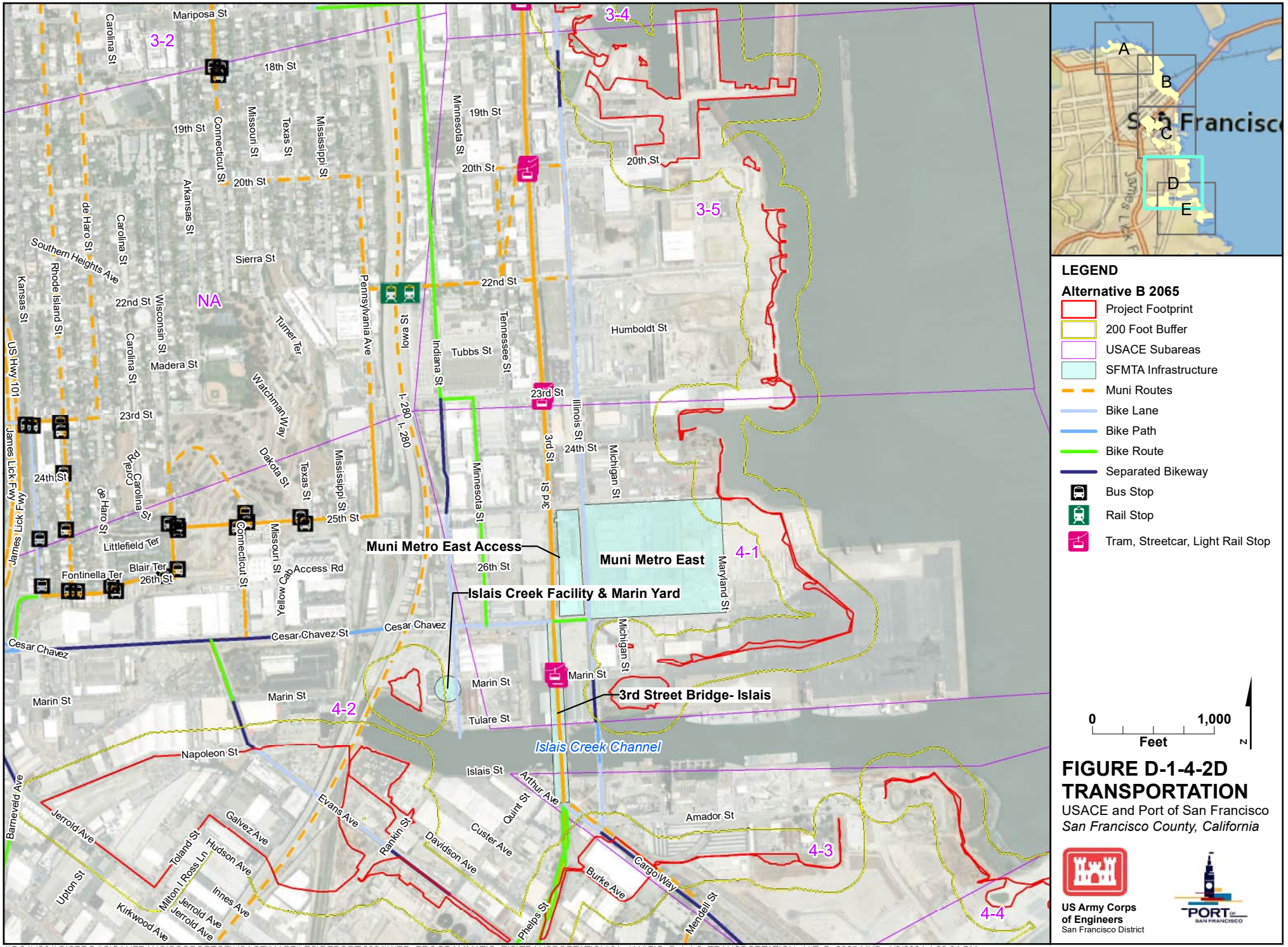


FIGURE D-1-4-2D TRANSPORTATION

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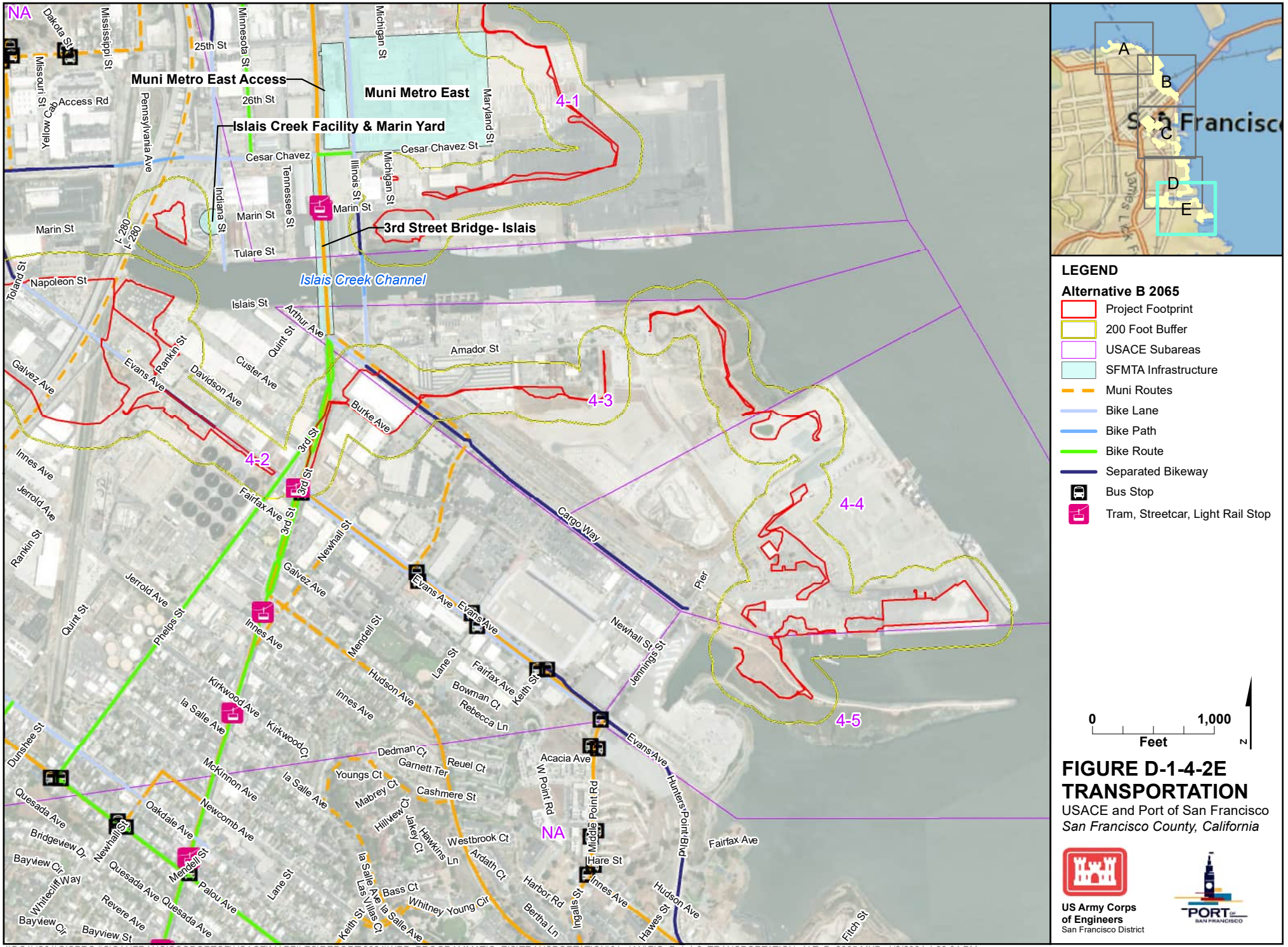


FIGURE D-1-4-2E
TRANSPORTATION

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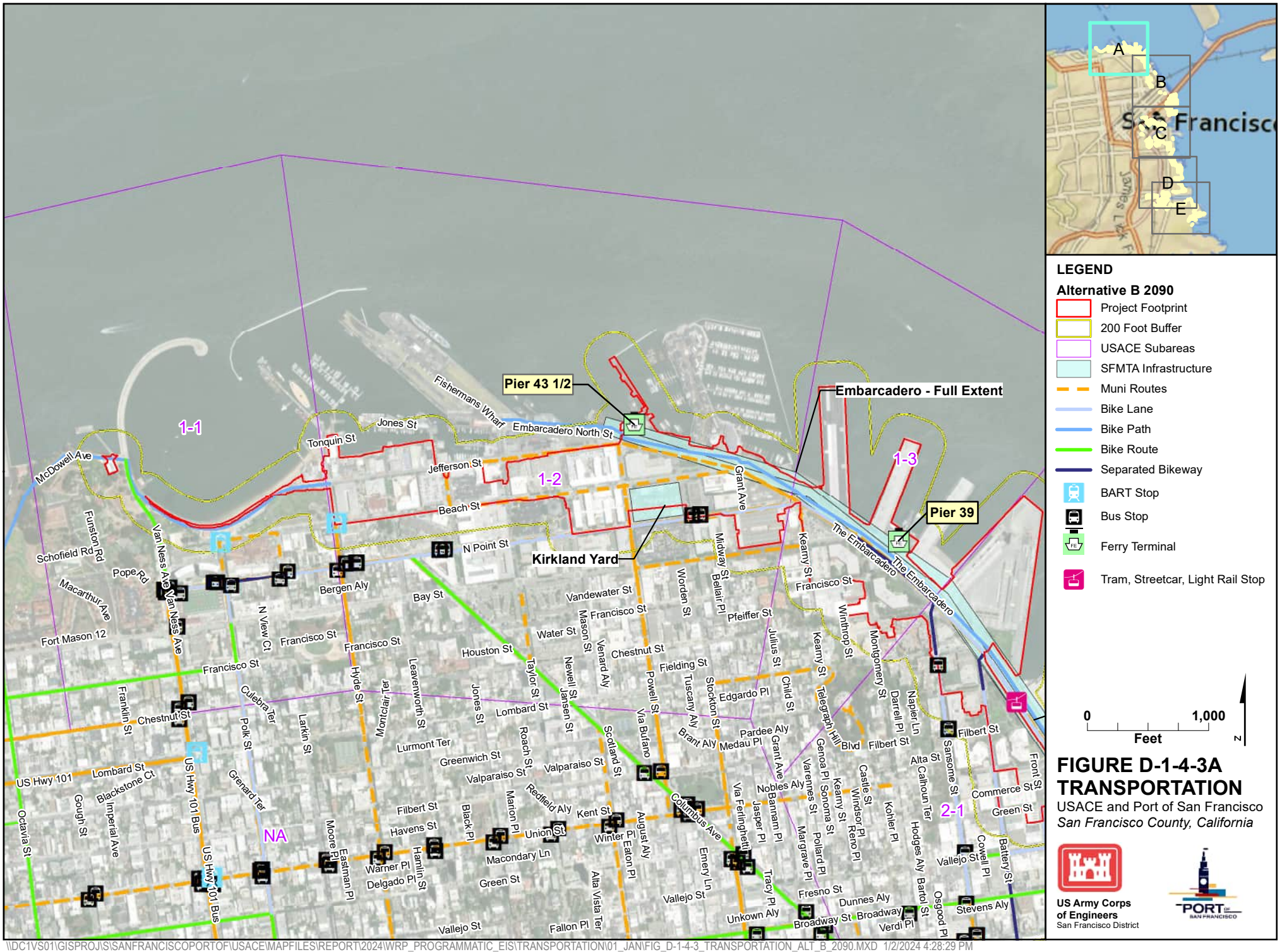
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Alternative B 2090


Pier 43 1/2
Embarcadero - Full Extent
Kirkland Yard
Pier 39
1-1
1-2
1-3
2-1
NA
Fishermans Wharf
Jones St
Tonquin St
Embarcadero North St
Jefferson St
Beach St
N Point St
Grant Ave
The Embarcadero
McDowell Ave
Schofield Rd
Funston Rd
Pope Rd
Macarthur Ave
Fort Mason 12
Van Ness Ave
Bergen Aly
Bay St
Vandewater St
Francisco St
Water St
Houston St
Chestnut St
Fielding St
Pfeiffer St
Worden St
Midway St
Bellair Pl
Mason St
Venard Aly
Taylor St
Newell St
Jansen St
Powell St
Tuscany Aly
Stockton St
Edgardo Pl
Julius St
Child St
Kearny St
Telegraph Hill Blvd
Montgomery St
Winthrop St
Darrell Pl
Napier Ln
Filbert St
Alta St
Calhoun Ter
Sansome St
Commerce St
Front St
Green St
Franklin St
Culebra Ter
Polk St
Larkin St
Hyde St
Montclair Ter
Leavenworth St
Jones St
Lombard St
Roach St
Scotland St
Via Bufano
Brant Aly
Medau Pl
Pardee Aly
Grant Ave
Nobles Aly
Varennes St
Genoa Pl
Sonoma St
Castle St
Windsor Pl
Reno Pl
Kohler Pl
Hodges Aly
Bartol St
Osgood Pl
Stevens Aly
Cowell Pl
Battery St
Vallejo St
Lurmont Ter
Greenwich St
Valparaiso St
Redfield Aly
Kent St
Columbus Ave
Via Ferlinghetti
Jasper Pl
Margrave Pl
Pollard Pl
Fresno St
Dunnes Aly
Broadway St
Unkown Aly
Verdi Pl
Tracy Pl
Emery Ln
Eaton Pl
August Aly
Winter Pl
Union St
Macondary Ln
Green St
Vallejo St
Fallon Pl
Alta Vista Ter
Filbert St
Havens St
Black Pl
Marion Pl
Warner Pl
Hamlin St
Delgado Pl
Moore Pl
Eastman Pl
Grenard Ter
US Hwy 101
US Hwy 101 Bus
Lombard St
Blackstone Ct
Gough St
Imperial Ave
Octavia St
Chestnut St
Francisco St
Van Ness Ave
N View Ct
Bay St
Francisco St
Water St
Vandewater St
Francisco St
Pfeiffer St
Francisco St
The Embarcadero
Kearny St
Montgomery St
Filbert St
Green St
Vallejo St
Broadway
Broadway St
Fresno St
Unkown Aly
Verdi Pl
Stevens Aly
Osgood Pl
Bartol St
Hodges Aly
Kohler Pl
Windsor Pl
Reno Pl
Castle St
Varennes St
Genoa Pl
Sonoma St
Kearny St
Margrave Pl
Pollard Pl
Nobles Aly
Grant Ave
Via Ferlinghetti
Columbus Ave
Jasper

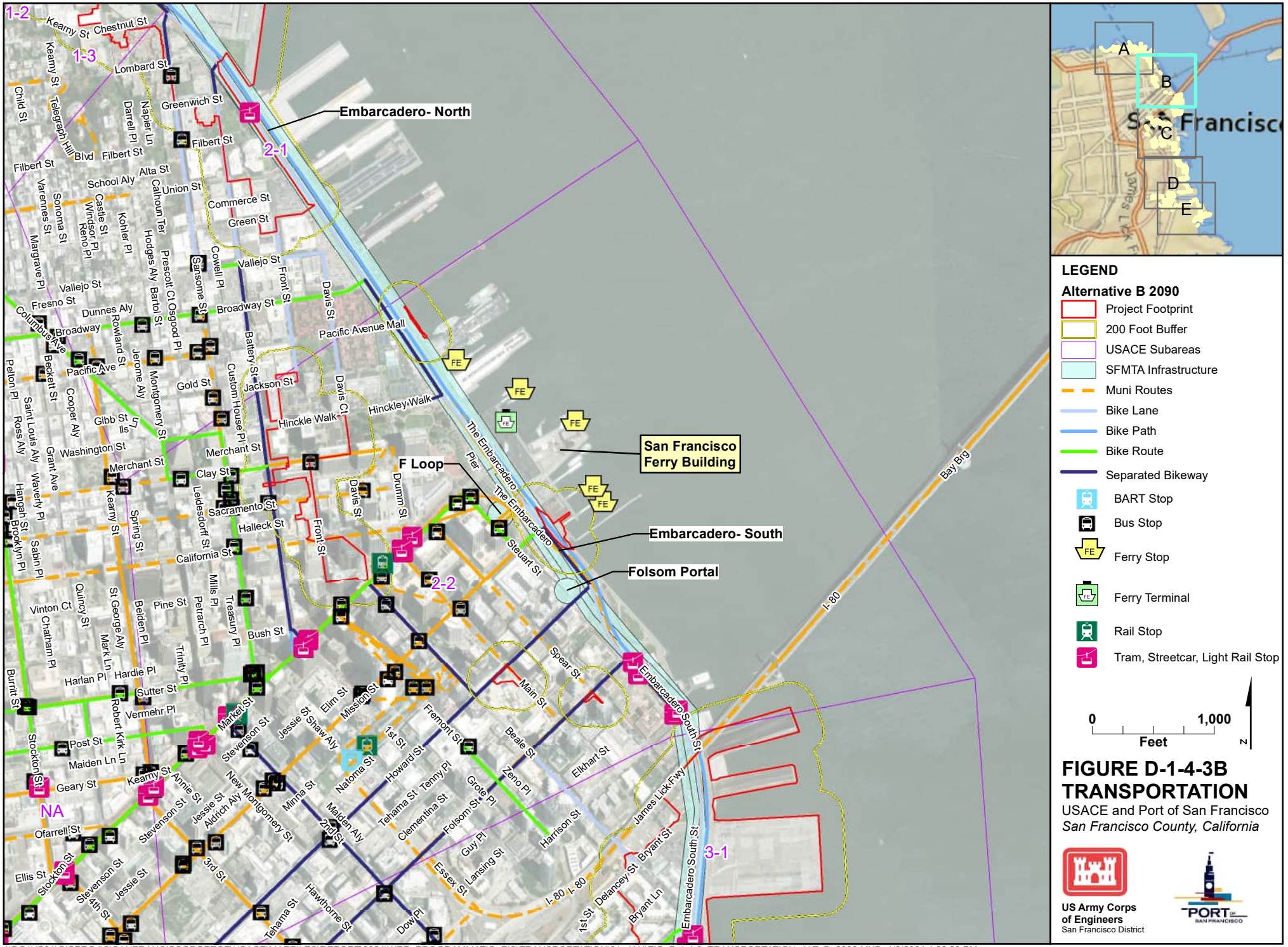


FIGURE D-1-4-3B
TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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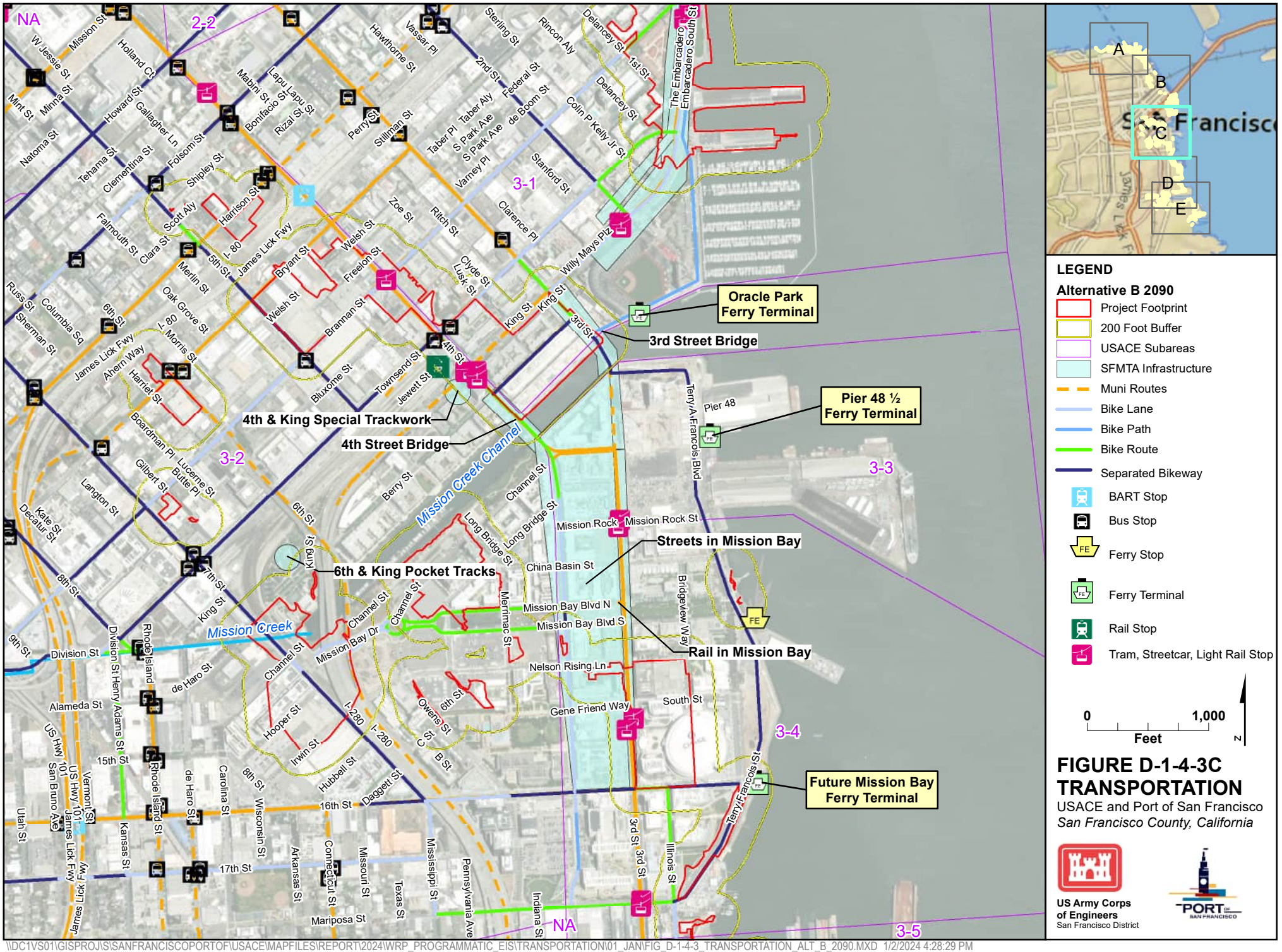


FIGURE D-1-4-3C
TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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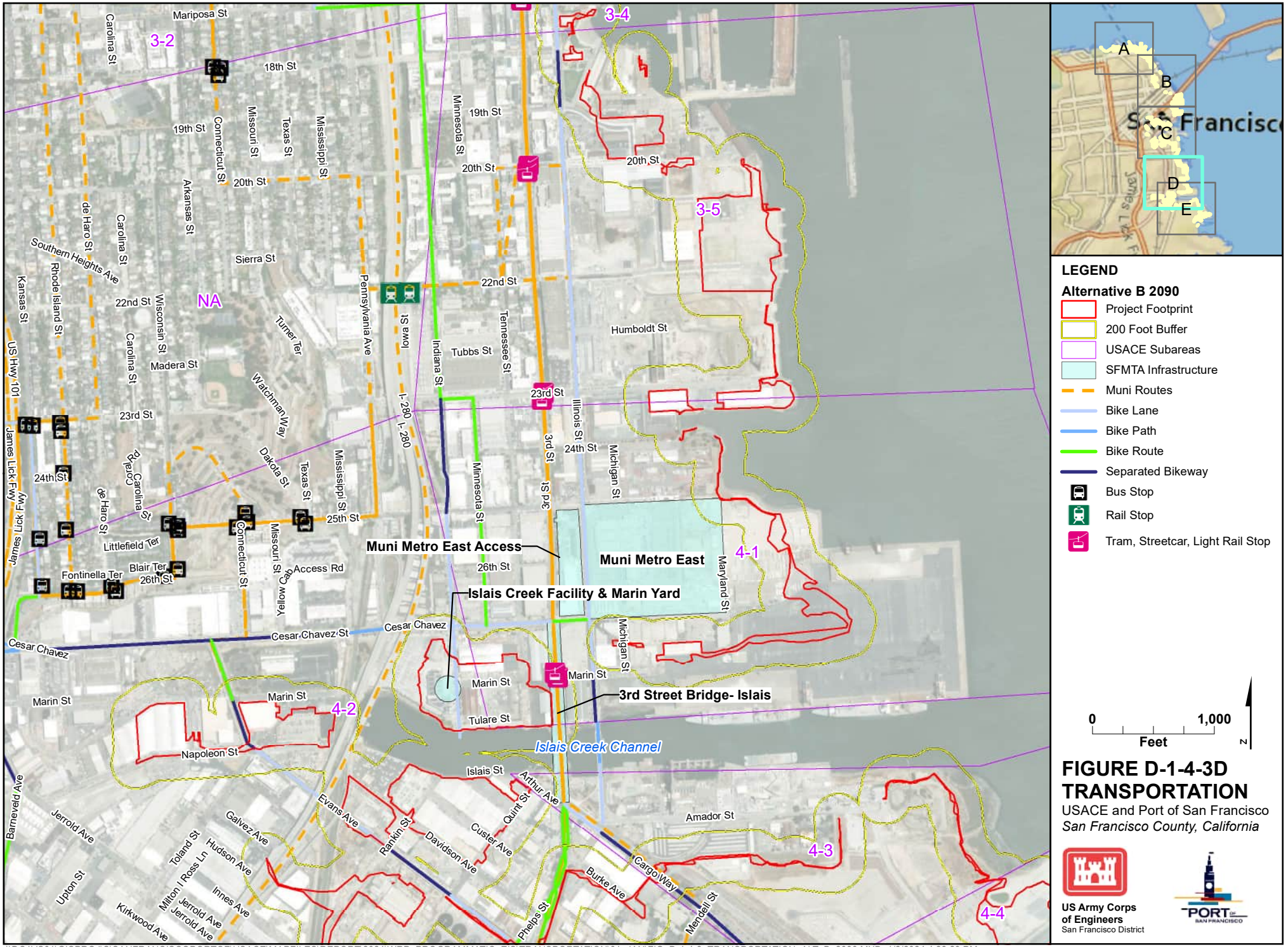


FIGURE D-1-4-3D TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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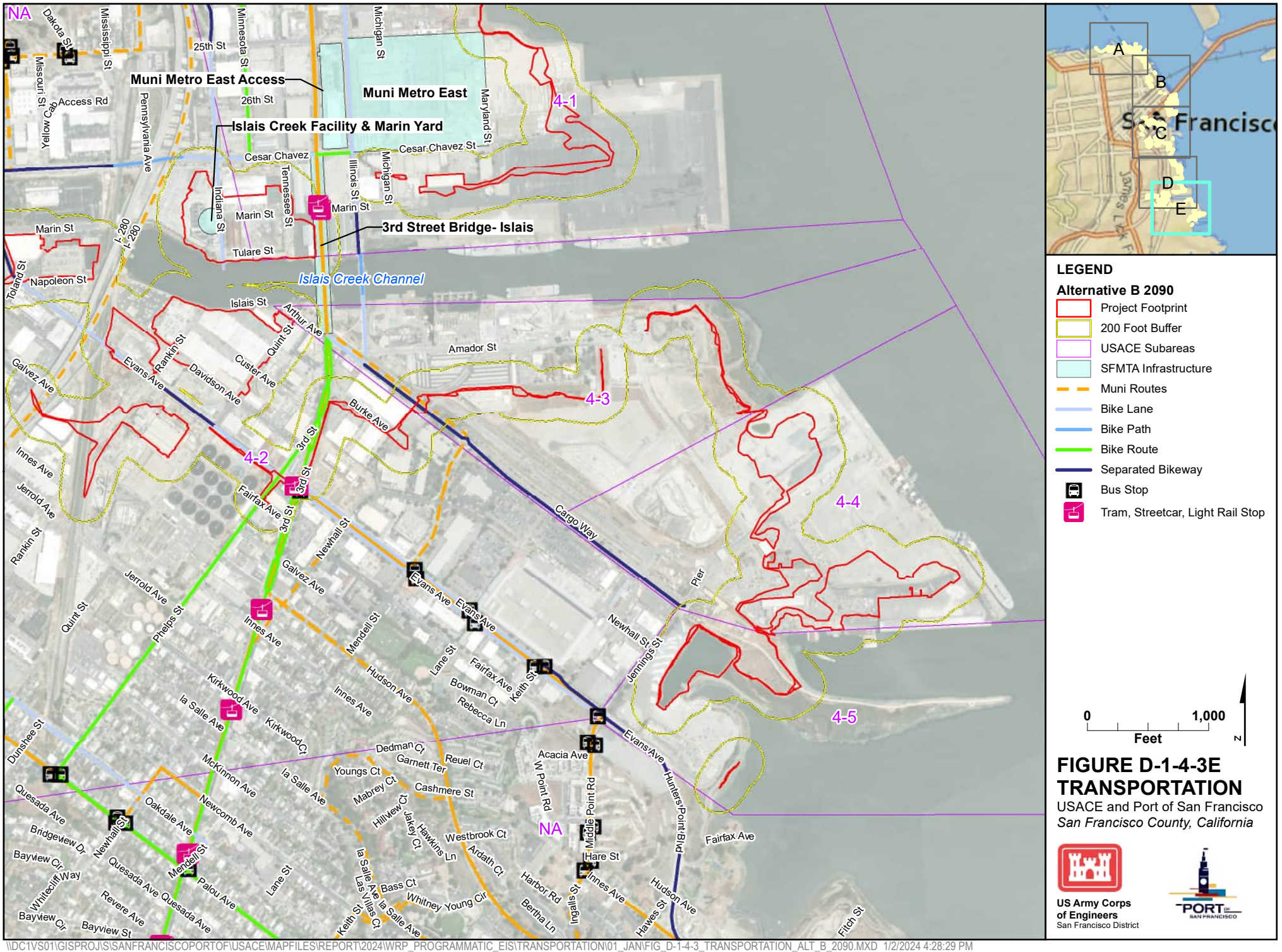


FIGURE D-1-4-3E
TRANSPORTATION

USACE and Port of San Francisco

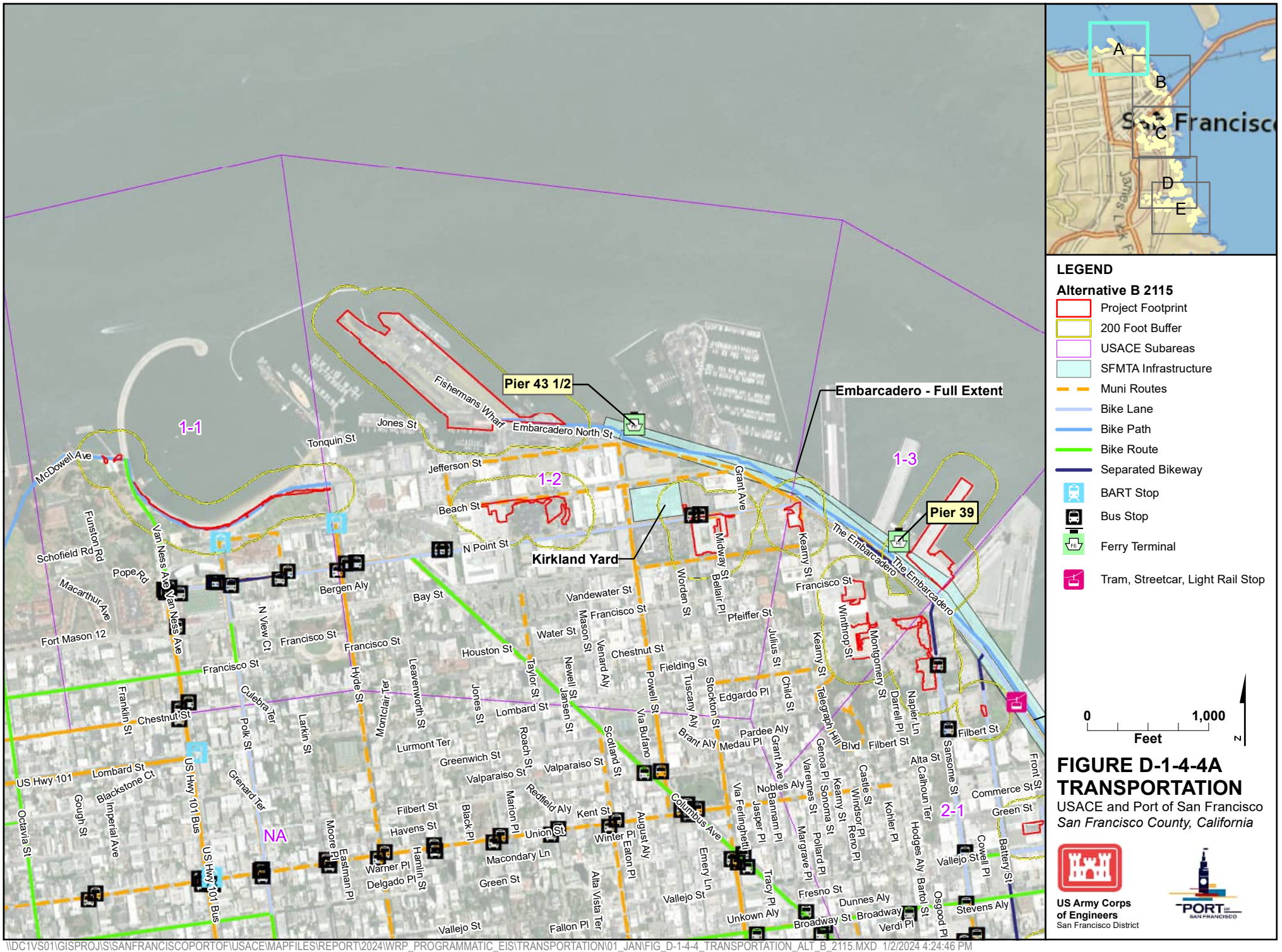
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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Alternative B 2115


A
B
C
D
E
Pier 43 1/2
Embarcadero - Full Extent
Pier 39
Kirkland Yard
1-1
1-2
1-3
2-1
NA
Fishermans Wharf
Jones St
Tonquin St
McDowell Ave
Jefferson St
Beach St
N Point St
Embarcadero North St
Grant Ave
The Embarcadero
Kearny St
Francisco St
Bay St
Vandewater St
Water St
Chestnut St
Fielding St
Pfeiffer St
Houston St
Lombard St
Greenwich St
Lurmont Ter
Valparaiso St
Filbert St
Green St
Vallejo St
Broadway St
Fresno St
Dunnes Aly
Unkown Aly
Fallon Pl
Stevens Aly
Schofield Rd
Pope Rd
Macarthur Ave
Fort Mason 12
Van Ness Ave
Funston Rd
Bergen Aly
N View Ct
Hyde St
Leavenworth St
Jones St
Taylor St
Newell St
Jansen St
Mason St
Venard Aly
Worden St
Midway St
Bellair Pl
Julius St
Child St
Powell St
Tuscany Aly
Stockton St
Edgardo Pl
Via Bufano
Scotland St
Roach St
Redfield Aly
Marion Pl
Black Pl
Union St
Kent St
Winter Pl
August Aly
Eaton Pl
Columbus Ave
Via Ferlinghetti
Jasper Pl
Emery Ln
Macondary Ln
Warner Pl
Delgado Pl
Hamlin St
Moore Pl
Eastman Pl
Alta Vista Ter
Tracy Pl
Brant Aly
Medau Pl
Pardee Aly
Grant Ave
Nobles Aly
Varennes St
Genoa Pl
Sonoma St
Margrave Pl
Pollard Pl
Kearny St
Windsor Pl
Reno Pl
Castle St
Kohler Pl
Hodges Aly
Bartol St
Osgood Pl
Verdi Pl
Broadway
Telegraph Hill Blvd
Montgomery St
Winthrop St
Darrell Pl
Napier Ln
Alta St
Calhoun Ter
Sansome St
Filbert St
Commerce St
Front St
Green St
Vallejo St
Cowell Pl
Battery St
Franklin St
Chestnut St
Culebra Ter
Polk St
Larkin St
Montclair Ter
Lombard St
Blackstone Ct
US Hwy 101
US Hwy 101 Bus
Grenard Ter
Gough St
Imperial Ave
Octavia St
Havens St
Francisco St
Mason St
Water St
Vandewater St
Bay St
Chestnut St
Fielding St
Pfeiffer St
Houston St
Lombard St
Greenwich St
Lurmont Ter
Valparaiso St
Filbert St
Green St
Vallejo St
Broadway St
Fresno St
Dunnes Aly
Unkown Aly
Fallon Pl
Stevens Aly
Francisco St
Kearny St
Montgomery St
Winthrop St
Darrell Pl
Napier Ln
Alta St
Calhoun Ter
Sansome St
Filbert St
Commerce St
Front St
Green St
Vallejo St
Cowell Pl
Battery St
Broadway
Telegraph Hill Blvd
Grant Ave
Nobles Aly
Varennes St
Genoa Pl
Sonoma St
Margrave Pl
Pollard Pl
Kearny St
Windsor Pl
Reno Pl
Castle St
Kohler Pl
Hodges Aly
Bartol St
Osgood Pl
Verdi Pl
Brant Aly
Medau Pl
Pardee Aly
Via Ferlinghetti
Jasper Pl
Emery Ln
Macondary Ln
Warner Pl
Delgado Pl
Hamlin St
Moore Pl
Eastman Pl
Alta Vista Ter
Tracy Pl
Scotland St
Roach St
Redfield Aly
Marion Pl
Black Pl
Union St
Kent St
Winter Pl
August Aly
Eaton Pl
Columbus Ave
Via Bufano
Powell St
Tuscany Aly
Stockton St
Edgardo Pl
Child St
Julius St
Worden St
Midway St
Bellair Pl
Grant Ave
Kearny St
The Embarcadero
Francisco St
Bay St
Vandewater St
Water

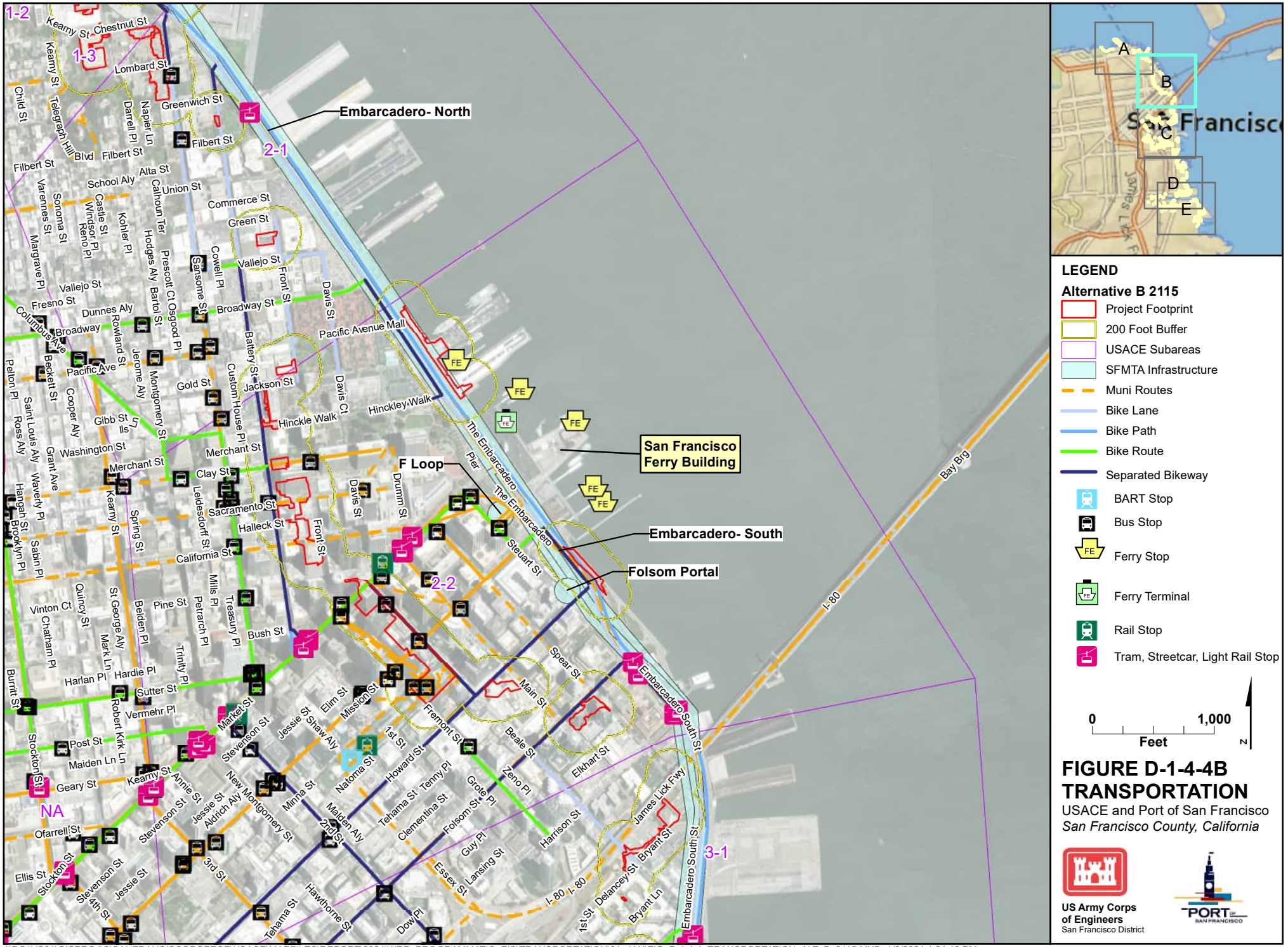


FIGURE D-1-4-4B
TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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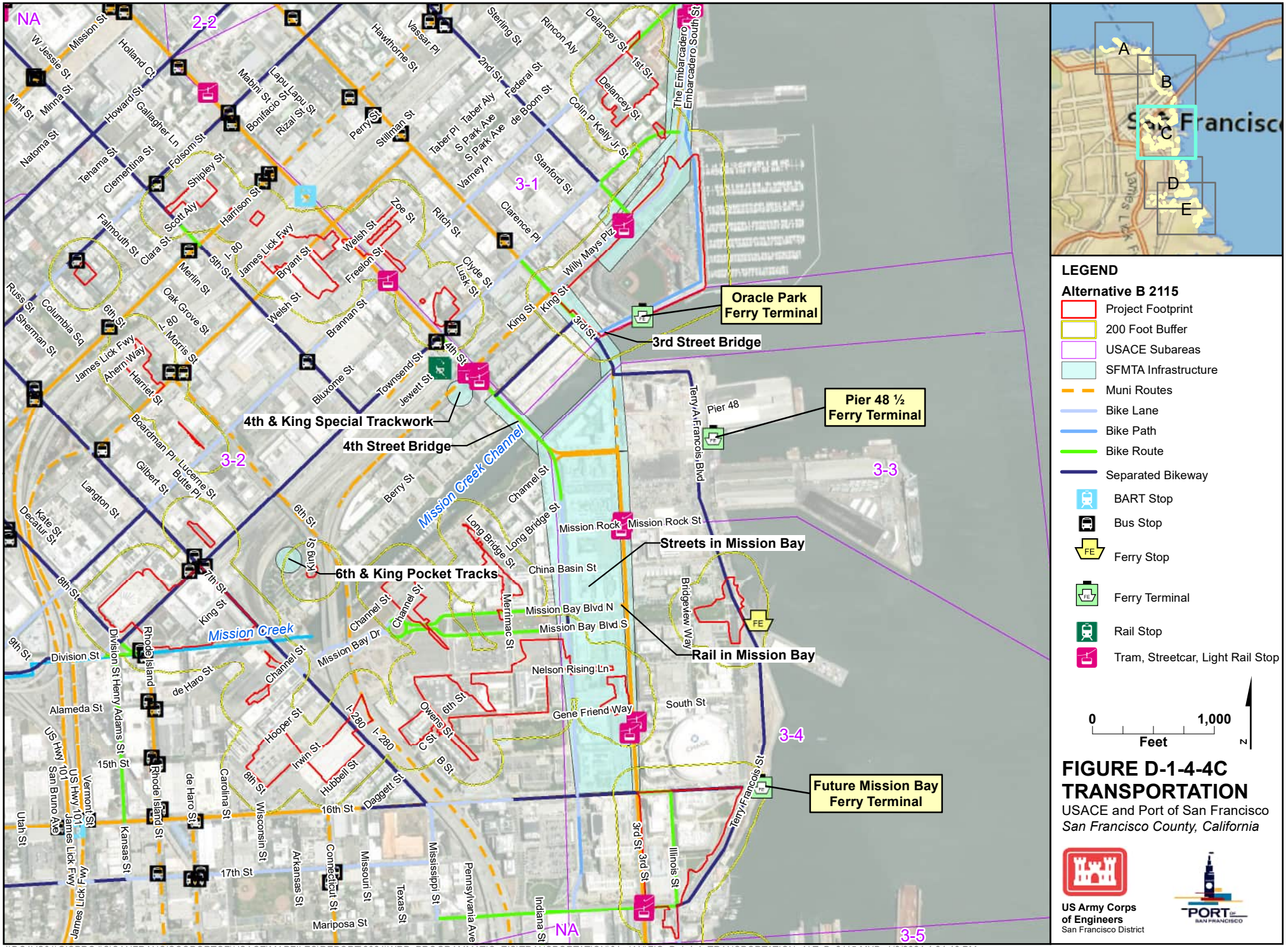


FIGURE D-1-4-4C TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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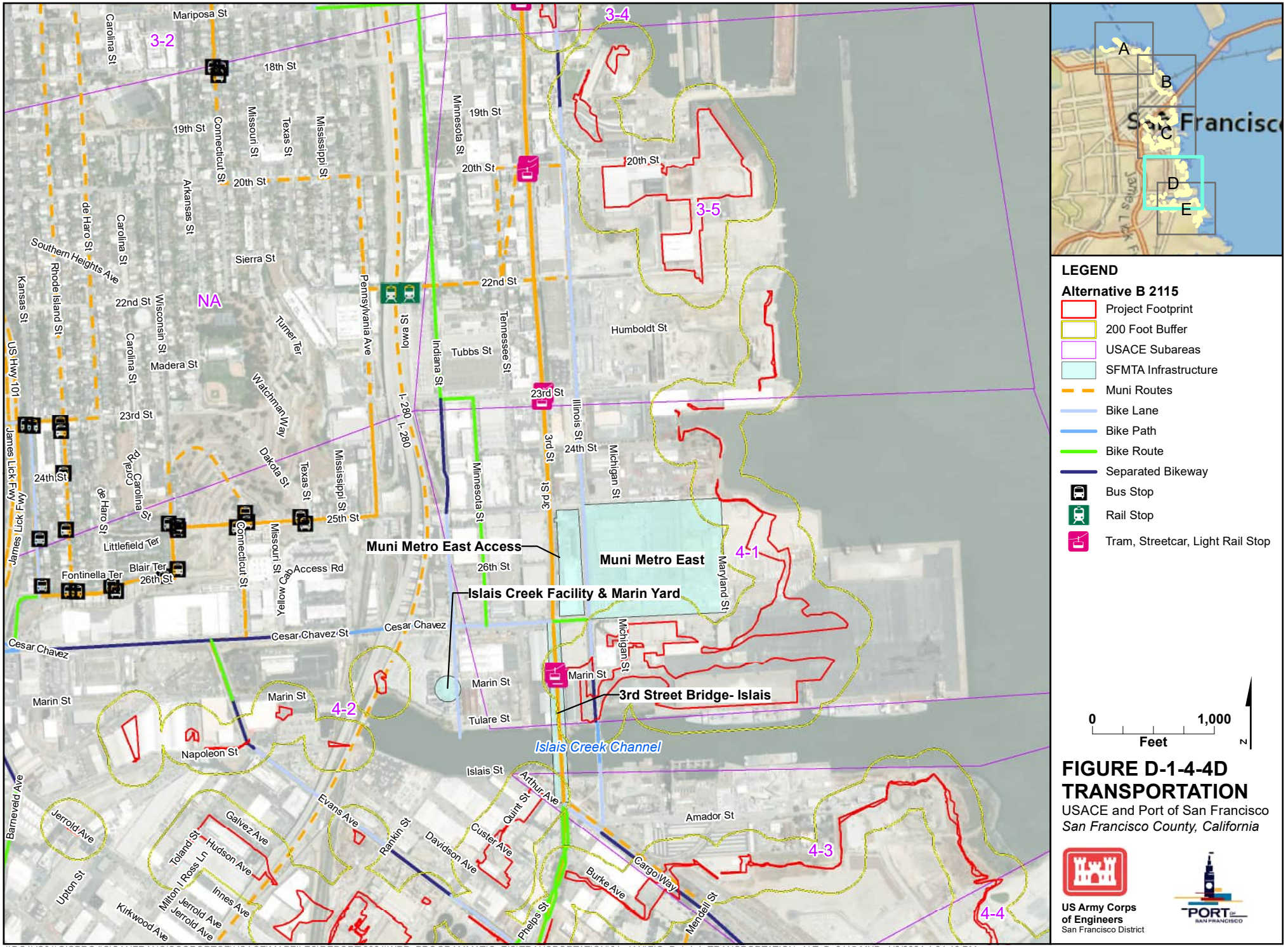


FIGURE D-1-4-4D TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

\\DC1VS01\GISPROJ\S\SANFRANCISCOPORTOF\USACE\MAPFILES\REPORT\2024\WRP_PROGRAMMATIC_EIS\TRANSPORTATION\01_JAN\FIG_D-1-4-4_TRANSPORTATION_ALT_B_2115.MXD 1/2/2024 4:24:46 PM

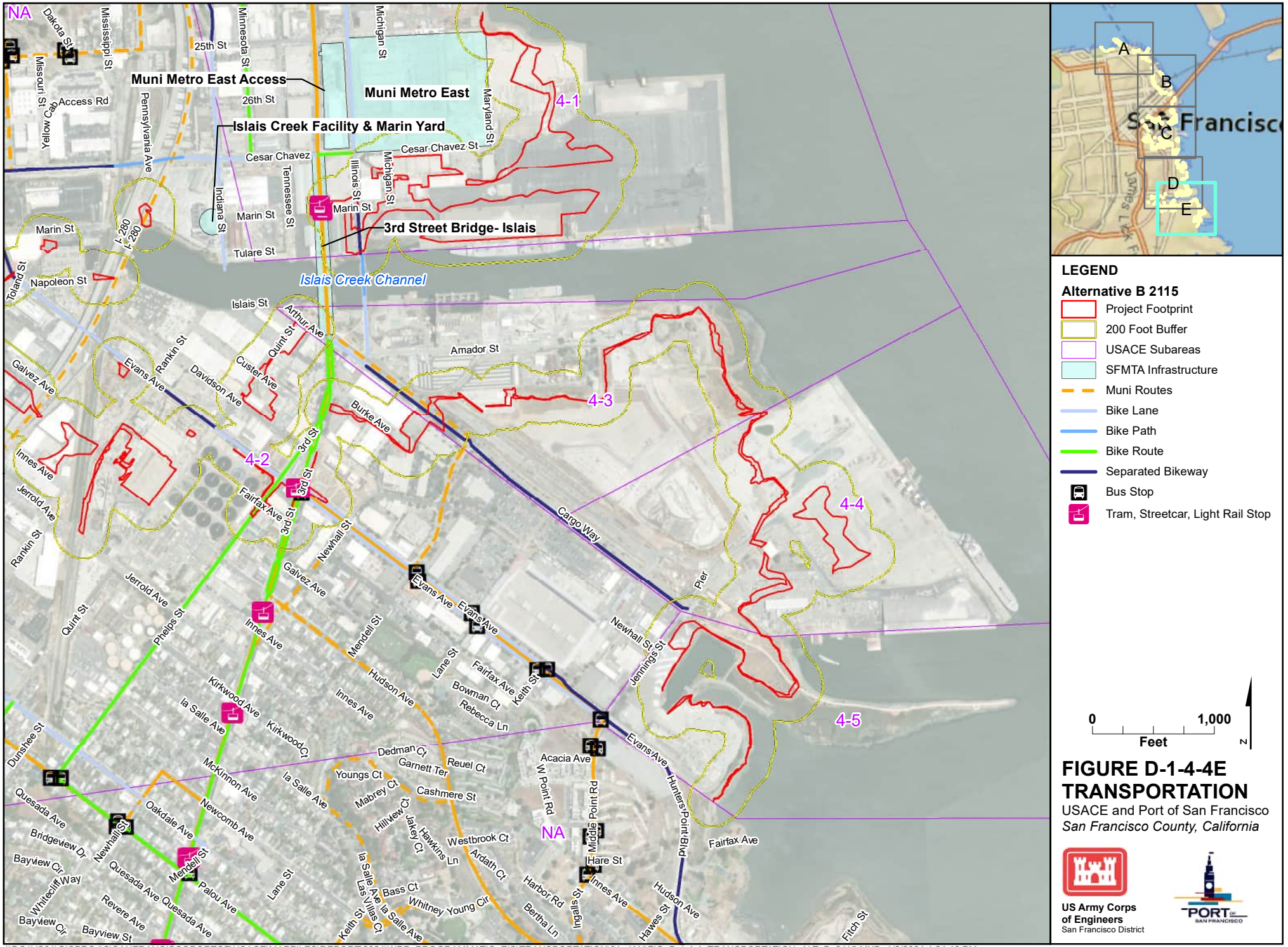


FIGURE D-1-4-4E
TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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TNBP 1st Action

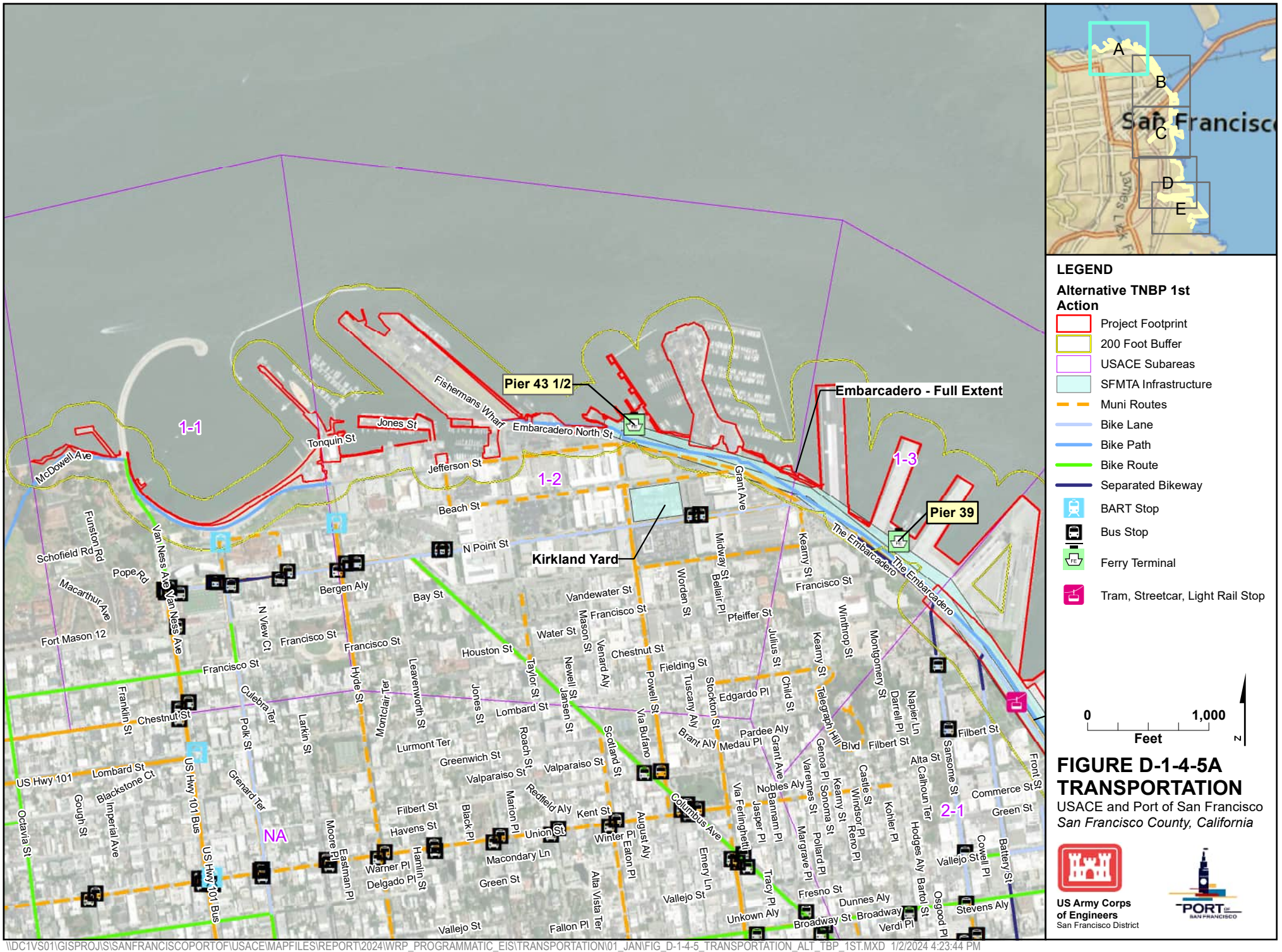


FIGURE D-1-4-5A TRANSPORTATION

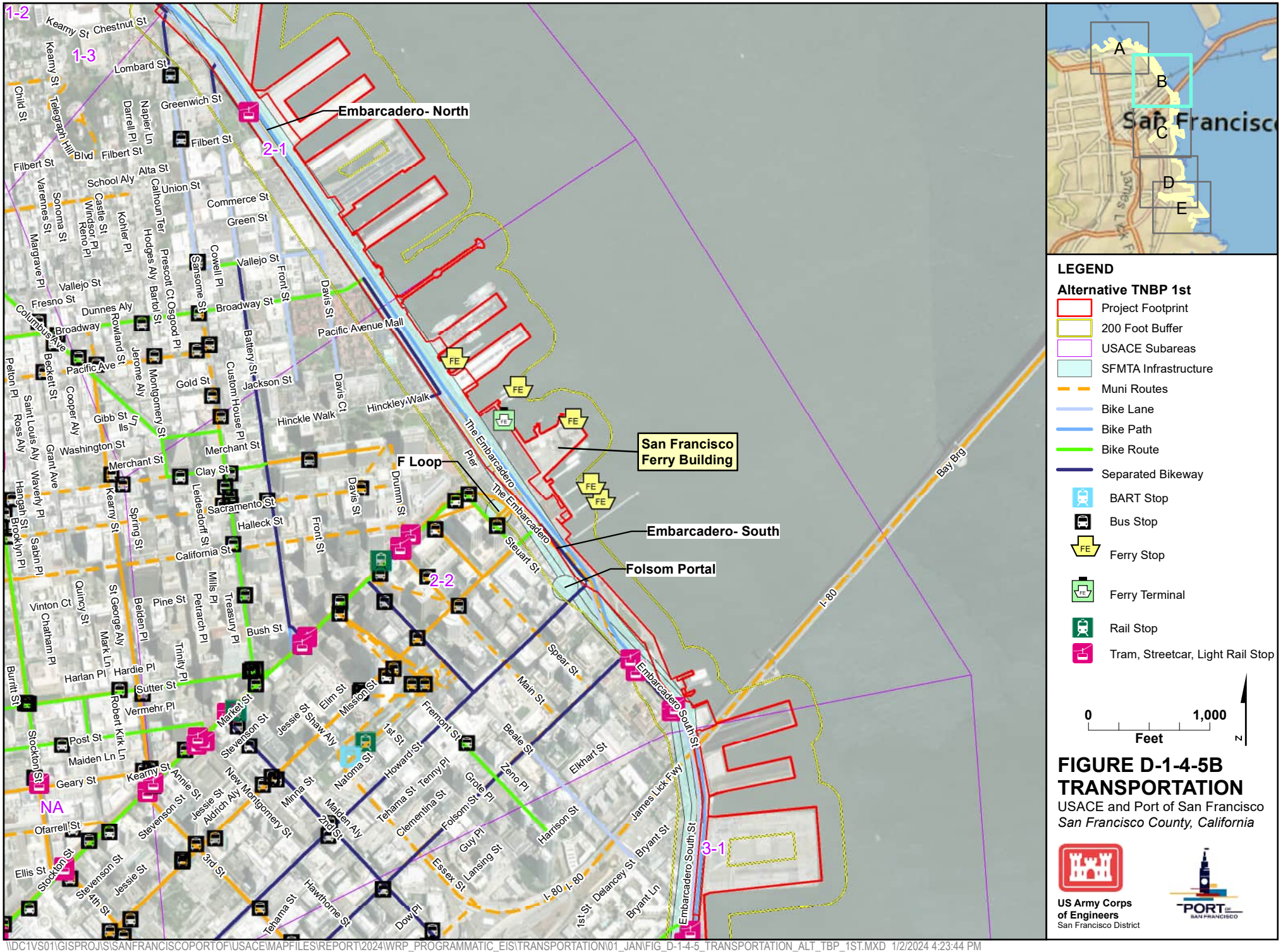
USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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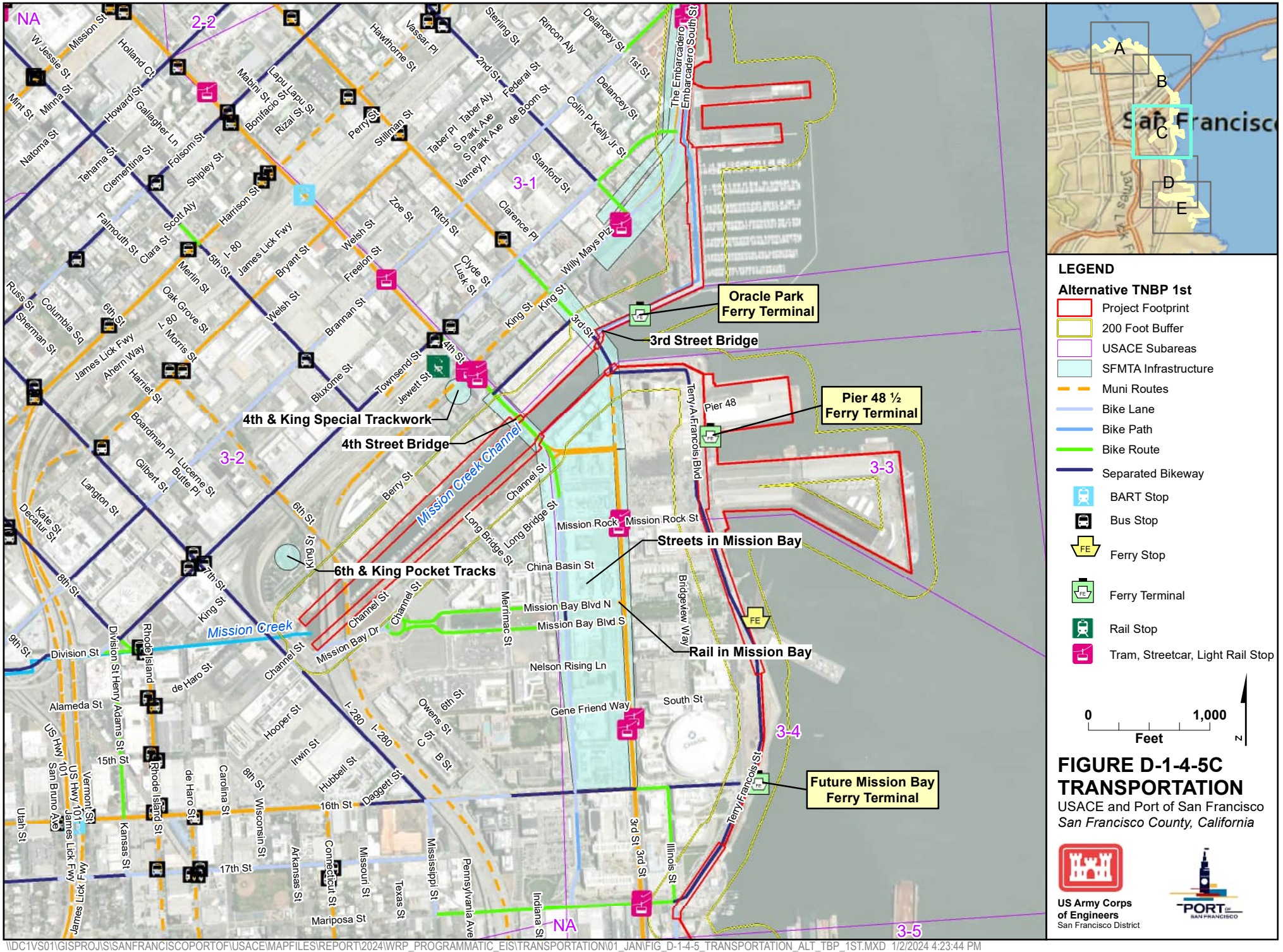


FIGURE D-1-4-5C TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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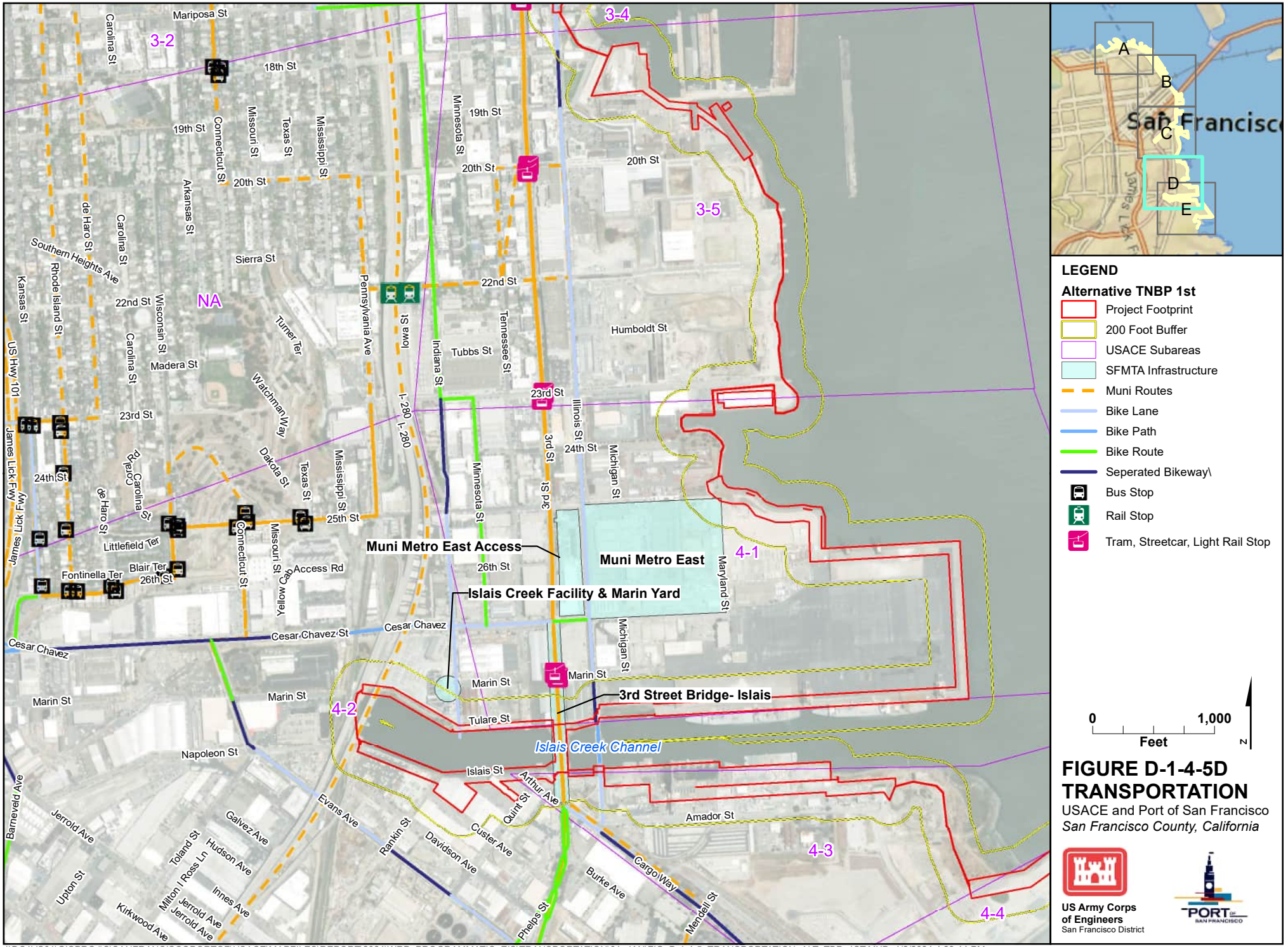


FIGURE D-1-4-5D TRANSPORTATION

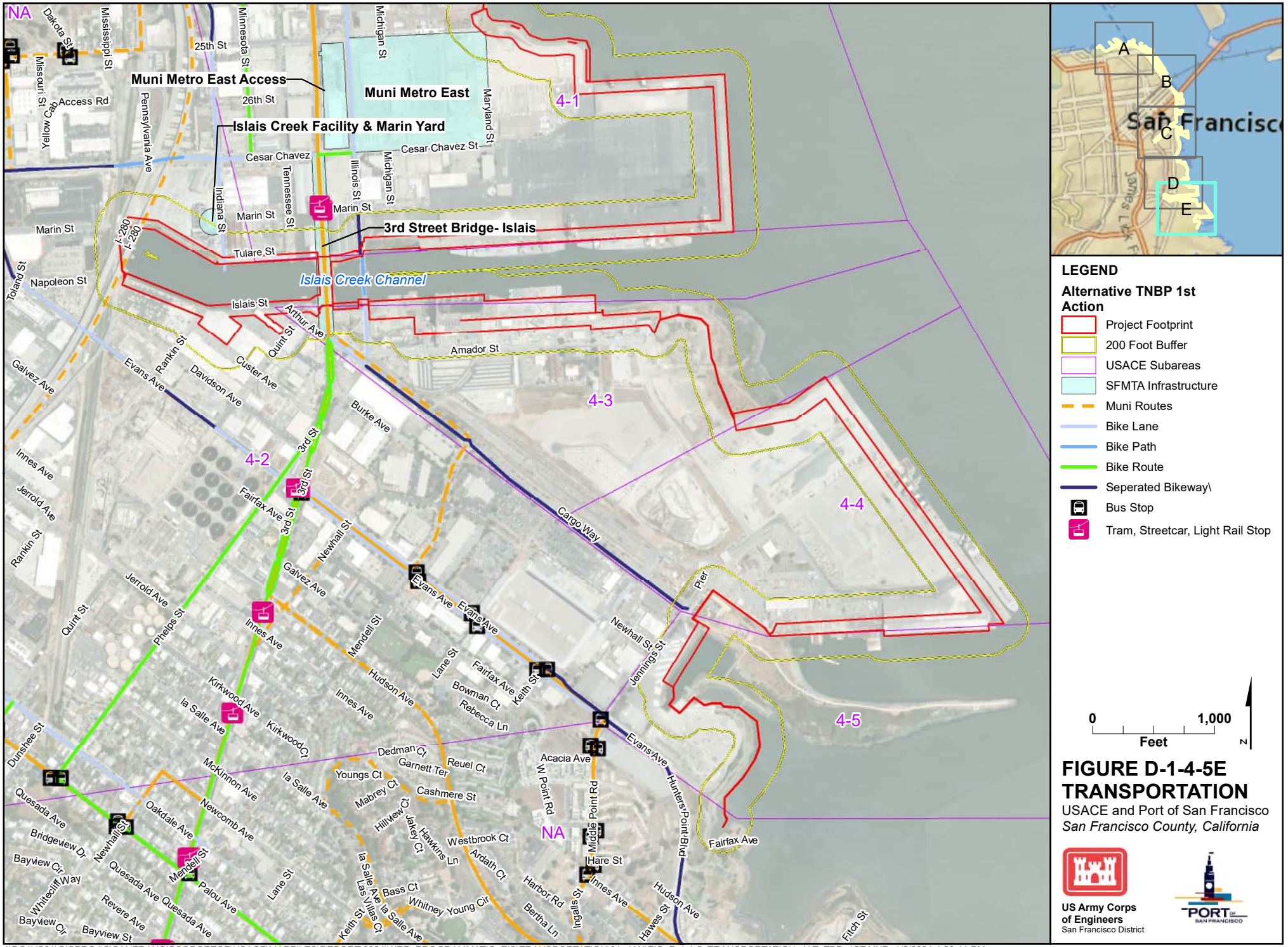
USACE and Port of San Francisco

San Francisco County, California

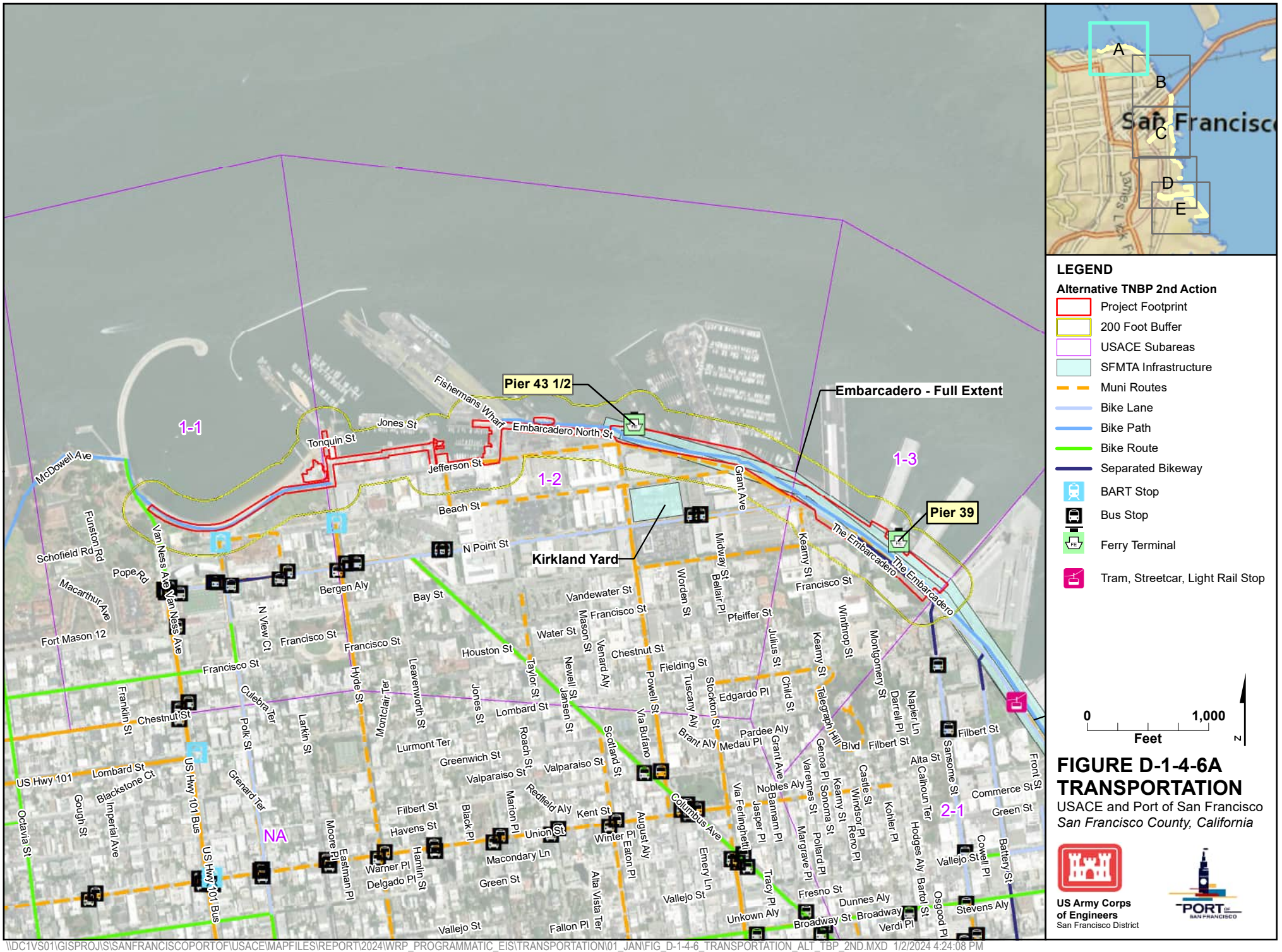
US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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Muni Metro East Access
Muni Metro East
Islais Creek Facility & Marin Yard
3rd Street Bridge- Islais
Islais Creek Channel
4-1
4-2
4-3
4-4
4-5
NA
25th St
26th St
Cesar Chavez
Cesar Chavez St
Marin St
Tulare St
Islais St
Amador St
Burke Ave
Cargo Way
Pier
Evans Ave
Fairfax Ave
Newhall St
Jennings St
Hudson Ave
Innes Ave
Kirkwood Ave
Dedman Ct
Garnett Ter
Reuel Ct
Youngs Ct
Mabrey Ct
Cashmere St
Westbrook Ct
Ardath Ct
Harbor Rd
Bertha Ln
Whitney Young Cir
Bass Ct
Las Villas Ct
Keith St
Hare St
Middle Point Rd
W Point Rd
Acacia Ave
Hunters Point Blvd
Fitch St
Hawes St
Ingalls St
Mendell St
Lane St
Quint St
Rankin St
Davidson Ave
Custer Ave
Galvez Ave
Jerrold Ave
Innes Ave
Phelps St
Dunshee St
Quesada Ave
Bridgeview Dr
Bayview Cir
Whitecliff Way
Revere Ave
Bayview St
Palou Ave
Oakdale Ave
McKinnon Ave
Newcomb Ave
Hillview Ct
Jakey Ct
Hawkins Ln
Dakota St
Mississippi St
Missouri St
Yellow Cab Access Rd
Pennsylvania Ave
Indiana St
Tennessee St
Illinois St
Michigan St
Minnesota St
Maryland St
Napoleon St
Toland St
Arthur Ave
Quint St
Rankin St
Evans Ave
Galvez Ave
Davidson Ave
Custer Ave
Burke Ave
3rd St
Fairfax Ave
Innes Ave
Jerrold Ave
Rankin St
Quint St

TNBP 2nd Action



LEGEND

Alternative TNBP 2nd Action

- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- SFMTA Infrastructure
- Muni Routes
- Bike Lane
- Bike Path
- Bike Route
- Separated Bikeway
- BART Stop
- Bus Stop
- Ferry Terminal
- Tram, Streetcar, Light Rail Stop

0 1,000 Feet

N

FIGURE D-1-4-6A TRANSPORTATION

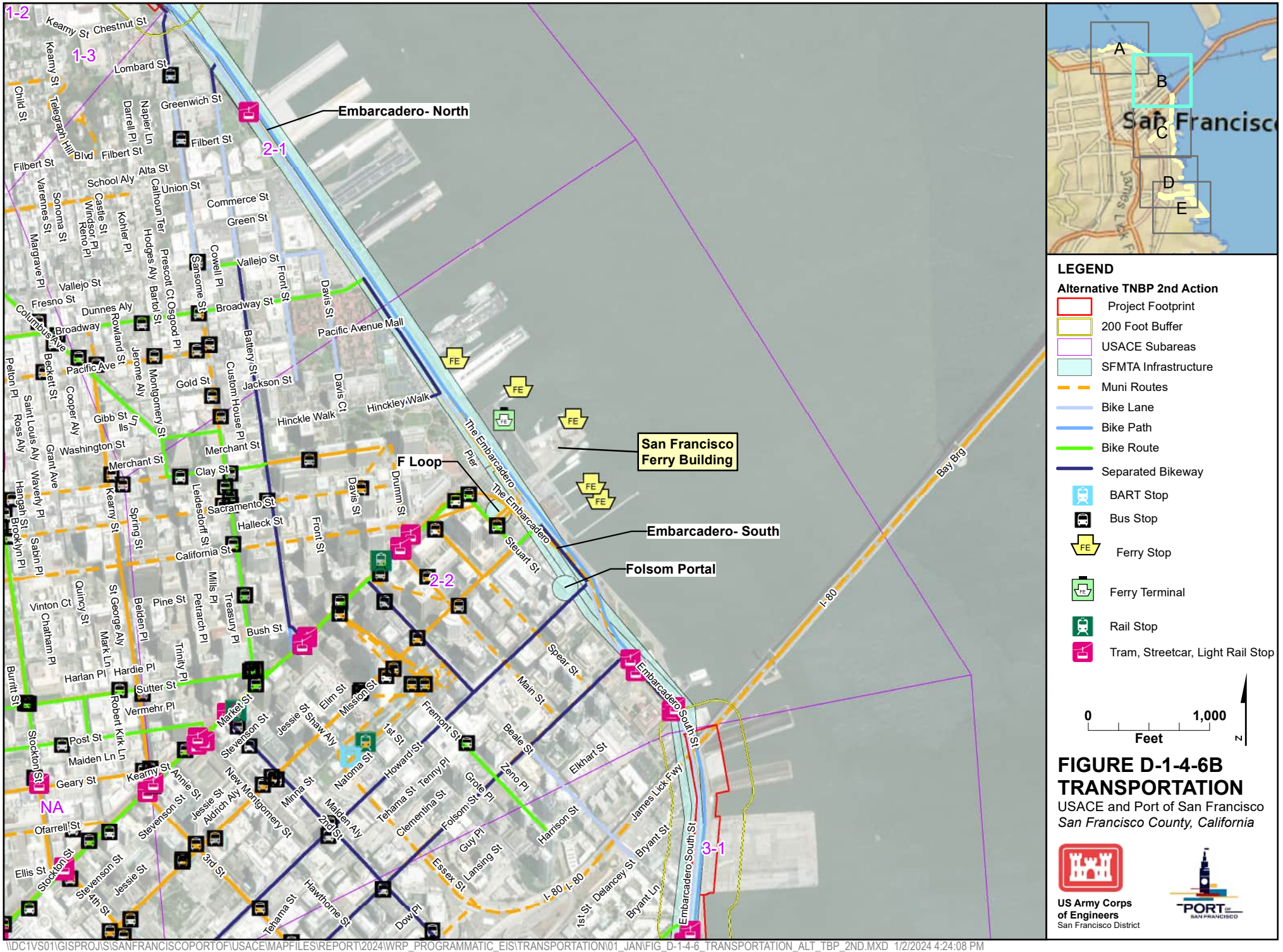
USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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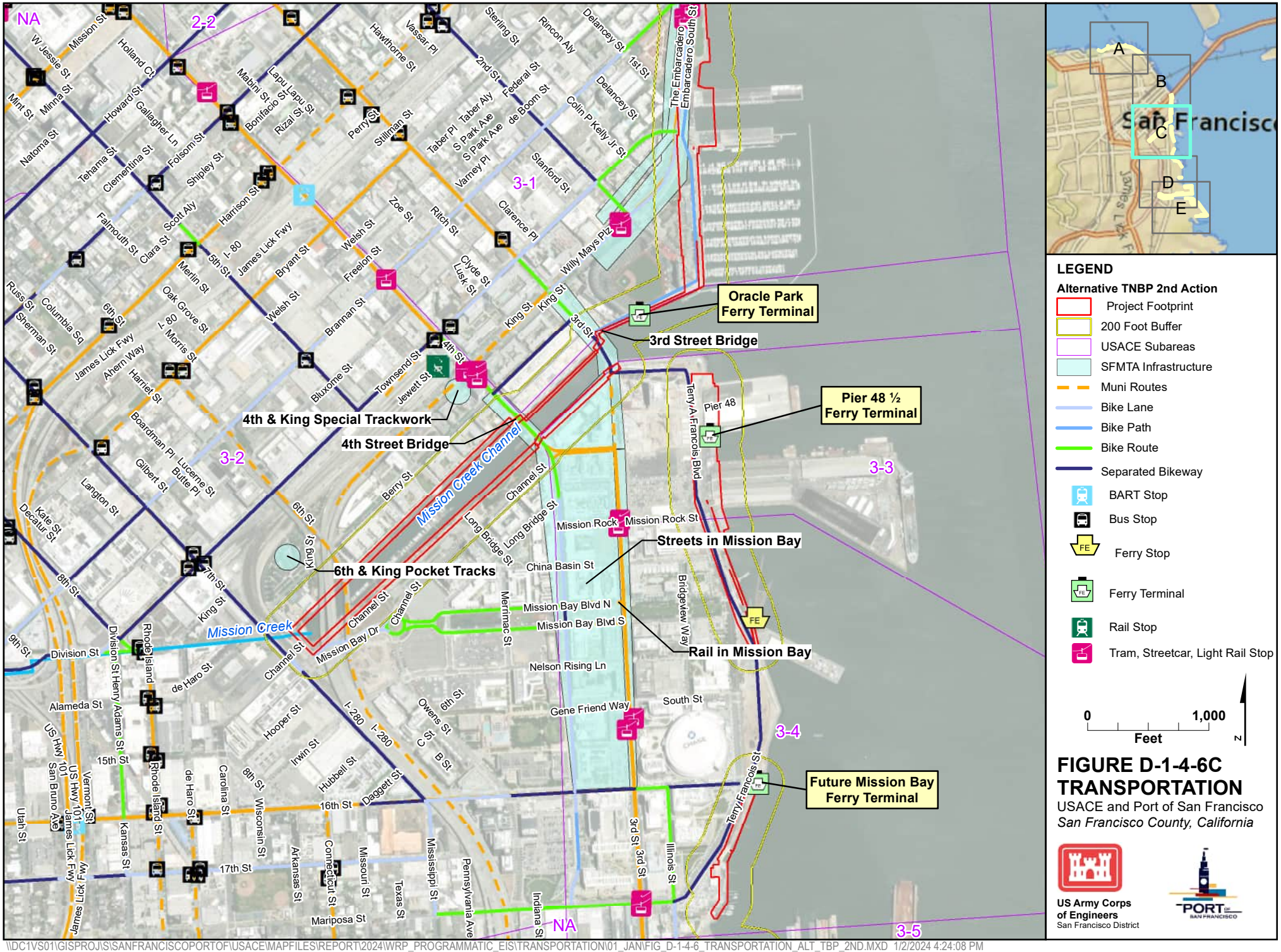


FIGURE D-1-4-6C TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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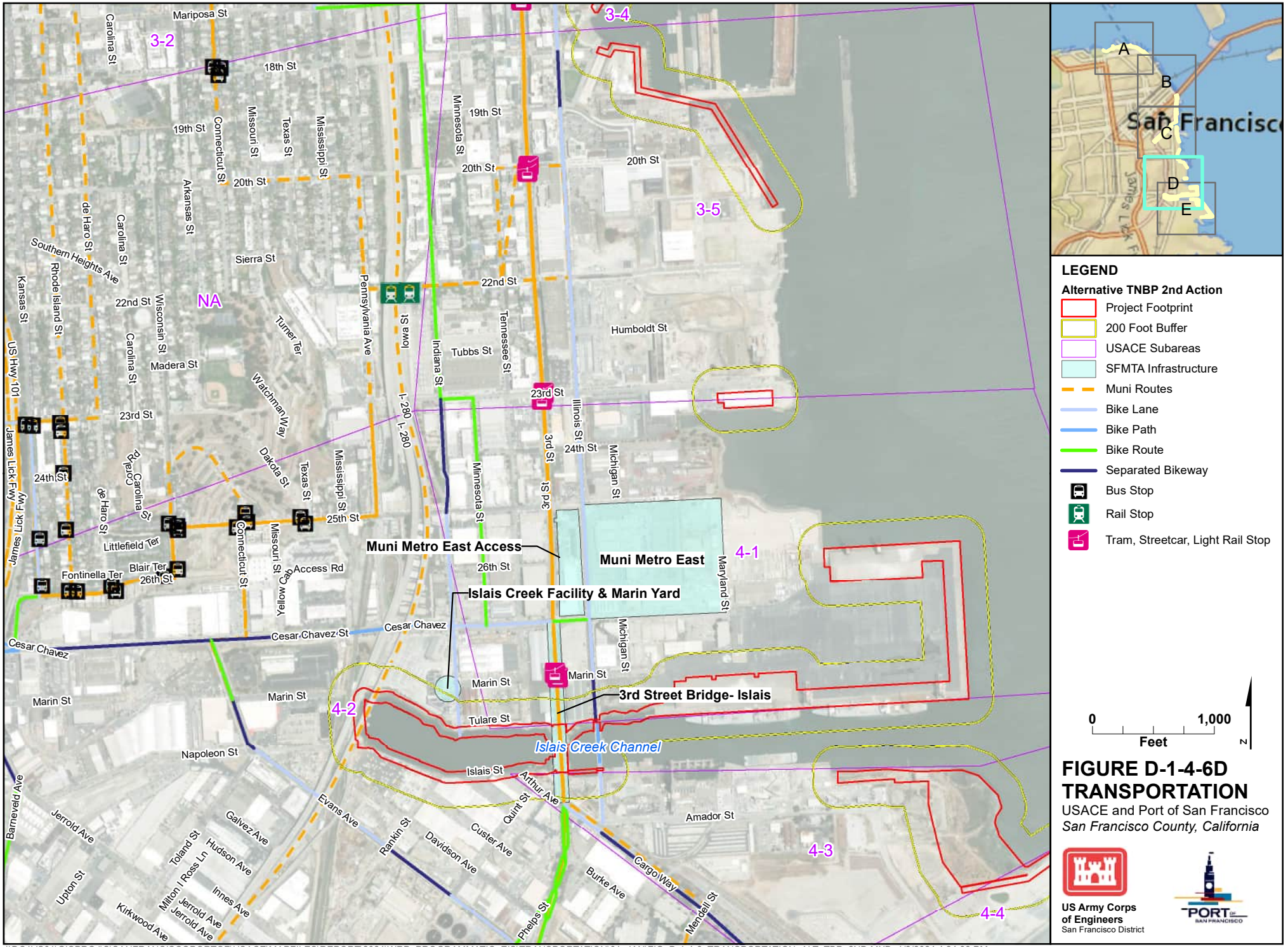


FIGURE D-1-4-6D
TRANSPORTATION

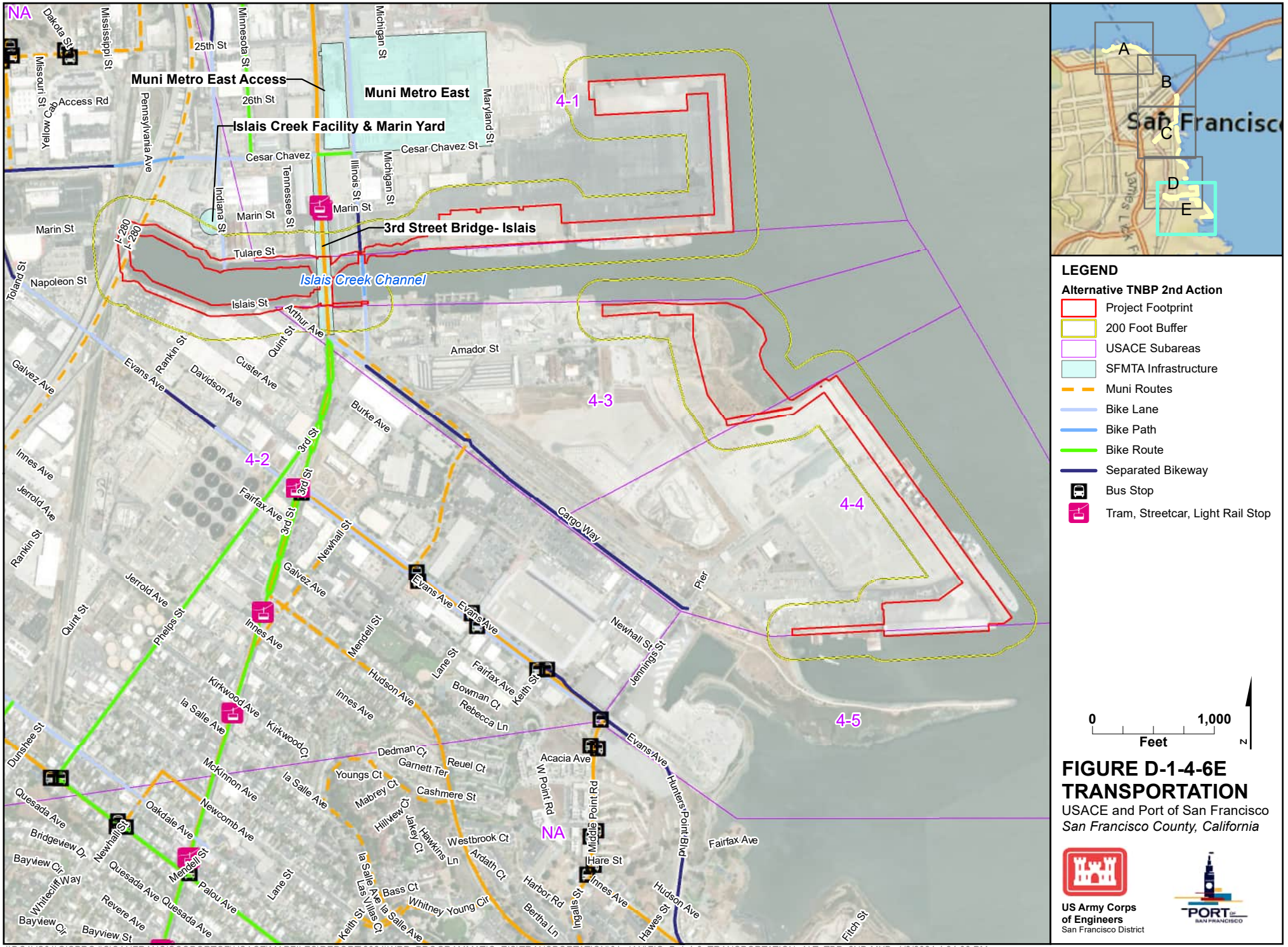
USACE and Port of San Francisco

San Francisco County, California

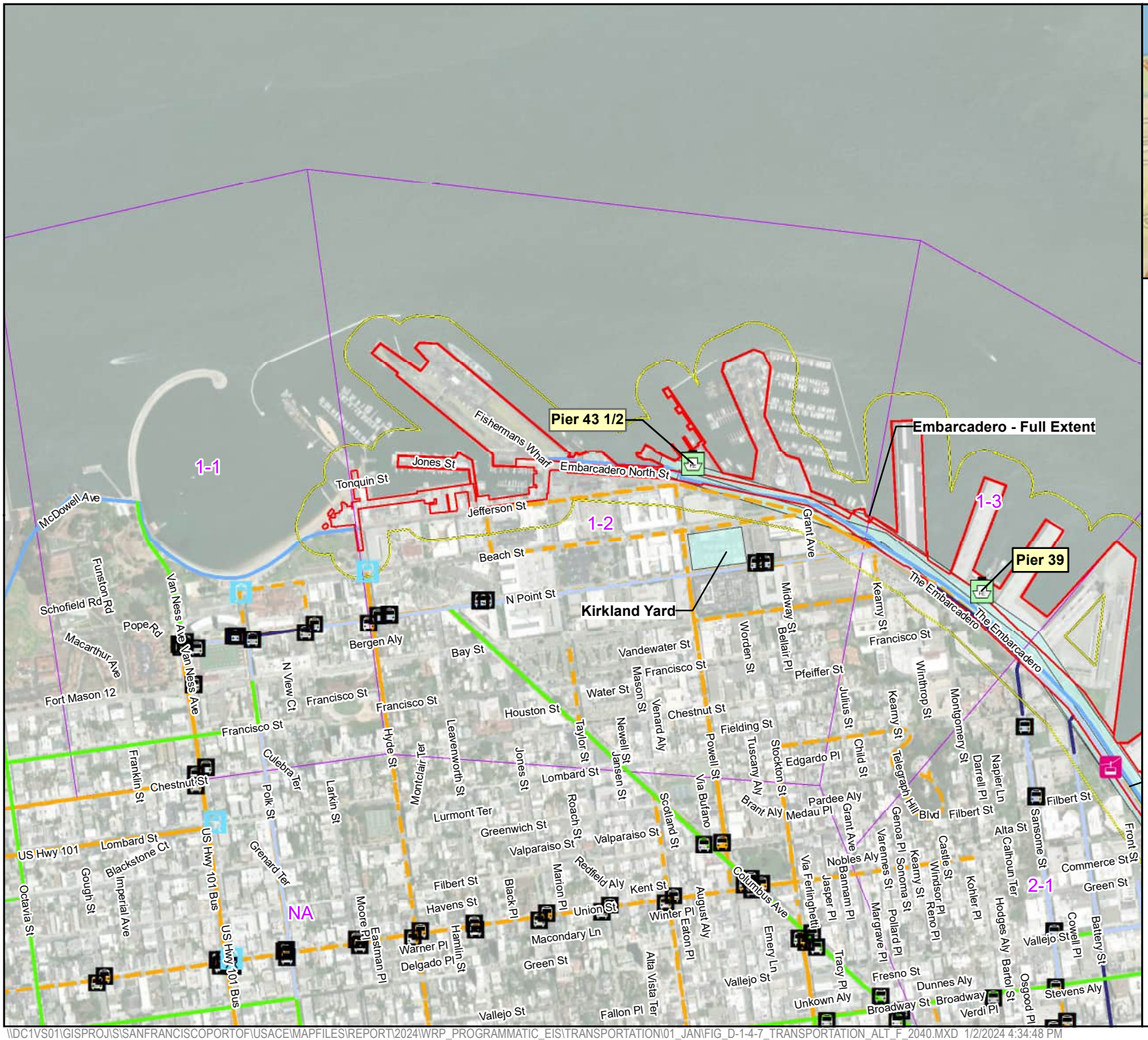
US Army Corps of Engineers
San Francisco District

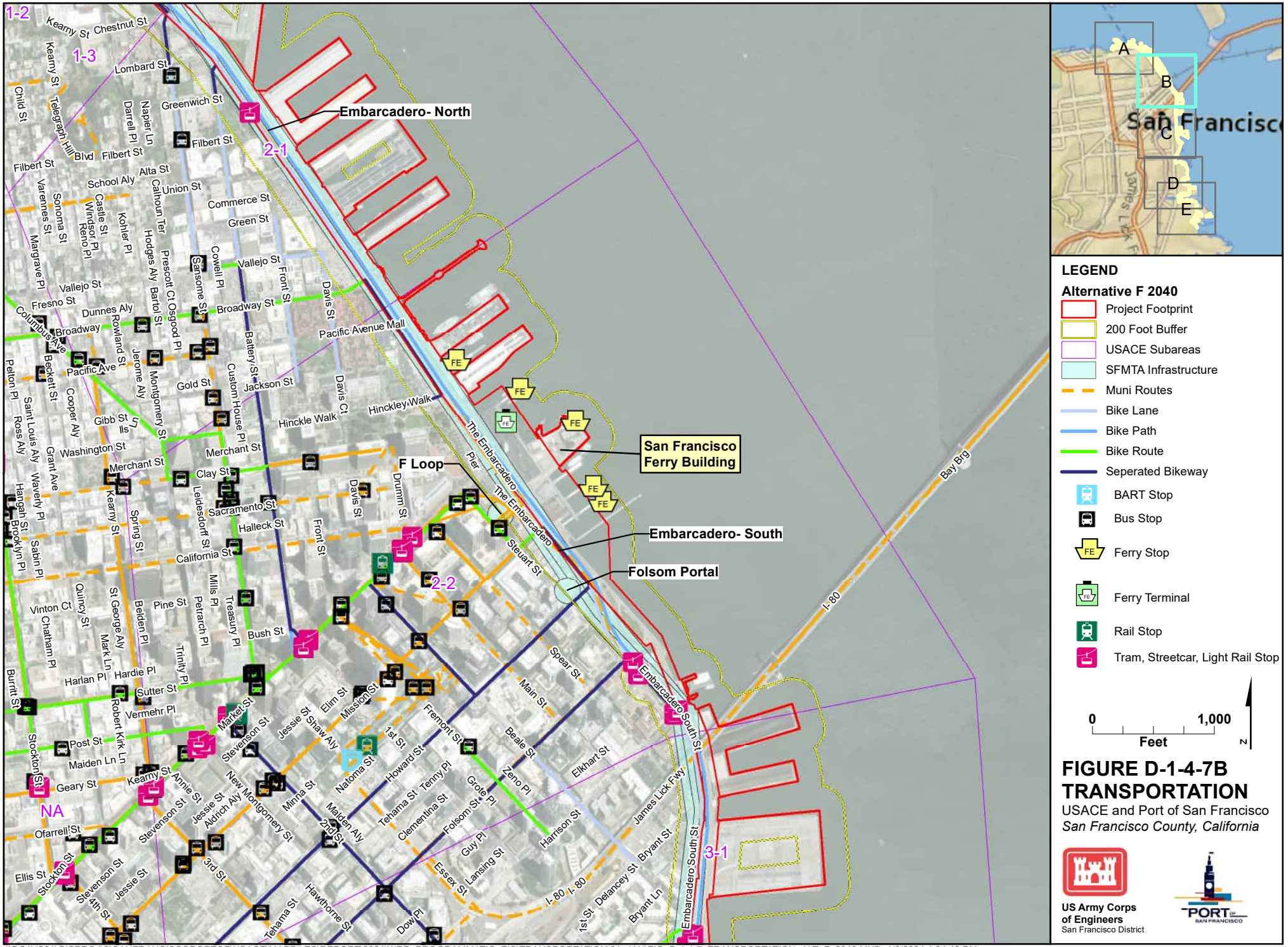
PORT of SAN FRANCISCO

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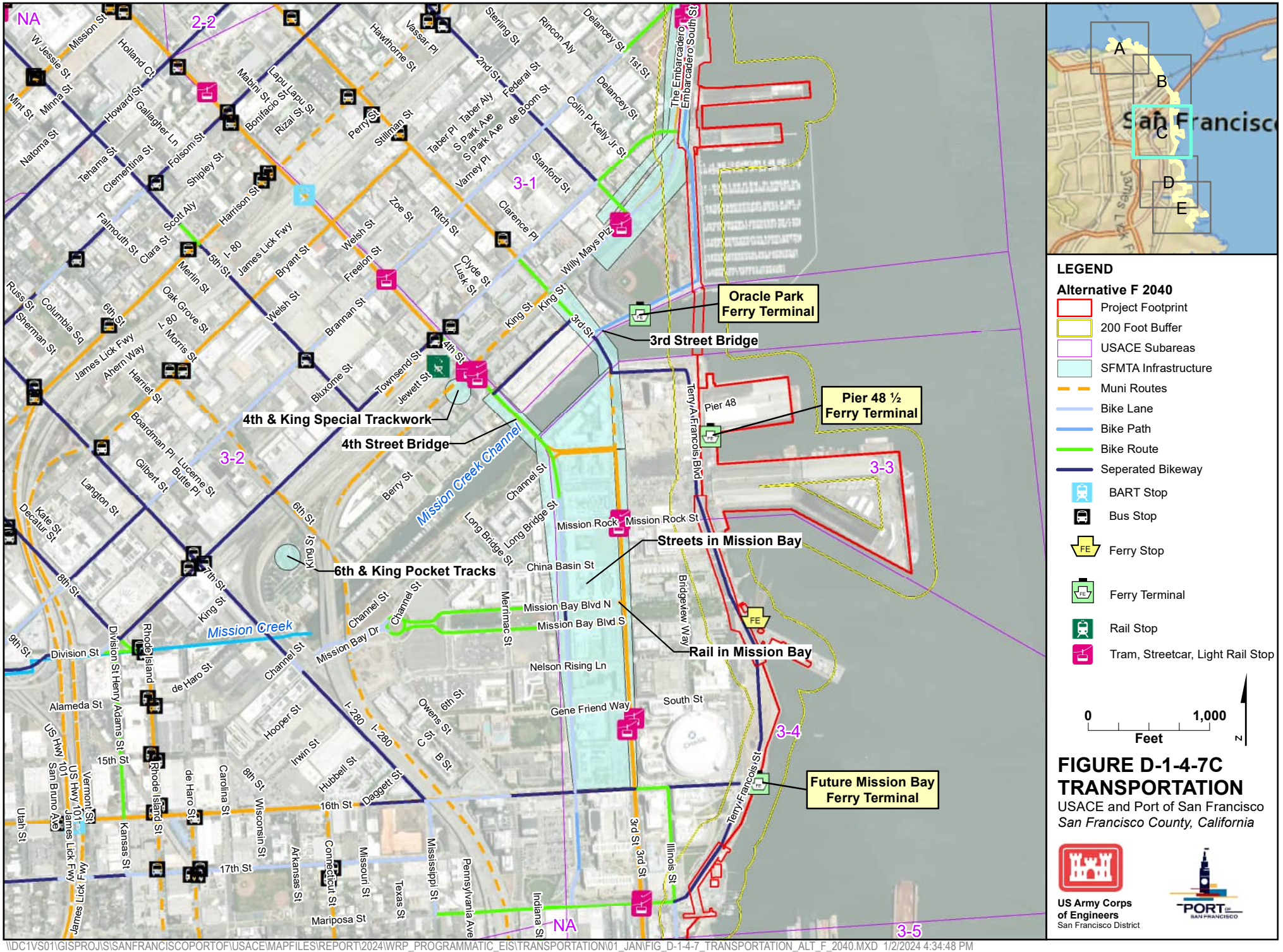

Muni Metro East Access
Muni Metro East
Islais Creek Facility & Marin Yard
3rd Street Bridge- Islais
Islais Creek Channel
4-1
4-2
4-3
4-4
4-5
NA
25th St
26th St
Cesar Chavez
Cesar Chavez St
Marin St
Tulare St
Islais St
Amador St
Burke Ave
Cargo Way
Pier
Evans Ave
Fairfax Ave
Newhall St
Innes Ave
Hudson Ave
Kirkwood Ave
Quesada Ave
Oakdale Ave
Palou Ave
Revere Ave
Bayview St
Acacia Ave
Hare St
Fairfax Ave
Hunters Point Blvd
Jennings St
Mendell St
Lane St
Keith St
Ingalls St
Harbor Rd
Bertha Ln
Fitch St
Hawes St
Whitney Young Cir
Bass Ct
Dedman Ct
Garnett Ter
Reuel Ct
Youngs Ct
Mabrey Ct
Cashmere St
Hillview Ct
Jakey Ct
Hawkins Ln
Westbrook Ct
Ardath Ct
Las Villas Ct
Bowman Ct
Rebecca Ln
Middle Point Rd
W Point Rd
Dakota St
Mississippi St
Minnesota St
Michigan St
Maryland St
Illinois St
Tennessee St
Indiana St
Pennsylvania Ave
Missouri St
Yellow Cab Access Rd
Napoleon St
Toland St
Galvez Ave
Evans Ave
Rankin St
Davidson Ave
Custer Ave
Quint St
Arthur Ave
Innes Ave
Jerrold Ave
Phelps St
Dunshee St
Bridgeview Dr
Bayview Cir
Whitecliff Way
Quesada Ave
Newcomb Ave
McKinnon Ave
Ia Salle Ave
Kirkwood Ct
Mendell St
Newhall St
3rd St
Fairfax Ave
Galvez Ave
Jerrold Ave
Innes Ave
Quint St
Rankin St
Marin St
Napoleon St
Tulare St
Islais St
Arthur Ave
Amador St
Burke Ave
Cargo Way
Pier
Evans Ave
Newhall St
Jennings St
Fairfax Ave
Keith St
Lane St
Hudson Ave
Innes Ave
Rebecca Ln
Bowman Ct
Acacia Ave
Middle Point Rd
W Point Rd
Hunters Point Blvd
Fairfax Ave
Hare St
Ingalls St
Harbor Rd
Bertha Ln
Fitch St
Hawes St
Whitney Young Cir
Bass Ct
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Ia Salle Ave
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Garnett Ter
Reuel Ct
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Mabrey Ct
Cashmere St
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Hawkins Ln
Westbrook Ct
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Middle Point Rd
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Innes Ave
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Lane St
Palou Ave
Revere Ave
Bayview St
Quesada Ave
Bayview Cir
Whitecliff Way
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Oakdale Ave
Newcomb Ave
McKinnon Ave
Ia Salle Ave
Kirkwood Ct
Mendell St
Newhall St
Dunshee St
Phelps St
Jerrold Ave
Quint St
Rankin St
Innes Ave
Galvez Ave
Evans Ave
Fairfax Ave
3rd St
Indiana St
Tennessee St
Illinois St
Michigan St
Maryland St
Pennsylvania Ave
Missouri St
Yellow Cab Access Rd
Mississippi St
Minnesota St
Dakota St
Napoleon St
Toland St
Marin

Alternative F 2040

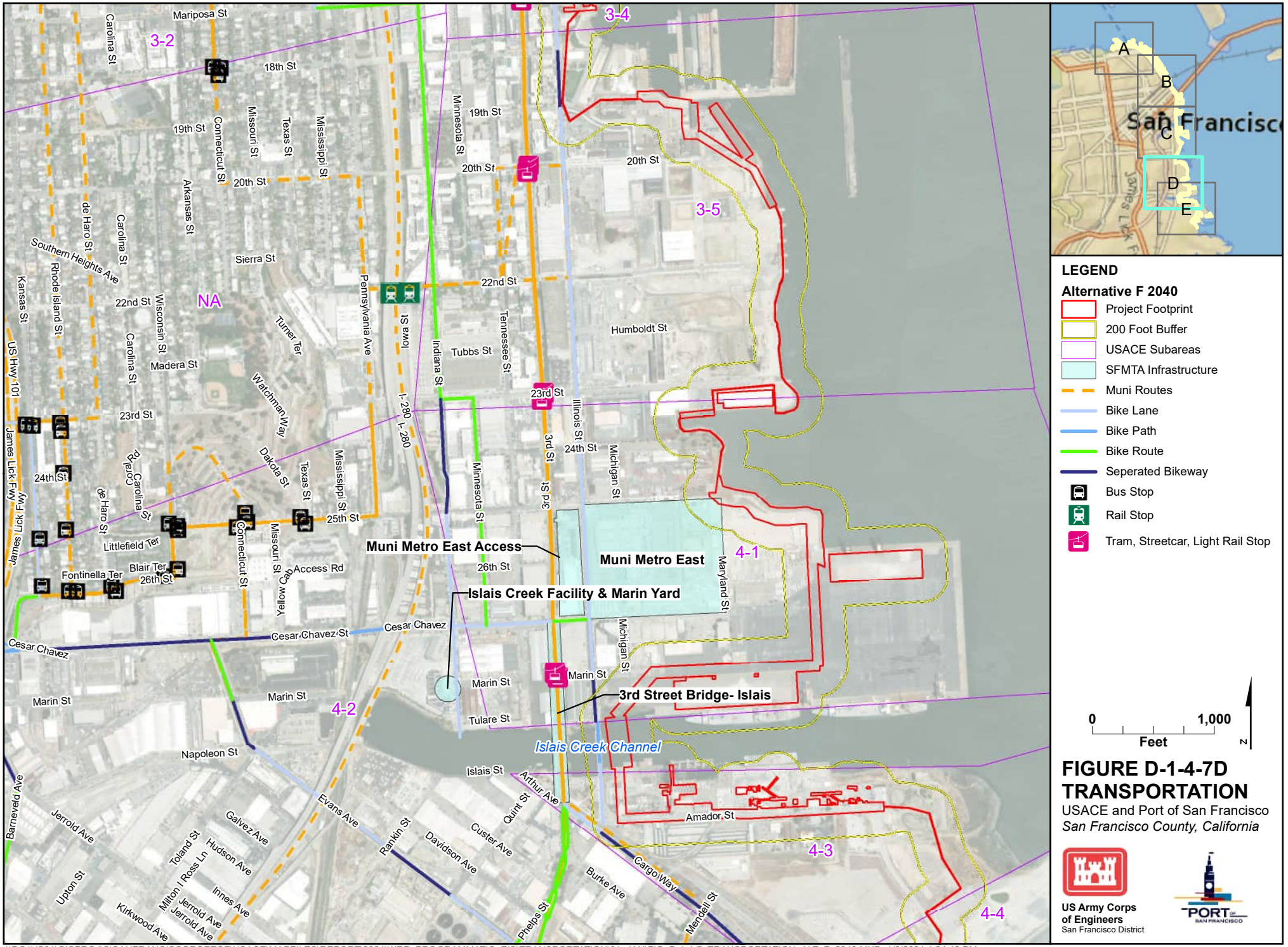

Pier 43 1/2
Embarcadero - Full Extent
Kirkland Yard
Pier 39
1-1
1-2
1-3
2-1
NA
Fishermans Wharf
Jones St
Tonquin St
Jefferson St
Embarcadero North St
Beach St
N Point St
Bay St
Grant Ave
The Embarcadero
Kearny St
Francisco St
Vandewater St
Water St
Chestnut St
Fielding St
Edgardo Pl
Pfeiffer St
Houston St
Lombard St
Greenwich St
Valparaiso St
Lurmont Ter
Filbert St
Green St
Vallejo St
Broadway St
Columbus Ave
Montgomery St
Sansome St
Battery St
Front St
Commerce St
Stevens Aly
Fallon Pl
Unkown Aly
Macondary Ln
Union St
Havens St
Kent St
Winter Pl
Eaton Pl
August Aly
Emery Ln
Tracy Pl
Fresno St
Dunnes Aly
Verdi Pl
Osgood Pl
Bartol St
Hodges Aly
Cowell Pl
Vallejo St
Alta Calhoun Ter
Nobles Aly
Pardee Aly
Medau Pl
Brant Aly
Via Ferlinghetti
Jasper Pl
Margrave Pl
Pollard Pl
Varennes St
Genoa Pl
Sonoma St
Windsor Pl
Reno Pl
Castle St
Kohler Pl
Telegraph Hill Blvd
Napier Ln
Darrell Pl
Winthrop St
Julius St
Child St
Stockton St
Tuscany Aly
Powell St
Via Bufano
Scotland St
Redfield Aly
Roach St
Jansen St
Newell St
Taylor St
Jones St
Leavenworth St
Montclair Ter
Hyde St
Larkin St
Polk St
Culebra Ter
Grenard Ter
Franklin St
Chestnut St
Lombard St
US Hwy 101
US Hwy 101 Bus
Blackstone Ct
Gough St
Imperial Ave
Octavia St
Moore Pl
Eastman Pl
Warner Pl
Delgado Pl
Hamlin St
Black Pl
Marion Pl
Green St
Alta Vista Ter
Fort Mason 12
Schofield Rd
Pope Rd
Macarthur Ave
Van Ness Ave
Funston Rd
McDowell Ave
N View Ct
Bergen Aly
Midway St
Bellair Pl
Worden St
Mason St
Venard Aly
Francisco St
Filbert St
Alta St
Green St
Commerce St
Front St
Napier Ln
Darrell Pl
Montgomery St
Kearny St
Telegraph Hill Blvd
Child St
Julius St
Winthrop St
Pfeiffer St
Francisco St
Vallejo St
Cowell Pl
Battery St
Stevens Aly
Osgood Pl
Bartol St
Hodges Aly
Kohler Pl
Castle St
Windsor Pl
Reno Pl
Kearny St
Varennes St
Genoa Pl
Sonoma St
Pollard Pl
Margrave Pl
Jasper Pl
Via Ferlinghetti
Columbus Ave
Nobles Aly
Grant Ave
Pardee Aly
Medau Pl
Brant Aly
Stockton St
Tuscany Aly
Powell St
Via Bufano
Scotland St
Redfield Aly
Roach St
Jansen St
Newell St
Taylor St
Jones St
Leavenworth St
Montclair Ter
Hyde St
Larkin St
Polk St
Culebra Ter
Grenard Ter
Franklin St
Chestnut St
Lombard St
US Hwy 101
US Hwy 101 Bus
Blackstone Ct
Gough St
Imperial Ave
Octavia St
Moore Pl
Eastman Pl
Warner Pl
Delgado Pl
Hamlin St
Black Pl
Marion Pl
Green St
Alta Vista Ter
Fort Mason 12
Schofield Rd
Pope Rd
Macarthur Ave
Van Ness Ave
Funston Rd
McDowell Ave
N View Ct
Bergen Aly
Midway St
Bellair Pl
Worden St
Mason St
Venard Aly
Francisco St
Bay St
Beach St
N Point St
Grant Ave
The Embarcadero
Kearny St
Francisco St
Vandewater St
Water St
Chestnut St
Fielding St
Edgardo Pl
Pfeiffer St
Houston St
Lombard St
Greenwich St
Valparaiso St
Lurmont Ter
Filbert St
Green St
Vallejo St
Broadway St
Columbus Ave
Montgomery St
Sansome St
Battery St
Front St
Commerce St
Stevens Aly
Fallon Pl
Unkown Aly
Macondary Ln
Union St
Havens St
Kent St
Winter Pl
Eaton Pl
August Aly
Emery Ln
Tracy Pl
Fresno St
Dunnes Aly
Verdi Pl
Osgood Pl
Bartol St
Hodges Aly
Cowell Pl
Vallejo St
Alta Calhoun Ter
Nobles Aly
Pardee Aly
Medau Pl
Brant Aly
Via Ferlinghetti
Jasper Pl
Margrave Pl
Pollard Pl
Varennes St
Genoa Pl
Sonoma St
Windsor Pl
Reno Pl
Castle St
Kohler Pl
Telegraph Hill Blvd
Napier Ln
Darrell Pl
Winthrop St
Julius St
Child St



\\DC1VS01\GISPROJ\S\SANFRANCISCOPORTOF\USACE\MAPFILES\REPORT\2024\WRP_PROGRAMMATIC_EIS\TRANSPORTATION\01_JAN\FIG_D-1-4-7_TRANSPORTATION_ALT_F_2040.MXD 1/2/2024 4:34:48 PM



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LEGEND

Alternative F 2040

- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- SFMTA Infrastructure
- Muni Routes
- Bike Lane
- Bike Path
- Bike Route
- Seperated Bikeway
- Bus Stop
- Rail Stop
- Tram, Streetcar, Light Rail Stop

FIGURE D-1-4-7D TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

\\DC1VS01\GISPROJ\S\SANFRANCISCOPORTOF\USACE\MAPFILES\REPORT\2024\WRP_PROGRAMMATIC_EIS\TRANSPORTATION\01_JAN\FIG_D-1-4-7_TRANSPORTATION_ALT_F_2040.MXD 1/2/2024 4:34:48 PM

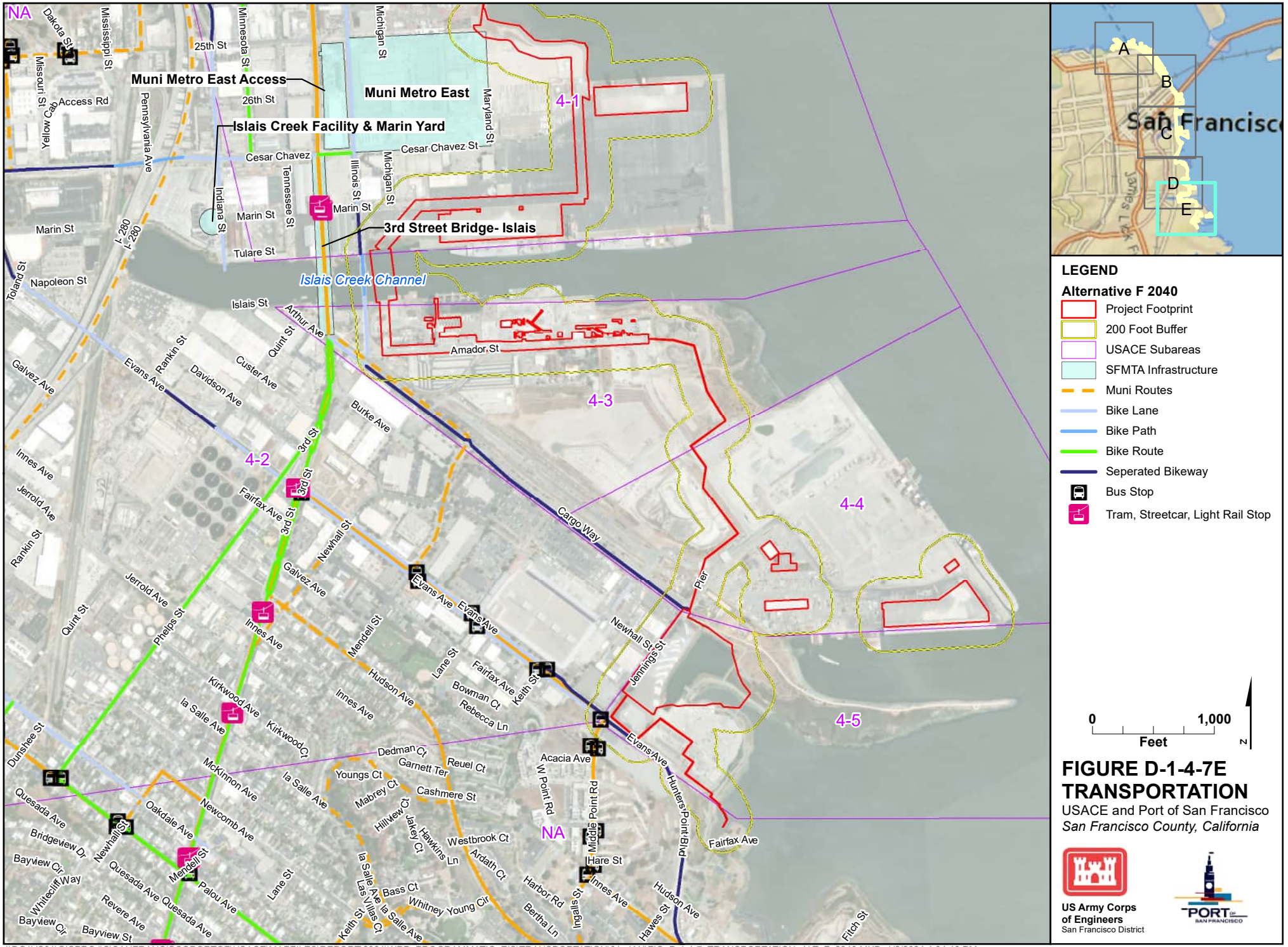


FIGURE D-1-4-7E
TRANSPORTATION

USACE and Port of San Francisco

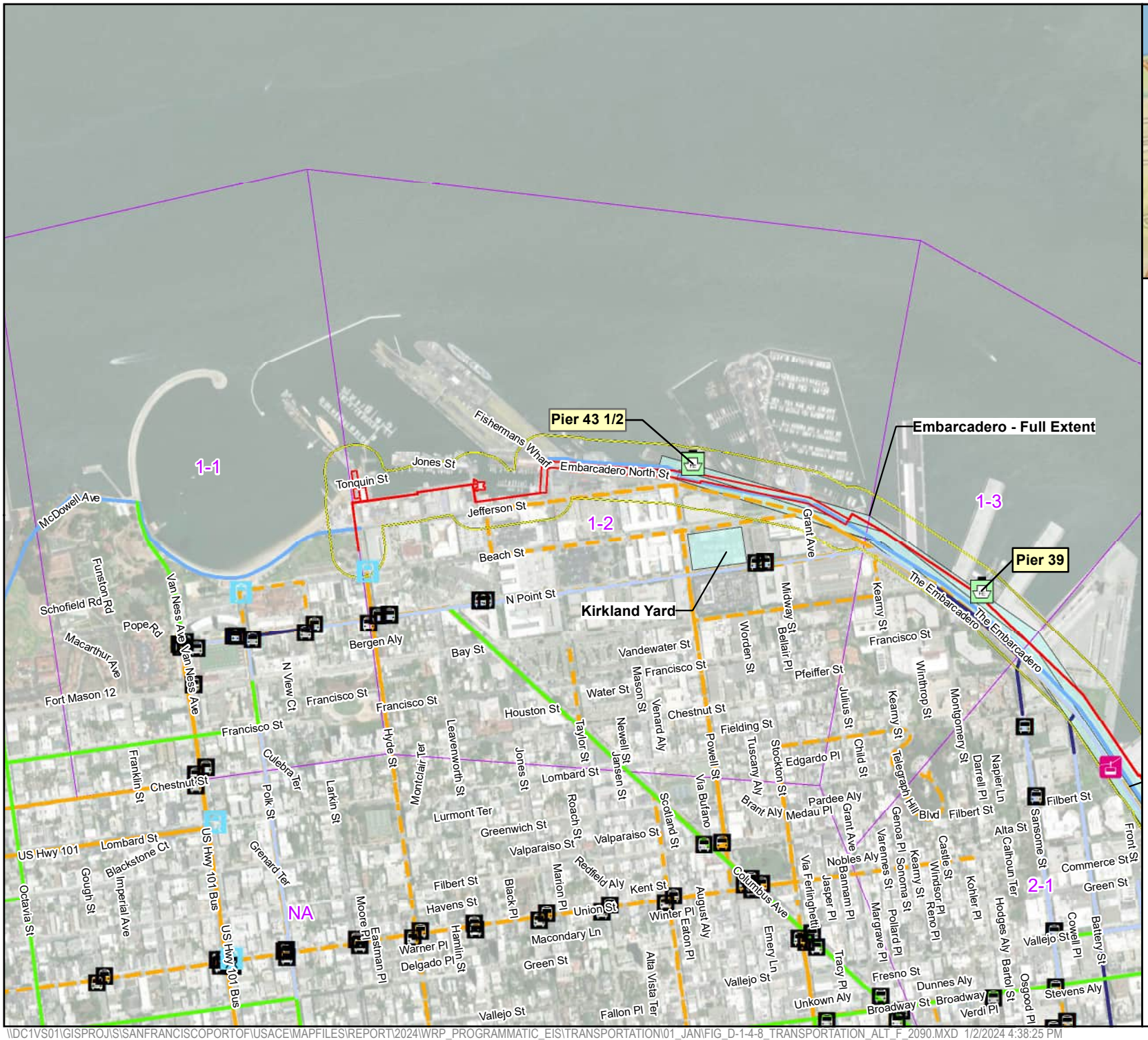
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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Alternative F 2090


Pier 43 1/2
Embarcadero - Full Extent
Kirkland Yard
Pier 39
1-1
1-2
1-3
2-1
NA
Fishermans Wharf
Jones St
Tonquin St
Embarcadero North St
Jefferson St
Beach St
N Point St
Bay St
Francisco St
Chestnut St
Lombard St
Filbert St
Green St
Vallejo St
Broadway St
Grant Ave
The Embarcadero
Kearny St
Montgomery St
Sansome St
Battery St
Front St
Commerce St
Alta St
Calhoun Ter
Telegraph Hill Blvd
Columbus Ave
Powell St
Mason St
Taylor St
Jones St
Hyde St
Leavenworth St
Polk St
Larkin St
Van Ness Ave
Franklin St
Gough St
Octavia St
Lombard St
US Hwy 101
US Hwy 101 Bus
Fort Mason 12
Macarthur Ave
Schofield Rd
Funston Rd
Pope Rd
McDowell Ave
Bergen Aly
Vandewater St
Water St
Houston St
Fielding St
Edgardo Pl
Pfeiffer St
Worden St
Midway St
Bellair Pl
Julius St
Child St
Winthrop St
Napier Ln
Darrell Pl
Filbert St
Alta St
Lurmont Ter
Greenwich St
Valparaiso St
Scotland St
Via Bufano
Brant Aly
Pardee Aly
Medau Pl
Nobles Aly
Via Ferlinghetti
Jasper Pl
Varennes St
Genoa Pl
Sonoma St
Kearny St
Windsor Pl
Reno Pl
Castle St
Kohler Pl
Hodges Aly
Bartol St
Cowell Pl
Vallejo St
Stevens Aly
Osgood Pl
Verdi Pl
Dunnes Aly
Fresno St
Unkown Aly
Margrave Pl
Pollard Pl
Tracy Pl
Emery Ln
Alta Vista Ter
Fallon Pl
Eaton Pl
August Aly
Winter Pl
Kent St
Union St
Macondary Ln
Marion Pl
Redfield Aly
Black Pl
Havens St
Filbert St
Warner Pl
Delgado Pl
Hamlin St
Moore Pl
Eastman Pl
Grenard Ter
Blackstone Ct
Imperial Ave
Culebra Ter
Montclair Ter
Newell St
Jansen St
Roach St
Stockton St
Tuscany Aly
Venard Aly
Chestnut St
Francisco St
Bay St
Van Ness Ave
N View Ct
Bergen Aly
Midway St
Worden St
Pfeiffer St
Julius St
Child St
Winthrop St
Montgomery St
Darrell Pl
Napier Ln
Filbert St
Alta St
Sansome St
Commerce St
Front St
Green St
Battery St
Stevens Aly
Osgood Pl
Verdi Pl
Broadway
Dunnes Aly
Fresno St
Unkown Aly
Vallejo St
Fallon Pl
Tracy Pl
Emery Ln
Alta Vista Ter
Eaton Pl
August Aly
Winter Pl
Kent St
Union St
Macondary Ln
Marion Pl
Redfield Aly
Black Pl
Havens St
Filbert St
Warner Pl
Delgado Pl
Hamlin St
Moore Pl
Eastman Pl
Grenard Ter
Blackstone Ct
Imperial Ave
Gough St
Octavia St
Lombard St
US Hwy 101
US Hwy 101 Bus
Fort Mason 12
Macarthur Ave
Schofield Rd
Funston Rd
Pope Rd
McDowell Ave
Bergen Aly
Vandewater St
Water St
Houston St
Fielding St
Edgardo Pl
Pfeiffer St
Worden St
Midway St
Bellair Pl
Julius St
Child St
Winthrop St
Napier Ln
Darrell Pl

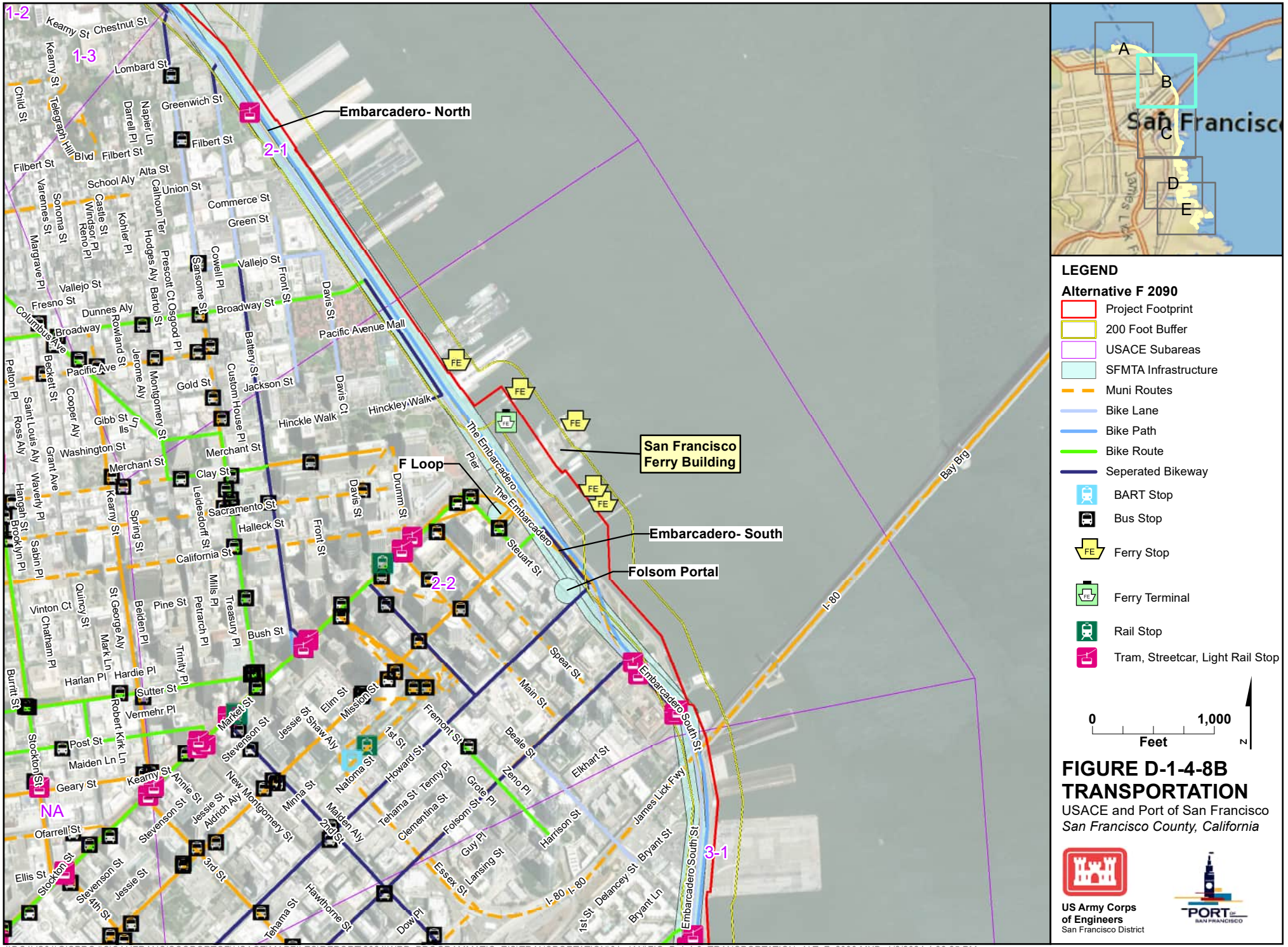


FIGURE D-1-4-8B
TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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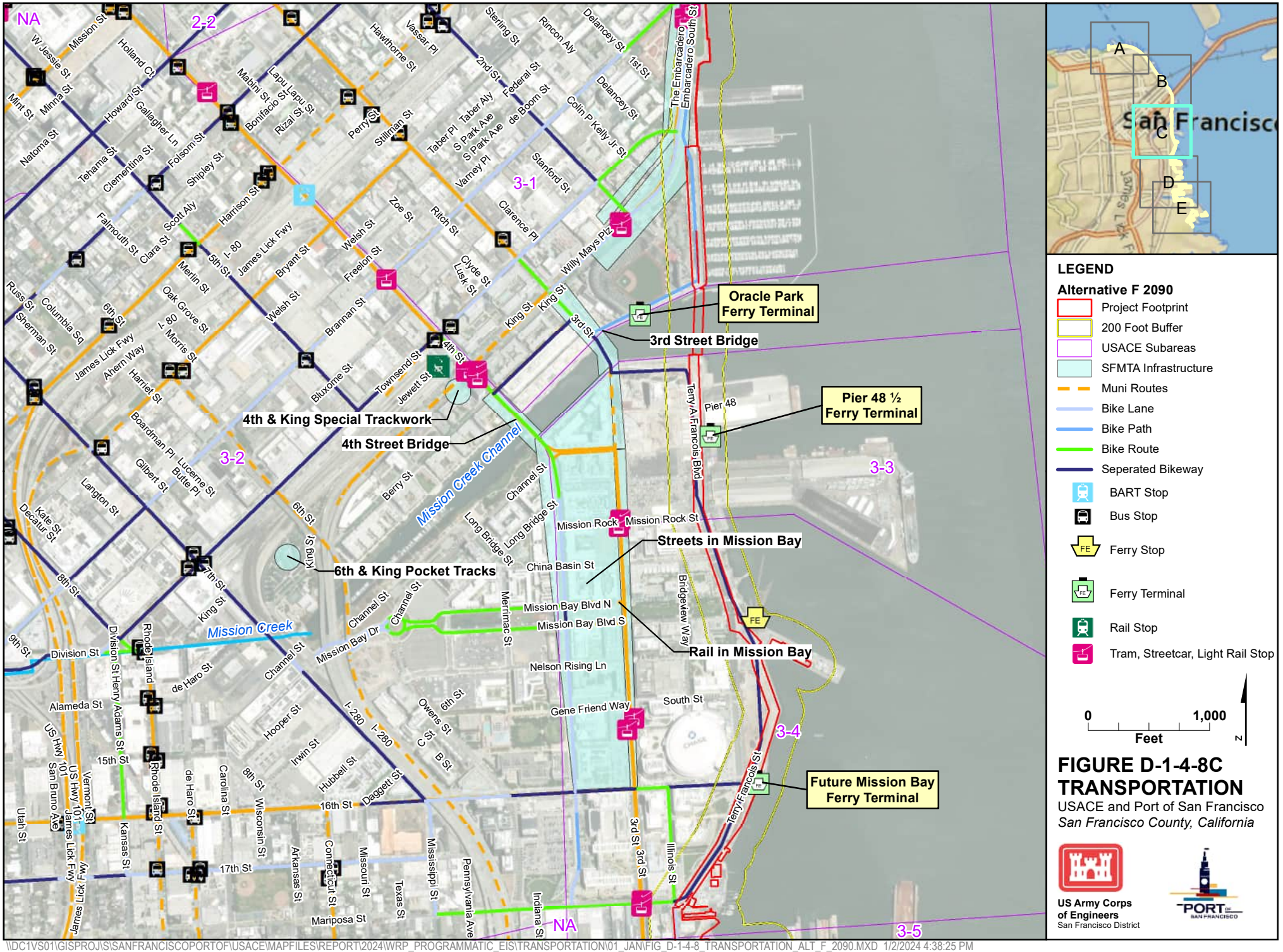


FIGURE D-1-4-8C TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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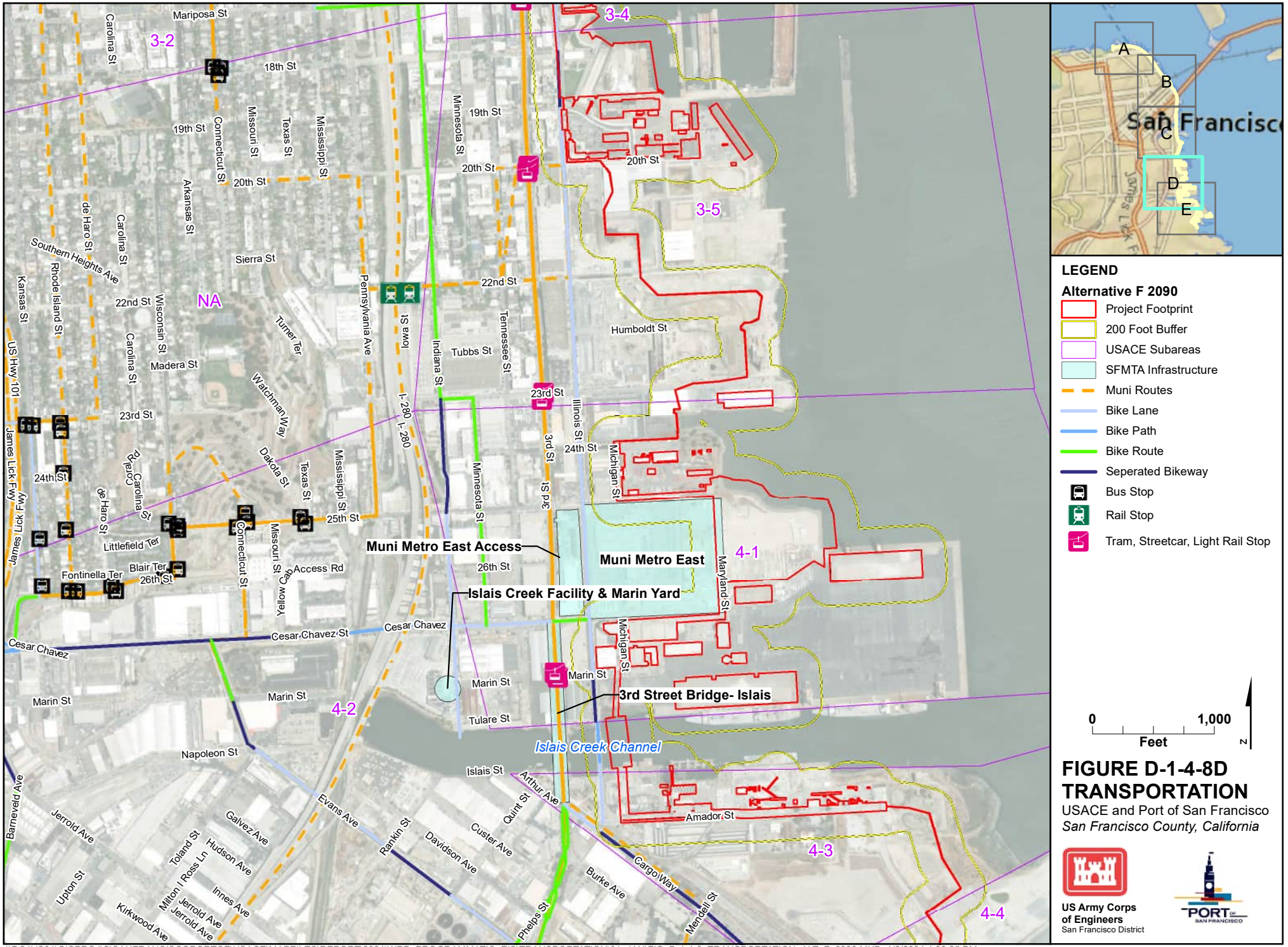


FIGURE D-1-4-8D
TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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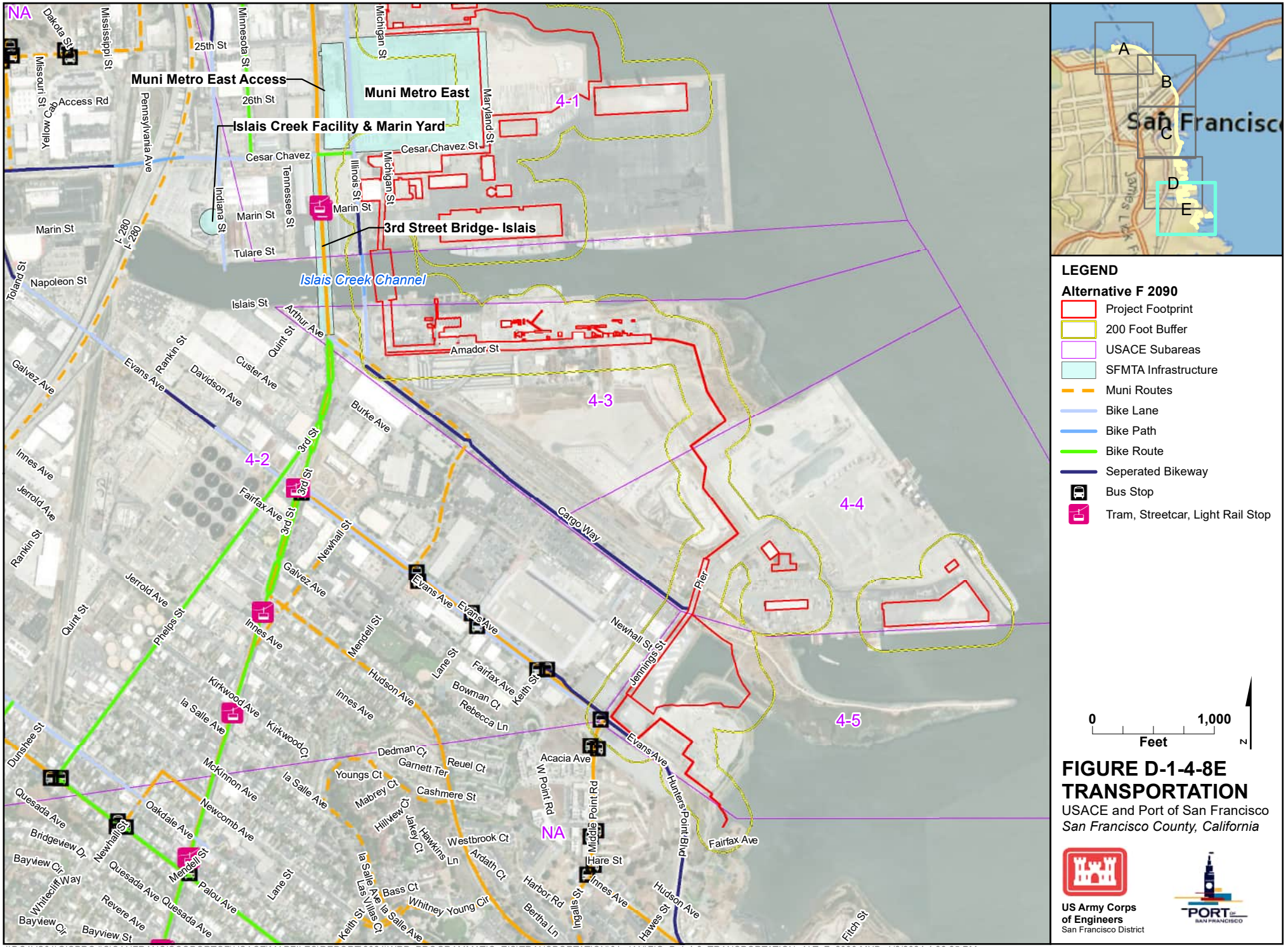


FIGURE D-1-4-8E TRANSPORTATION

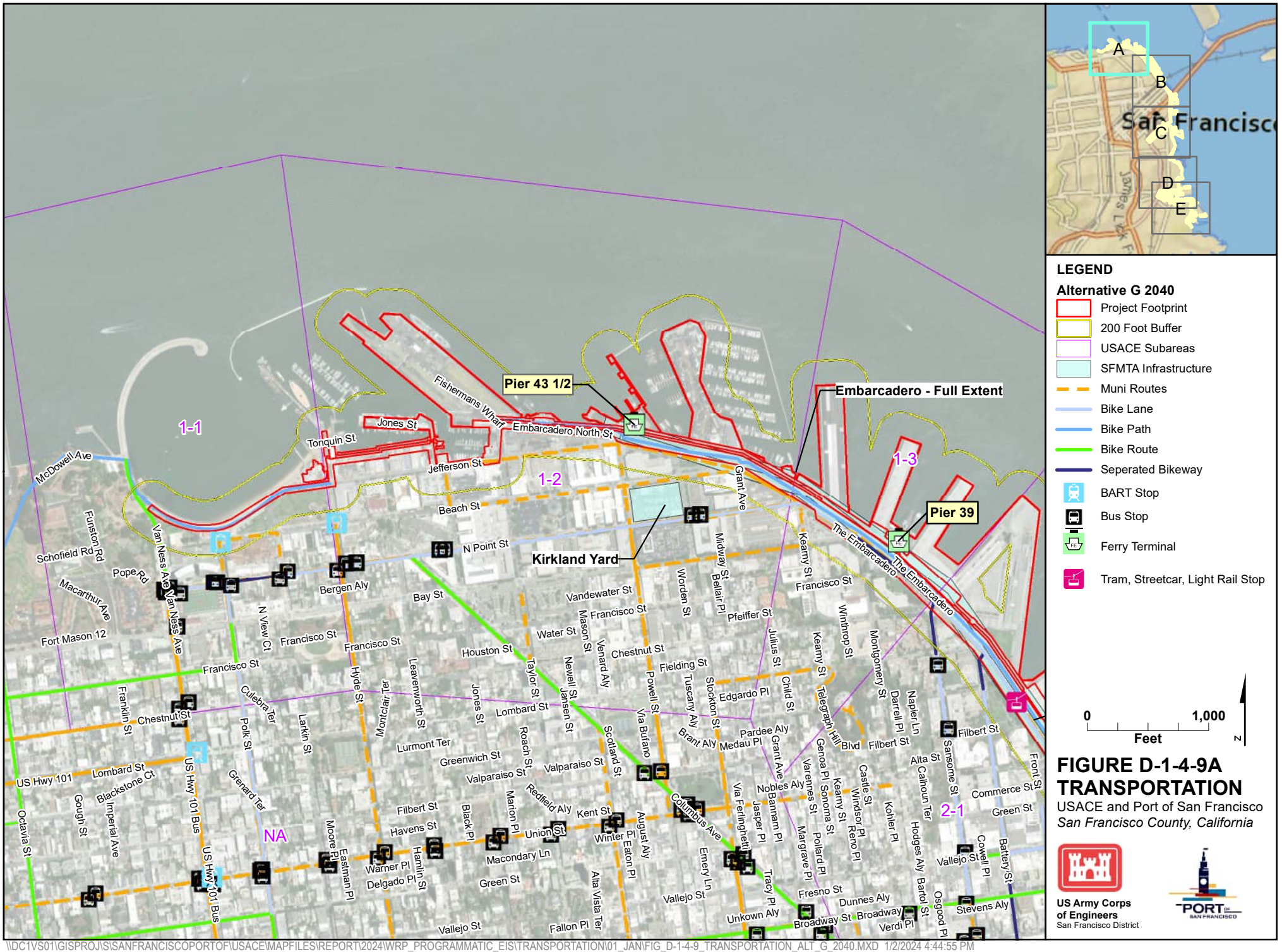
USACE and Port of San Francisco

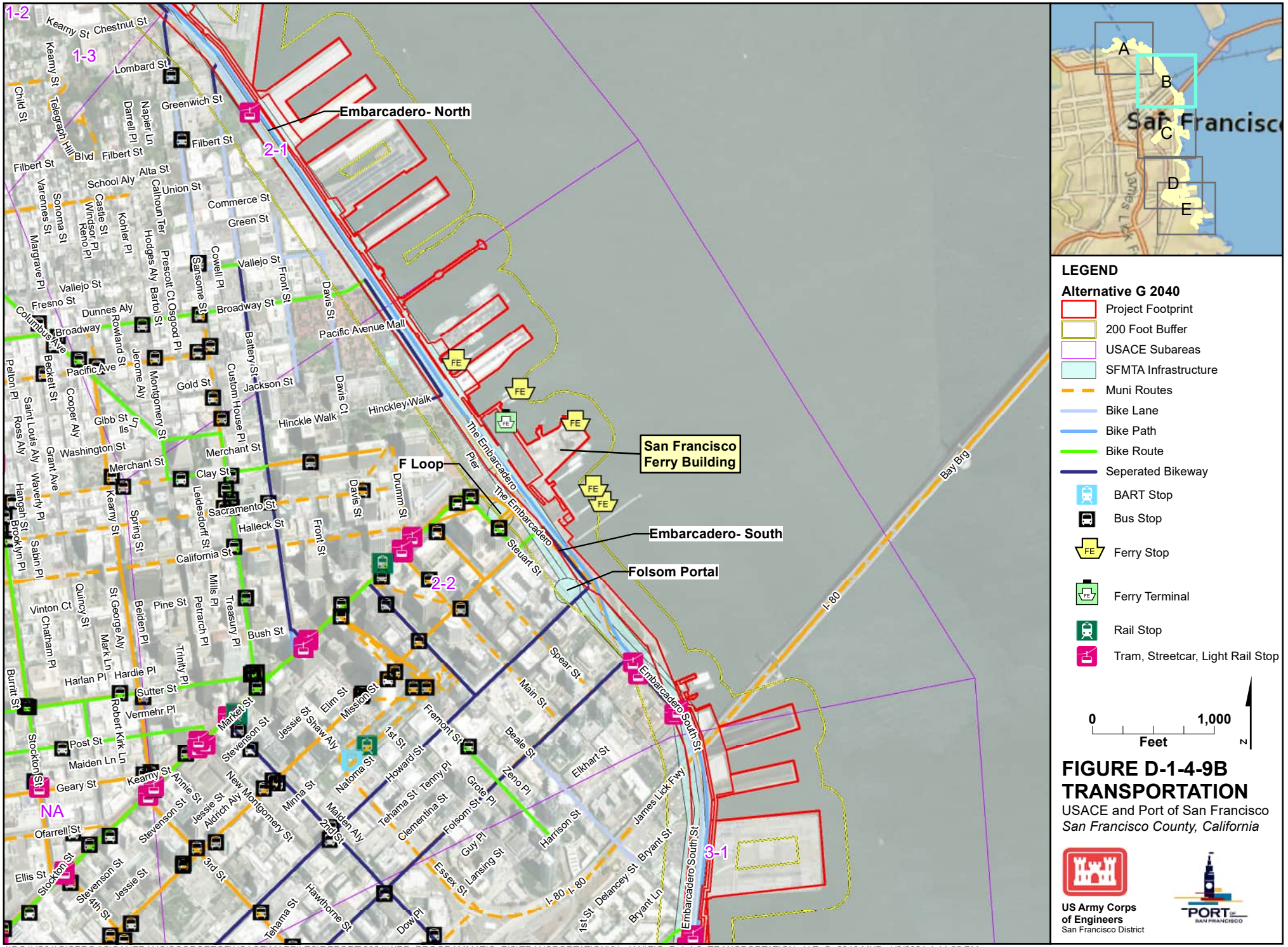
San Francisco County, California

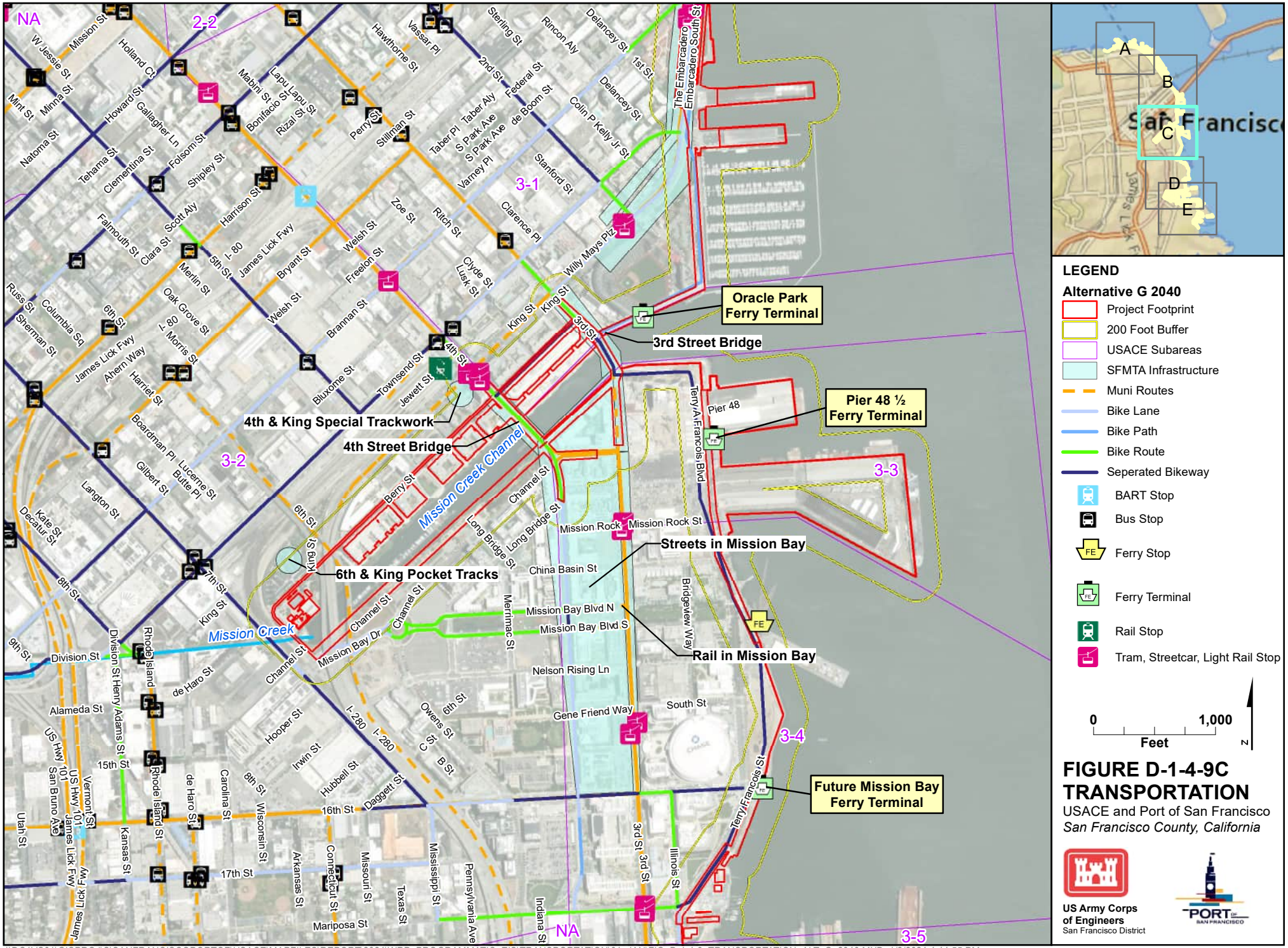
US Army Corps of Engineers
San Francisco District

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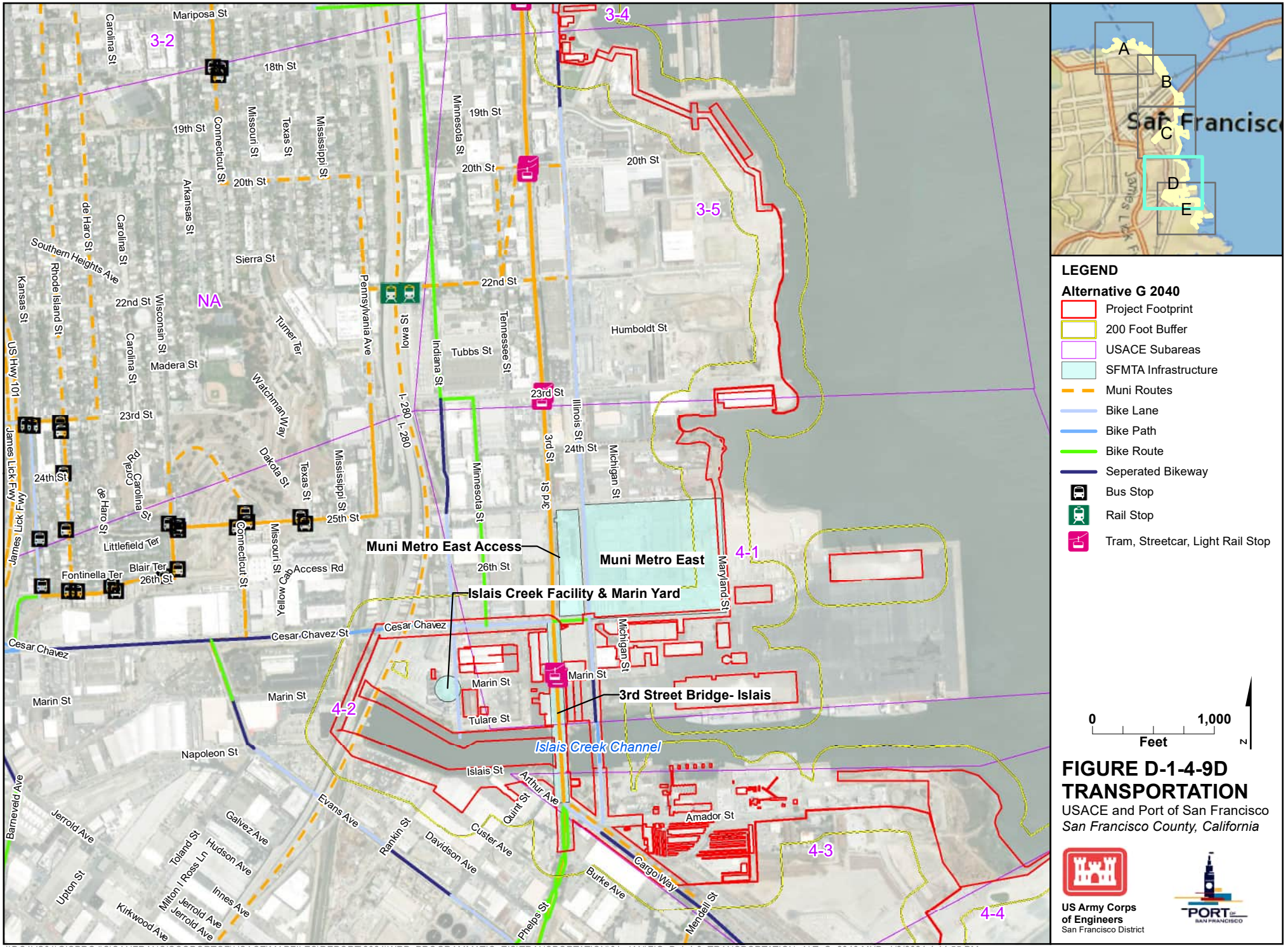
Alternative G 2040


Pier 43 1/2
Embarcadero - Full Extent
Pier 39
Kirkland Yard
1-1
1-2
1-3
2-1
NA
Fishermans Wharf
Jones St
Tonquin St
Jefferson St
Embarcadero North St
Beach St
N Point St
Bay St
Francisco St
Chestnut St
Lombard St
Greenwich St
Filbert St
Green St
Vallejo St
Broadway St
Grant Ave
Kearny St
The Embarcadero
Montgomery St
Sansome St
Battery St
Columbus Ave
Via Ferlinghetti
McDowell Ave
Van Ness Ave
Bergen Aly
Fort Mason 12
Macarthur Ave
Schofield Rd
Pope Rd
Funston Rd
Franklin St
Culebra Ter
Polk St
Larkin St
Hyde St
Leavenworth St
Jones St
Taylor St
Mason St
Venard Aly
Newell St
Jansen St
Powell St
Stockton St
Tuscany Aly
Brant Aly
Via Bufano
Scotland St
Roach St
Redfield Aly
Marion Pl
Black Pl
Moore Pl
Eastman Pl
Warner Pl
Delgado Pl
Hamlin St
Union St
Havens St
Kent St
Winter Pl
August Aly
Eaton Pl
Macondary Ln
Green St
Alta Vista Ter
Emery Ln
Tracy Pl
Fallon Pl
Unkown Aly
Fresno St
Dunnes Aly
Verdi Pl
Stevens Aly
Osgood Pl
Bartol St
Hodges Aly
Kohler Pl
Castle St
Windsor Pl
Reno Pl
Varennes St
Genoa Pl
Sonoma St
Margrave Pl
Pollard Pl
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Bannam Pl
Napier Ln
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Worden St
Midway St
Bellair Pl
Pfeiffer St
Vandewater St
Water St
Houston St
Fielding St
Edgardo Pl
Medau Pl
Pardee Aly
Lurmont Ter
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Octavia St
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US Hwy 101
US Hwy 101 Bus
Telegraph Hill Blvd
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Calhoun Ter
Front St
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Cowell Pl
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Filbert St
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Mason St
Chestnut St
Fielding St
Lombard St
Greenwich St
Valparaiso St
Filbert St
Green St
Vallejo St
Broadway St
Grant Ave
Columbus Ave
Via Ferlinghetti
Kearny St
The Embarcadero
Montgomery St
Sansome St
Battery St
Front St
Commerce St
Green St
Vallejo St
Broadway St


1-2
1-3
2-1
2-2
3-1
NA
Embarcadero- North
San Francisco Ferry Building
F Loop
Embarcadero- South
Folsom Portal
Kearny St
Chestnut St
Lombard St
Greenwich St
Filbert St
Union St
Commerce St
Green St
Vallejo St
Broadway St
Pacific Avenue Mall
Davis St
Front St
Battery St
Jackson St
Gold St
Pacific Ave
Broadway
Columbus Ave
Washington St
Merchant St
Clay St
Sacramento St
Halleck St
California St
Pine St
Bush St
Sutter St
Post St
Geary St
Ofarrell St
Ellis St
Market St
Stevenson St
Mission St
Howard St
Folsom St
Harrison St
Bryant St
Main St
Spear St
Beale St
Fremont St
1st St
2nd St
3rd St
4th St
Natoma St
Minna St
Tehama St
Clementina St
Tenny Pl
Grove Pl
Zeno Pl
Elkhart St
Guy Pl
Lansing St
Essex St
Delancey St
Dow Pl
Hawthorne St
Malden Alley
Aldrich Alley
New Montgomery St
Jessie St
Jessie Shaw Alley
Elim St
Stewart St
The Embarcadero
Pier
Hinckley Walk
Drumm St
Embarcadero South St
James Lick Fwy
I-80
Bay Brg
Telegraph Hill Blvd
Darrell Pl
Napier Ln
School Aly
Alta St
Calhoun Ter
Hodges Aly
Prescott Ct
Osgood Pl
Sansome St
Cowell Pl
Davis Ct
Dunnes Aly
Rowland St
Jerome Aly
Montgomery St
Custom House Pl
Hinckle Walk
Merchant St
Leidesdorff St
Front St
Kearny St
Spring St
Belden Pl
Mills Pl
Petrarch Pl
Treasury Pl
Trinity Pl
Quincy St
St George Aly
Mark Ln
Robert Kirk Ln
Vermehr Pl
Harlan Pl
Hardie Pl
Vinton Ct
Chatham Pl
Burritt St
Maiden Ln Ln
Kearny St
Annie St
Stockton St
Stevenson St
Jessie St
Ellis St
Ofarrell St
Geary St
Post St
Sutter St
Bush St
Pine St
California St
Sacramento St
Clay St
Merchant St
Washington St
Jackson St
Gold St
Broadway St
Vallejo St
Fresno St
Green St
Union St
Filbert St
Greenwich St
Lombard St
Chestnut St
Kearny St
Child St



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LEGEND

Alternative G 2040

- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- SFMTA Infrastructure
- Muni Routes
- Bike Lane
- Bike Path
- Bike Route
- Seperated Bikeway
- Bus Stop
- Rail Stop
- Tram, Streetcar, Light Rail Stop

FIGURE D-1-4-9D
TRANSPORTATION

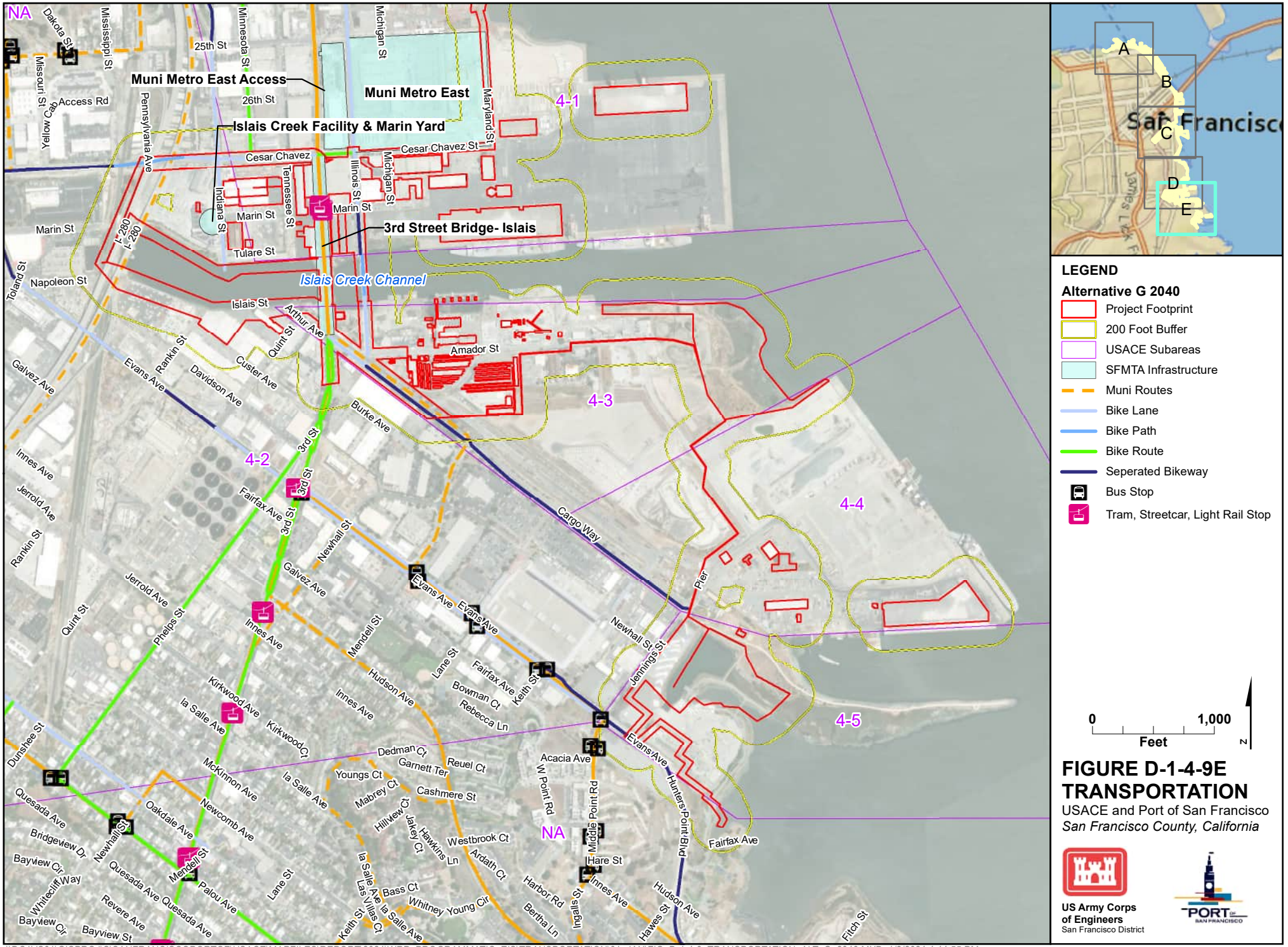
USACE and Port of San Francisco

San Francisco County, California

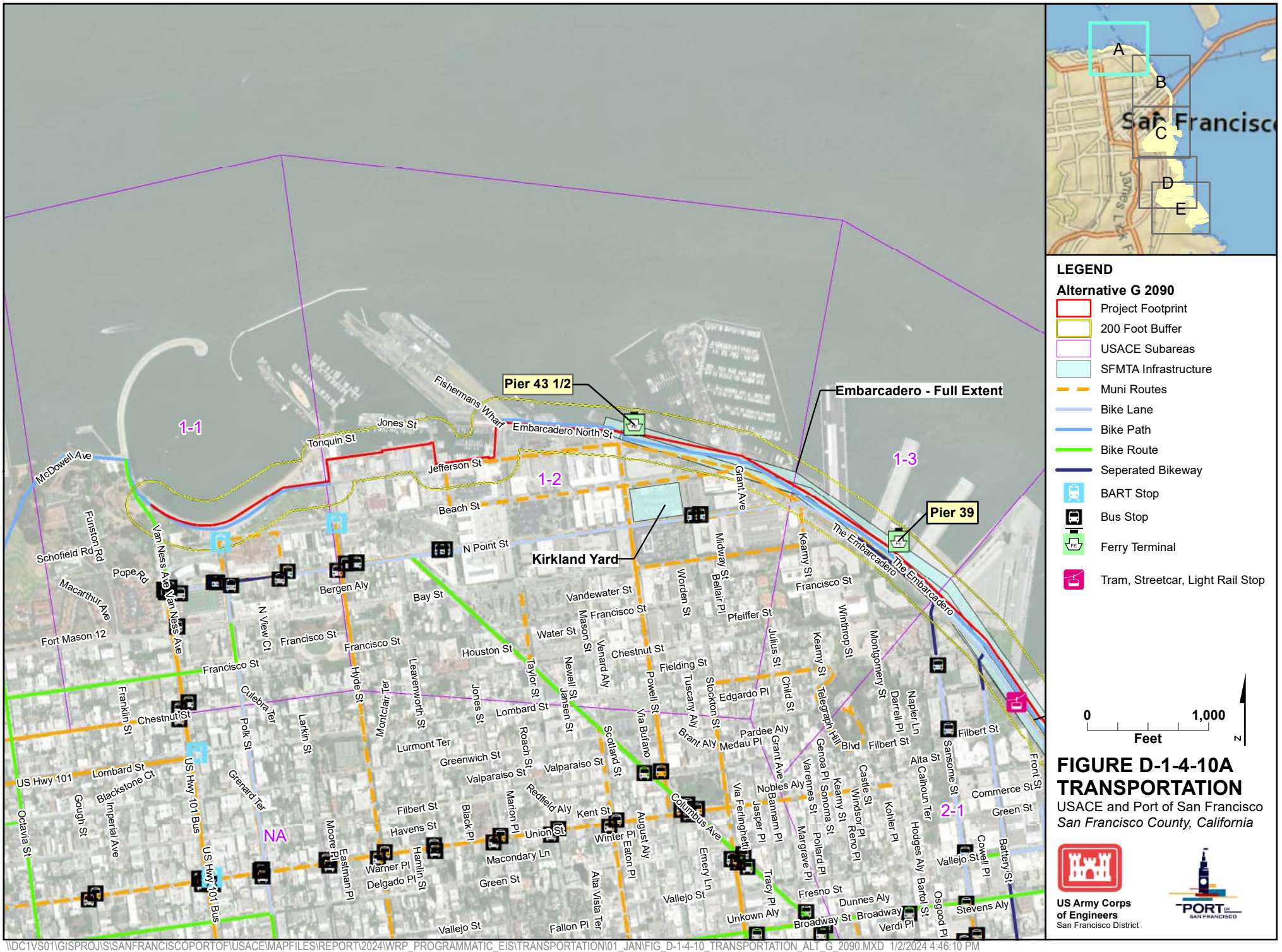
US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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Muni Metro East Access
Muni Metro East
Islais Creek Facility & Marin Yard
3rd Street Bridge- Islais
Islais Creek Channel
4-1
4-2
4-3
4-4
4-5
NA
25th St
26th St
Cesar Chavez
Cesar Chavez St
Marin St
Tulare St
Islais St
Amador St
Burke Ave
3rd St
Evans Ave
Cargo Way
Pier
Newhall St
Jennings St
Fairfax Ave
Innes Ave
Hudson Ave
Kirkwood Ave
Mendell St
Quint St
Rankin St
Galvez Ave
Jerrold Ave
Phelps St
Dunshee St
Quesada Ave
Bayview Cir
Bayview St
Palou Ave
Revere Ave
Oakdale Ave
McKinnon Ave
Newcomb Ave
Lane St
Keith St
Bowman Ct
Rebecca Ln
Dedman Ct
Garnett Ter
Reuel Ct
Youngs Ct
Mabrey Ct
Cashmere St
Hillview Ct
Jakey Ct
Hawkins Ln
Westbrook Ct
Ardath Ct
Bass Ct
Whitney Young Cir
Harbor Rd
Bertha Ln
Ingalls St
Hare St
Middle Point Rd
W Point Rd
Acacia Ave
Hunters Point Blvd
Fairfax Ave
Innes Ave
Hawes St
Fitch St
Ia Salle Ave
Las Villas Ct
Whitecliff Way
Bridgeview Dr
Yellow Cab Access Rd
Missouri St
Mississippi St
Minnesota St
Michigan St
Maryland St
Pennsylvania Ave
Illinois St
Tennessee St
Indiana St
I-280
Napoleon St
Toland St
Arthur Ave
Quint St
Custer Ave
Davidson Ave
Evans Ave
Galvez Ave
Innes Ave
Jerrold Ave
Rankin St
Dakota St
Marin St
Access Rd
Newhall St
Mendell St
Lane St
Keith St
Fairfax Ave
Bowman Ct
Rebecca Ln
Hudson Ave
Kirkwood Ct
Ia Salle Ave

Alternative G 2090



LEGEND

Alternative G 2090

- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- SFMTA Infrastructure
- Muni Routes
- Bike Lane
- Bike Path
- Bike Route
- Seperated Bikeway
- BART Stop
- Bus Stop
- Ferry Terminal
- Tram, Streetcar, Light Rail Stop

0 1,000 Feet

N

FIGURE D-1-4-10A TRANSPORTATION

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San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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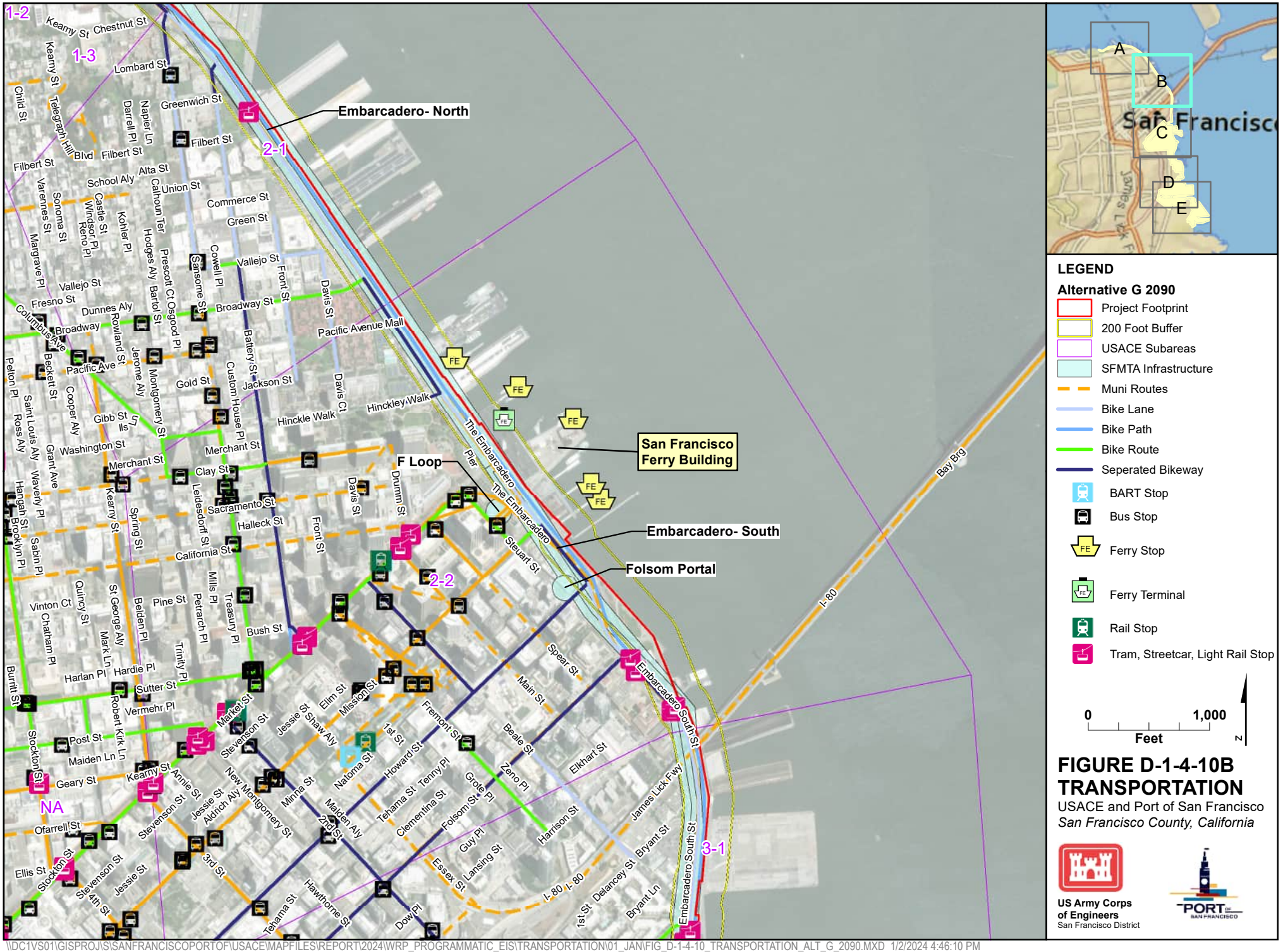


FIGURE D-1-4-10B
TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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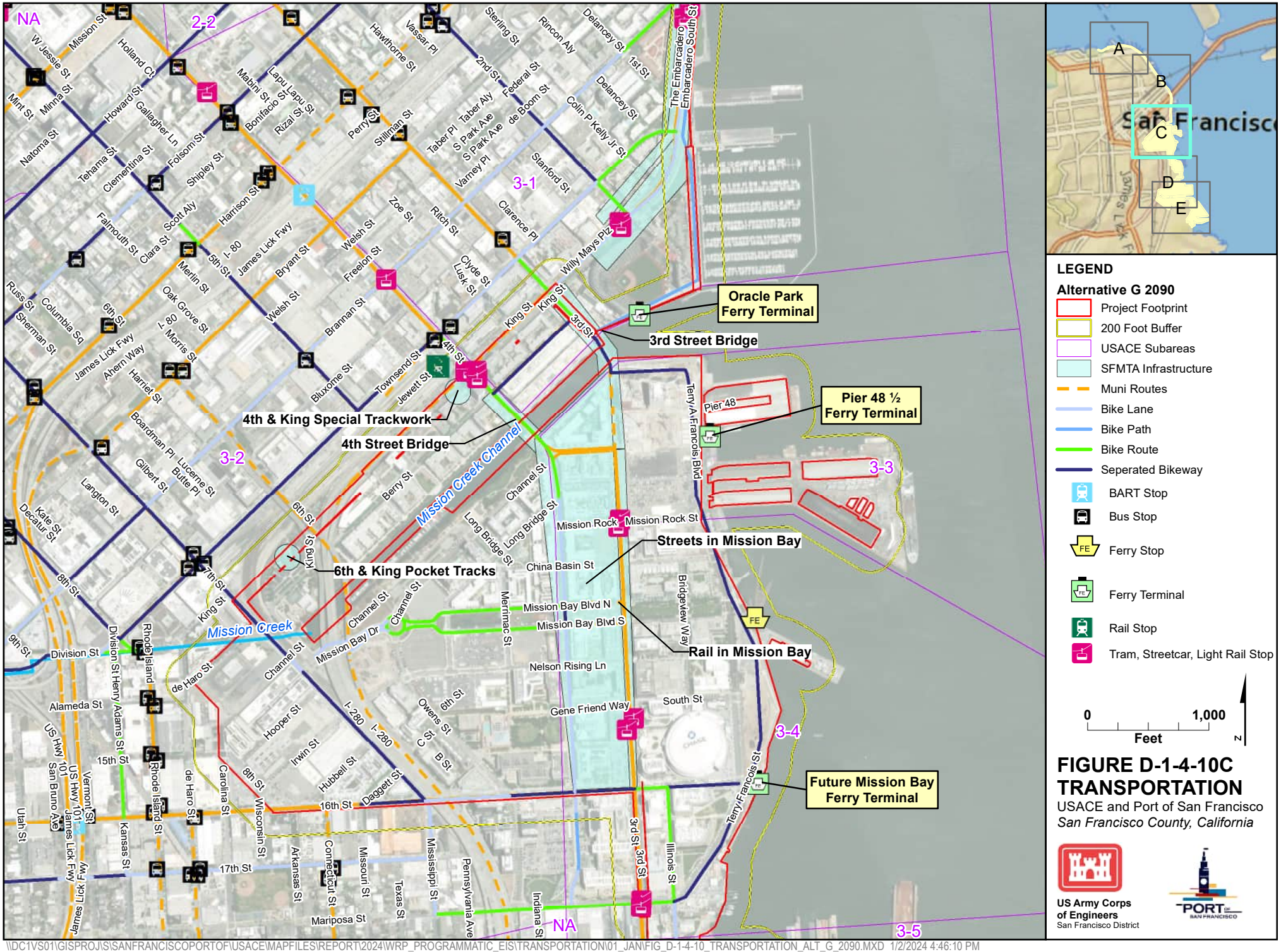


FIGURE D-1-4-10C TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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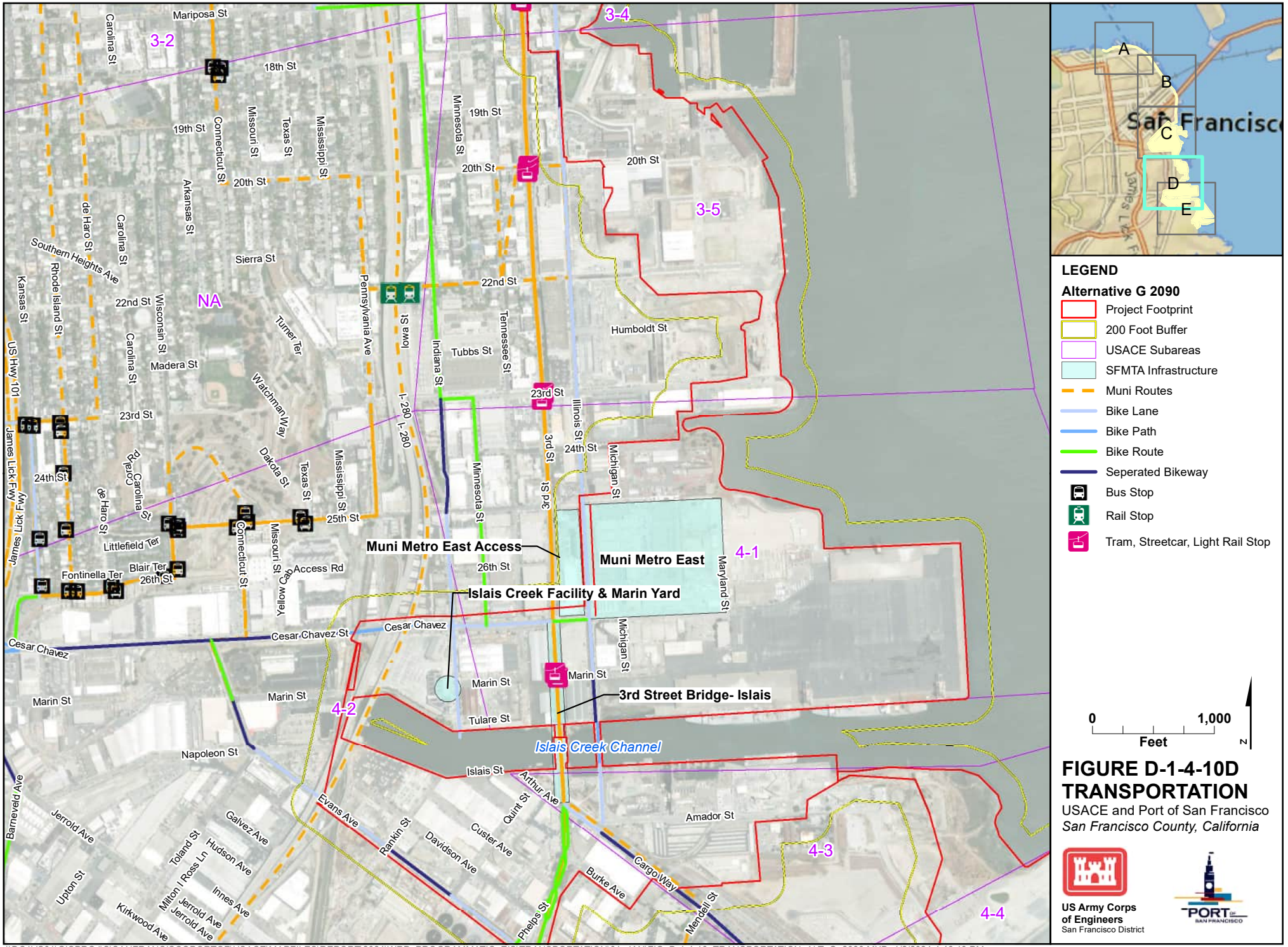


FIGURE D-1-4-10D
TRANSPORTATION

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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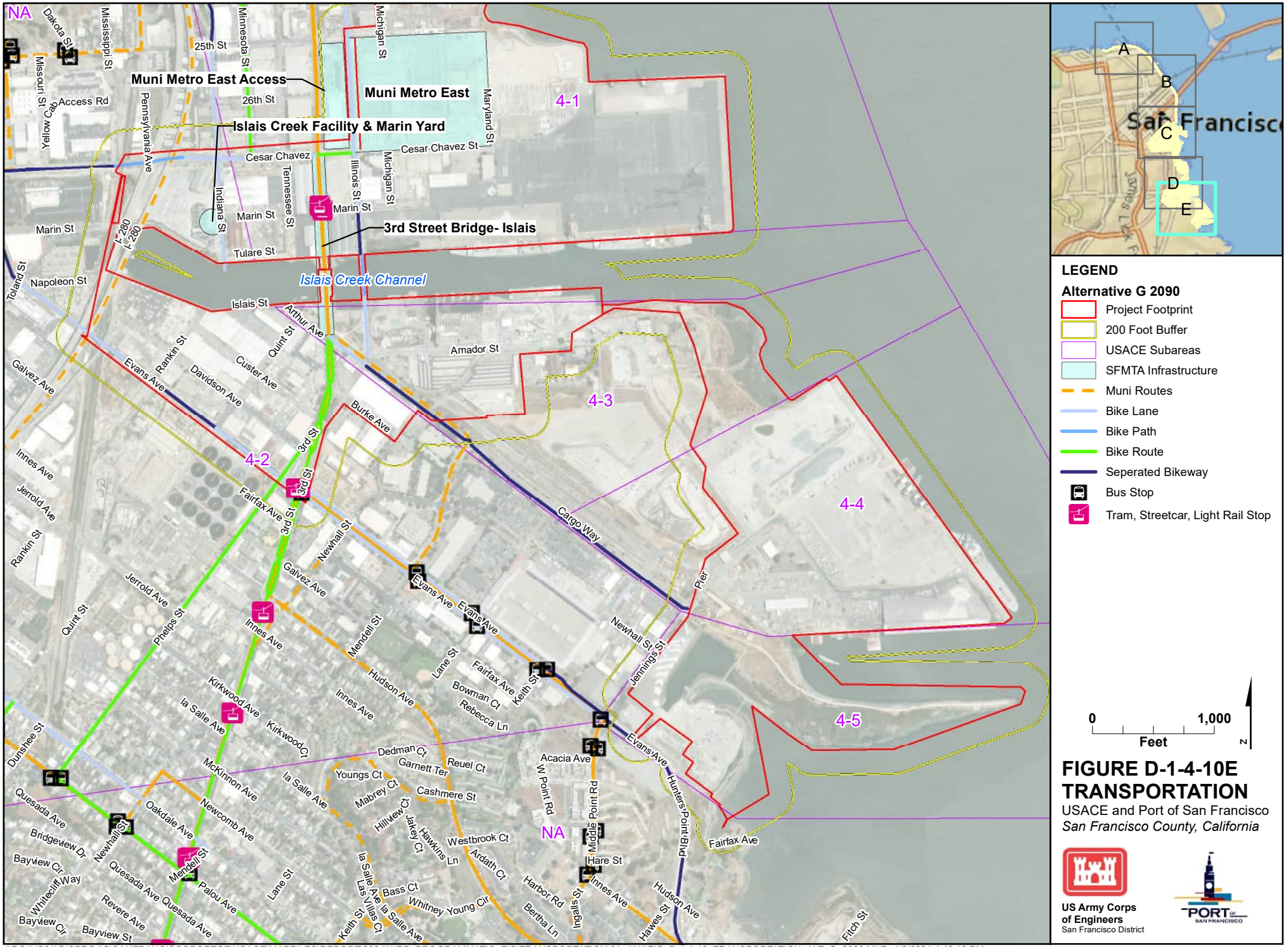


FIGURE D-1-4-10E
TRANSPORTATION

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San Francisco County, California

US Army Corps of Engineers
San Francisco District

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Independent Measures

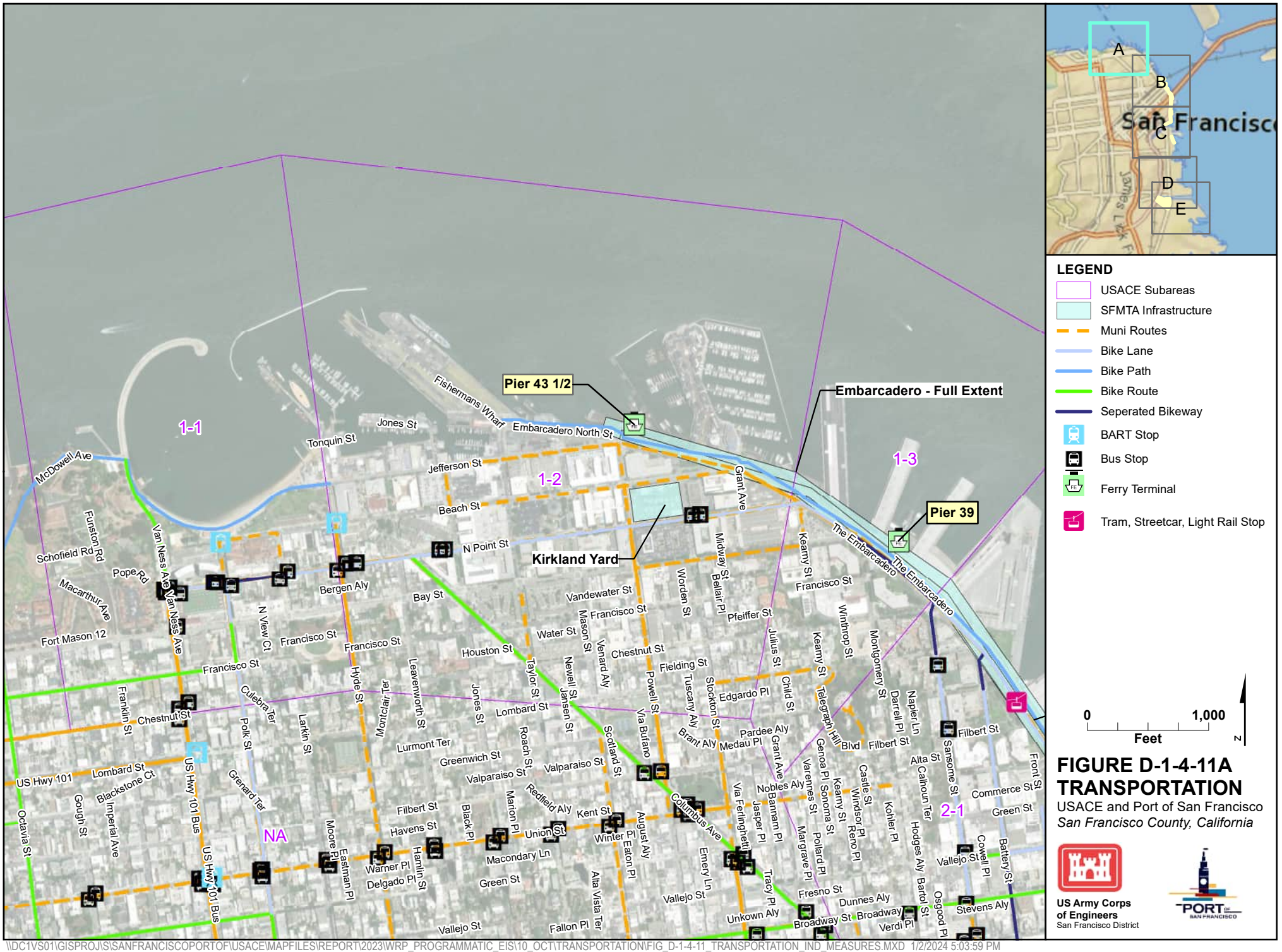


FIGURE D-1-4-11A
TRANSPORTATION

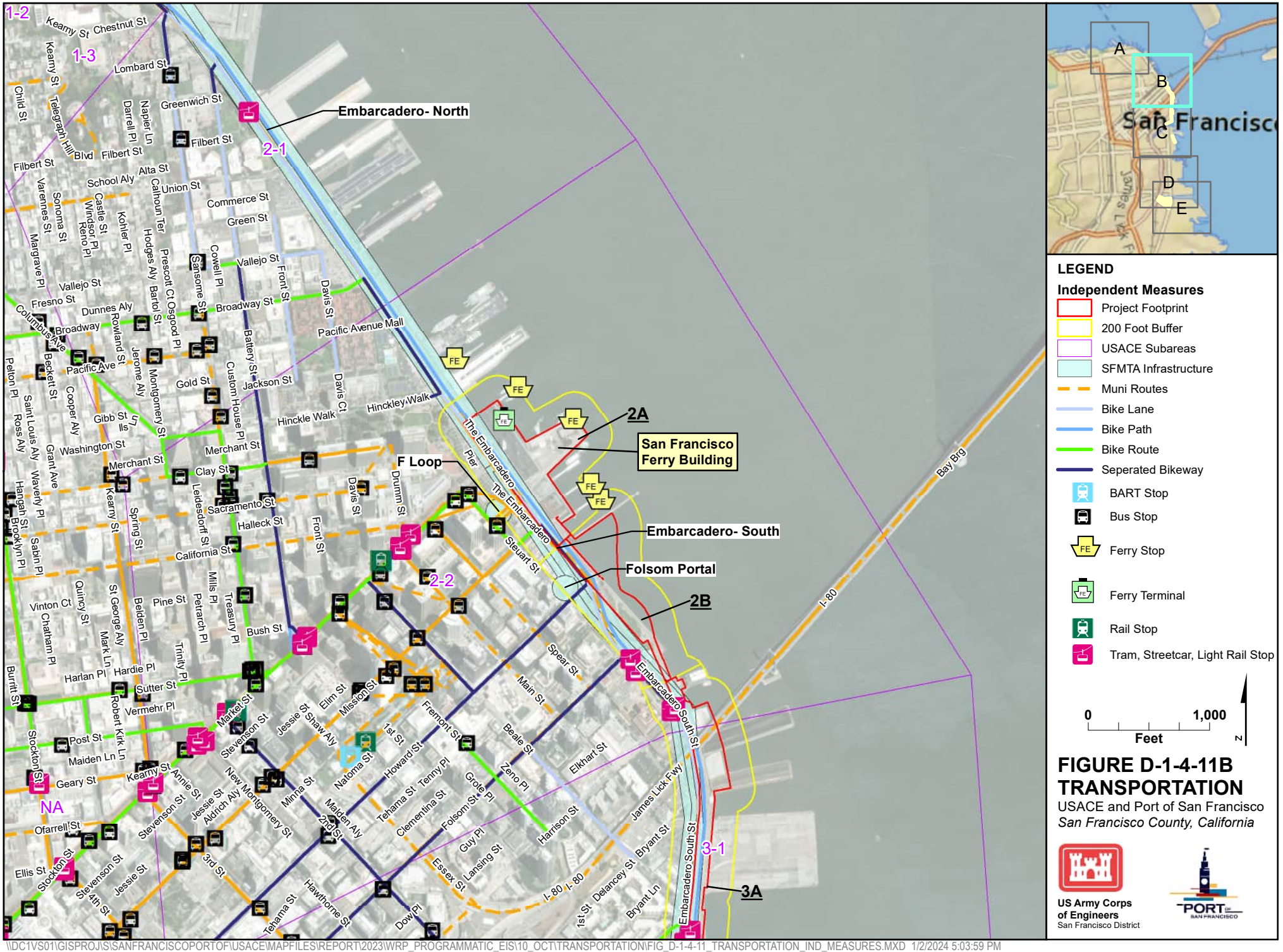
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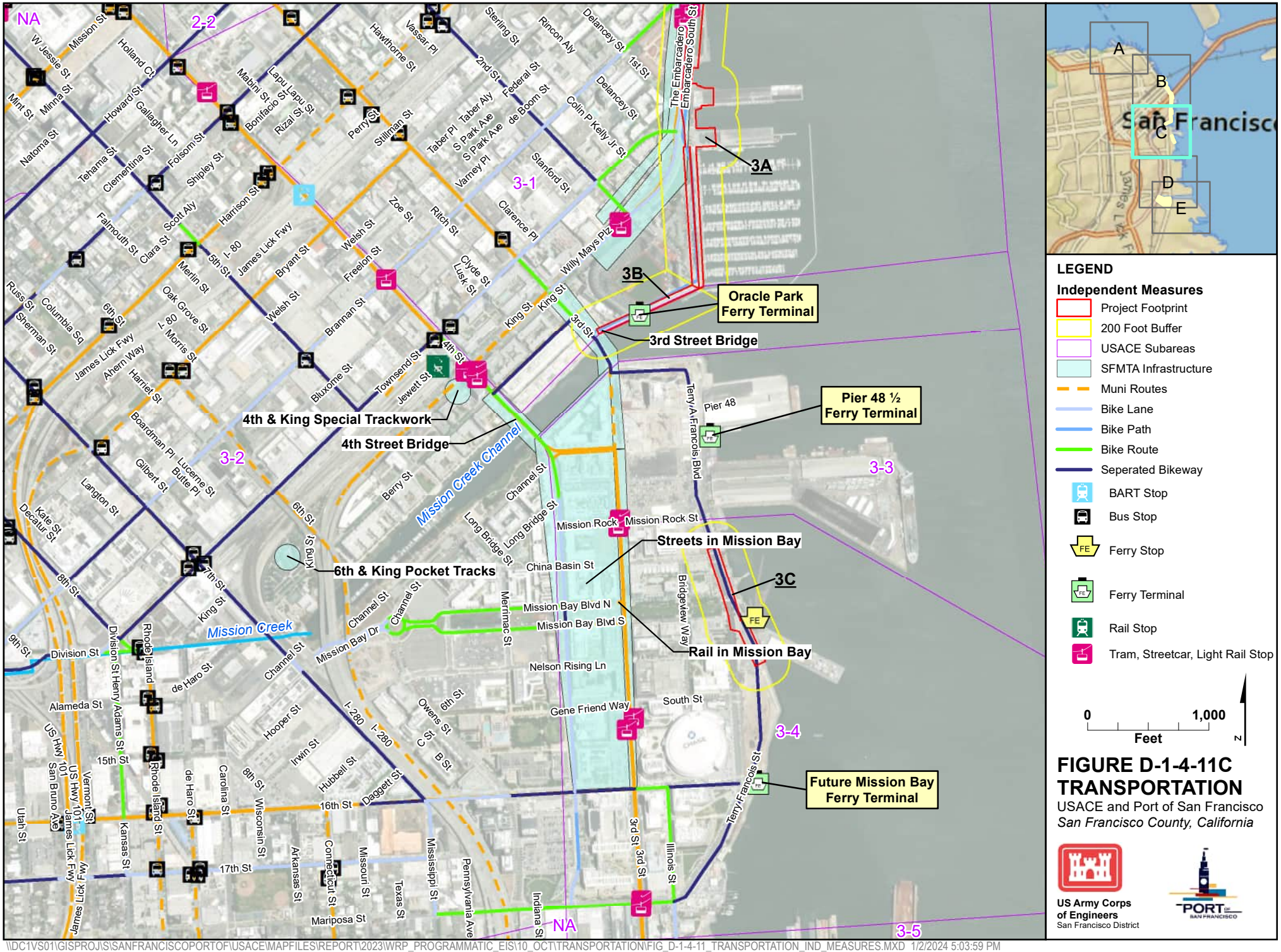
San Francisco County, California

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San Francisco District

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1-2
1-3
2-1
2-2
3-1
NA
Embarcadero- North
2A
San Francisco Ferry Building
F Loop
Embarcadero- South
Folsom Portal
2B
3A
Kearny St
Chestnut St
Lombard St
Greenwich St
Filbert St
Telegraph Hill Blvd
Union St
Green St
Vallejo St
Broadway St
Pacific Avenue Mall
Columbus Ave
Pacific Ave
Jackson St
Hinckley Walk
The Embarcadero
Pier
Bay Brg
Washington St
Merchant St
Clay St
Sacramento St
California St
Halleck St
Pine St
Bush St
Spear St
Main St
Steuart St
Embarcadero South St
Market St
Stevenson St
Jessie St
Shaw Alley
Elim St
Mission St
1st St
Fremont St
Beale St
Howard St
Natoma St
Tehama St
Tenny Pl
Clementina St
Folsom St
Grove Pl
Zeno Pl
Elkhart St
Harrison St
James Lick Fwy
Bryant St
Delancey St
Bryant Ln
Embarcadero South St
I-80
Post St
Geary St
Ofarrell St
Ellis St
Stockton St
Kearny St
Annie St
New Montgomery St
Minna St
Aldrich Alley
Malden Alley
2nd St
3rd St
4th St
Hawthorne St
Dow Pl
Essex St
Lansing St
Guy Pl
Sutter St
Post St
Maiden Ln
Vermehr Pl
Hardie Pl
Harlan Pl
Trinity Pl
Mark Ln
Robert Kirk Ln
Belden Pl
Quincy St
St George Alley
Vinton Ct
Chatham Pl
Burritt St
Brooklyn Pl
Sabin Pl
Waverly Pl
Grant Ave
Kearny St
Spring St
Leidesdorff St
Front St
Drumm St
Davis St
Davis Ct
Battery St
Custom House Pl
Montgomery St
Jerome Aly
Rowland St
Gold St
Cooper Aly
Beckett St
Pelton Pl
Saint Louis Aly
Ross Aly
Hangah St
Gibb St
Ills
Merchant St
Dunnes Aly
Fresno St
Margrave Pl
Varennes St
Sonoma St
Windsor Pl
Reno Pl
Castle St
School Aly
Alta St
Darrell Pl
Napier Ln
Child St
Filbert St
Calhoun Ter
Hodges Alley
Prescott Ct
Osgood Pl
Bartol St
Sansome St
Cowell Pl
Front St
Davis St
Commerce St
Kohler Pl
Mills Pl
Petrarch Pl
Treasury Pl
Pacific Ave Mall
Hinckle Walk
Drumm St
Stevenson St
Jessie St
Shaw Alley
Elim St
Mission St
Natoma St
Howard St
Tenny Pl
Clementina St
Folsom St
Grove Pl
Zeno Pl
Elkhart St
Harrison St
James Lick Fwy
Bryant St
Delancey St
Bryant Ln
Embarcadero South St
I-80
Spear St
Main St
Beale St
Fremont St
1st St
Malden Alley
2nd St
Minna St
New Montgomery St
Aldrich Alley
Jessie St
Annie St
Kearny St
Geary St
Post St
Maiden Ln
Stockton St
Ofarrell St
Ellis St
Stevenson St
Jessie St
3rd St
4th St
Stockton St
Hawthorne St
Tehama St
Dow Pl
Essex St
Lansing St
Guy Pl



LEGEND

Independent Measures

- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- SFMTA Infrastructure
- Muni Routes
- Bike Lane
- Bike Path
- Bike Route
- Seperated Bikeway
- BART Stop
- Bus Stop
- Ferry Stop
- Ferry Terminal
- Rail Stop
- Tram, Streetcar, Light Rail Stop

0 1,000 Feet

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FIGURE D-1-4-11C TRANSPORTATION

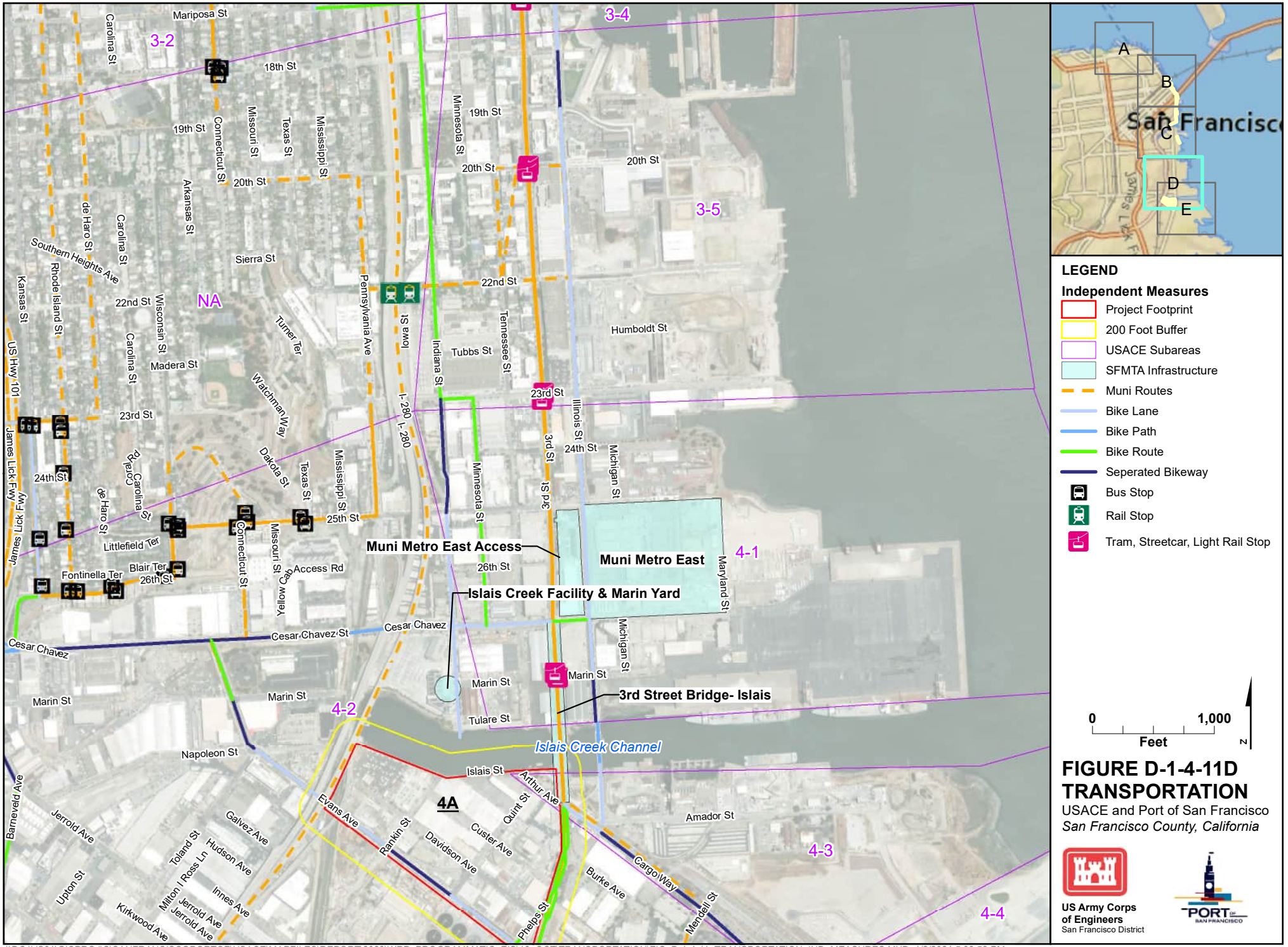
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San Francisco County, California

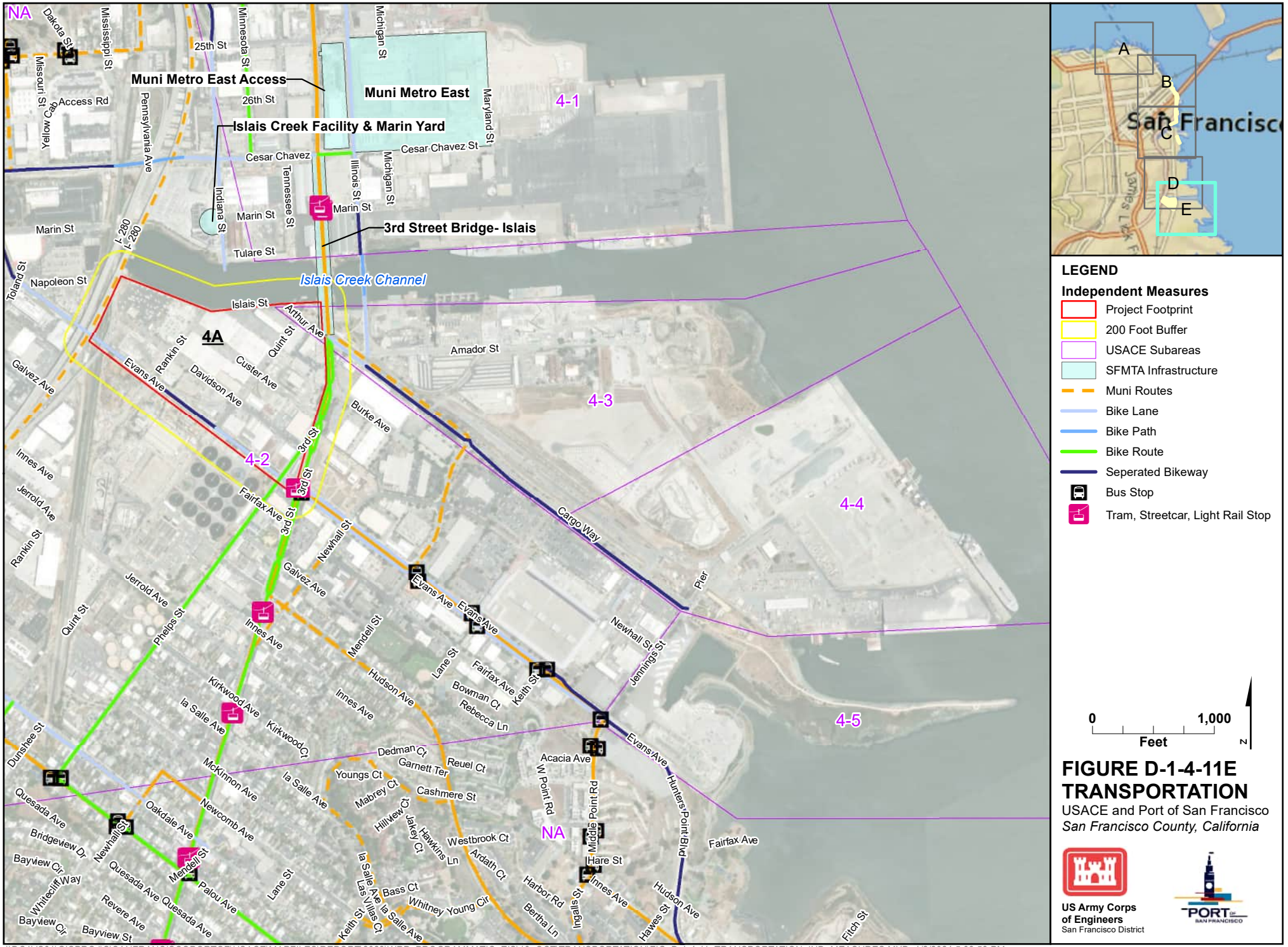
US Army Corps of Engineers
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PORT OF SAN FRANCISCO

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Transportation Table D-1-4-18

Roadway Class within Project Footprints

Table D-1-4-18 – Class of Roadways within Project Footprint and Construction Buffer Impacts in feet

Alternative	Action and Area	Class 1 Freeway	Class 3 Arterial Street	Class 4 Collector Street	Class 5 Residential Street	Class 6 Freeway Ramp	Class 0 Other (private streets, etc.)
TBP	First Action Footprint	631	14,038	197	2,695	377	15,016
TBP	First Action Construction Buffer	4,807	11,367	2,697	28,530	1,400	31,092
TBP	Second Action Footprint	1,389	5,873	932	4,106	258	8,208
TBP	Second Action Construction Buffer	3,599	6,672	1,156	22,384	1,492	16,980
Alternative B	2040 Footprint	5,008	14,675	10,222	45,919	2,954	37,273
Alternative B	2040 Construction Buffer	4,934	20,393	9,304	32,943	1,104	34,117
Alternative B	2065 Footprint	5,902	13,039	9,110	39,953	1,698	12,872
Alternative B	2065 Construction Buffer	8,001	16,605	13,314	51,870	2,772	30,236
Alternative B	2090 Footprint	2,467	17,601	7,693	43,443	1,110	14,630
Alternative B	2090 Construction Buffer	8,274	21,091	14,474	63,783	4,206	39,842
Alternative B	2115 Footprint	753	4,922	3,167	17,972	597	9,291
Alternative B	2115 Construction Buffer	9,971	25,409	19,635	76,515	3,586	31,980
Alternative F	2040 Footprint	324	10,562	652	5,085	-	13,576
Alternative F	2040 Construction Buffer	1,591	13,351	2,813	22,498	-	17,132
Alternative F	2090 Footprint	13	-	-	4,979	-	10,400
Alternative F	2090 Construction Buffer	977	18,292	2,067	31,056	-	21,068
Alternative G	2040 Footprint	1,626	24,493	1,130	16,498	259	23,227
Alternative G	2040 Construction Buffer	5,934	9,998	2,687	35,120	2,480	28,070
Alternative G	2090 Footprint	7,061	17,022	6,754	69,479	3,395	53,619
Alternative G	2090 Construction Buffer	4,259	27,625	3,338	26,257	1,240	32,483

Table D-1-4-18 – Class of Roadways within Project Footprint and Construction Buffer Impacts in feet

Alternative	Action and Area	Class 1 Freeway	Class 3 Arterial Street	Class 4 Collector Street	Class 5 Residential Street	Class 6 Freeway Ramp	Class 0 Other (private streets, etc.)
Independent Measures							
Measure 2A	Footprint	-	1,319	10	-	-	17
Measure 2A	Construction Buffer	-	1,681	201	-	-	1,380
Measure 2B	Footprint	-	602	-	-	-	1,958
Measure 2B	Construction Buffer	-	1,849	206	-	-	595
Measure 3A	Footprint	580	2,909	-	-	-	1,087
Measure 3A	Construction Buffer	958	5,054	130	630	-	1,149
Measure 3B	Footprint	-	-	-	-	-	-
Measure 3B	Construction Buffer	-	419	-	-	-	53
Measure 3C	Footprint	-	-	-	811	-	993
Measure 3C	Construction Buffer	-	-	-	1,218	-	484
Measure 4A	Footprint	-	-	2,073	6,389	-	812
Measure 4A	Construction Buffer	1,890	3,774	588	2,022	-	2,366

Source: USACE Alternatives GIS files with analysis conducted by Jacobs on roadway impacts.

Note: No impacts were identified for Class 2 roadways, major street or highway, and, therefore, this column was not included.

Transportation Table D-1-4-19
Parking Facilities

Table D-1-4-19- Parking Facilities within Project Footprint

Name	Reach	Number of Parking Spots
Hyde Street Harbor	1	13
Capurro's	1	25
Taylor/Little Embarcadero	1	53
Pier 45 - Shed C	1	37
Seawall Lot 301	1	125
Pier 39 Garage	1	1110
Seawall Lot 314	1	106
Pier 29 1/2 Shed	1	68
Pier 27 - Lot #81	2	122
Pier 19 1/2 Shed	2	77
Seawall Lot 321/Big Triangle	2	192
Kron 4 Parking	2	45
Pier 9	2	31
Seawall Lot 323-324/Aqua Lot	2	200
Washington Parking Lot	2	80
Pier 3 Hornblower Landing	2	112
Seawall Lot 328 - Gap	2	30
Pier 26 - Lot #65	2	42
Bayside Lot - Lot #26	3	160
Pier 30 - Lot #30	3	1130
Pier 40	3	40
South Beach Harbor	3	167
Oracle Park	3	34
Pier 50/401 TFB	3	29
Pier 50	3	60
Pier 52 Boat Launch	3	60
Pier 54	3	23
The Ramp	3	14
Crane Cover Lot #149	3	171
590 Georgia Street	3	37
Seawall Lot 349	3	234

Table D-1-4-19- Parking Facilities within Project Footprint

Pier 70 - Lot #118	3	207
Pier 70 - Parcel K	3	107
Pier 80 Admin. Building	4	104
Pier 80 - Gear and Maintenance Shed	4	15
Pier 80	4	6806
Pier 90 West	4	23
Pier 90	4	38
Pier 94	4	60
San Francisco Bay Railway	4	18
Pier 96/ SFCC POL/ HSA	4	200
Heron's Head Park	4	25
Recycle Central	4	76

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.1.5
HABITAT MODELING

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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List of Attachments

Attachment 1: Detailed Maps of Recommended Plan

Acronyms and Abbreviations

Acronym	Definition
AAA	Acronyms and Abbreviations
DSAY	discounted-service-acre-year
DSUY	discounted-service-unit-year
EWN	Engineering with Nature
HEA	Habitat Equivalency Analysis
LF	Linear Feet
NAVD88	North American Vertical Datum of 1988
NNBF	Natural and Nature-Based Features
RSLC	Relative Sea Level Change
SFWCFS	San Francisco Waterfront Coastal Flood Study, CA
SQFT	Square Feet
TSP	Tentatively Selected Plan

1.0 Introduction

This annex provides documentation of the habitat evaluation and quantification process that was conducted to evaluate potential adverse and beneficial impacts to various habitat types if the recommended plan of the San Francisco Waterfront Coastal Flood Study, CA (SFWCFS) is implemented. Quantification is needed in the project planning process to evaluate benefits or impacts of project features because traditional benefit/cost evaluation is not applicable when valuing habitat.

1.1 Study Area

The study area extends approximately 7.5 miles from Aquatic Park in the northeast to just past Heron's Head Park in the south. The study area is divided into four reaches for evaluating environmental impacts (**Figure D.1.5-1**). These reaches were chosen based on hydrologic separability, identifiable geographic references, specific wave action within each reach, and major differences in physical structure inventory. These reaches also provide a neighborhood-scale approach to communicate risks, impacts, and alternatives. Reach delineations included:

- **Reach 1:** Covers Aquatic Park, Fisherman's Wharf, Pier 31 to Pier 35, and the North Beach neighborhood.
- **Reach 2:** Includes the Northeast Waterfront and Financial District. This area comprises a significant portion of the Embarcadero Historic District and includes popular sites such as the Exploratorium, Embarcadero Promenade, and the San Francisco Ferry Building.
- **Reach 3:** Contains South Beach, Mission Creek, Mission Rock, Mission Bay and Pier 70, and includes the South Beach, SoMa, and Mission Bay neighborhoods. This area is known for the Giants' baseball stadium, Chase Center, and access to Mission Creek and the Bay. It is one of the densest residential areas within the study area.
- **Reach 4:** Encompasses Pier 80, Islais Creek, Cargo Way, Pier 96, and Heron's Head Park. This area is comprised of industrial uses along the waterfront and provides critical industrial, maritime, and commercial Port functions.



Figure D.1.5-1: Project Location Outlining the Four reaches of the Study Area

Much of the northern shoreline (i.e., north of the San Francisco Giants ballpark) is engineered with bulkhead wharves and finger piers, while the southern shoreline includes two inlets (Mission Creek and Islais Creek), working piers (Piers 80 – 96), and areas with sensitive habitat such as the Pier 94 wetlands and Heron's Head Park (**Figure D.1.5-2**). Much of the areas inland from the shoreline are built on reclaimed land that was filled over time (bay fill) to support the construction of the historic Embarcadero seawall in the late 1800s, and the ship building industries that supported the World Wars in the early 1900s (**Figure D.1.5-3**). This man-made shoreline is relatively flat, with a mean elevation of approximately 11.8 feet North American Vertical Datum of 1988 (NAVD88). The areas inland of the shoreline are high-density urban and industrial areas.

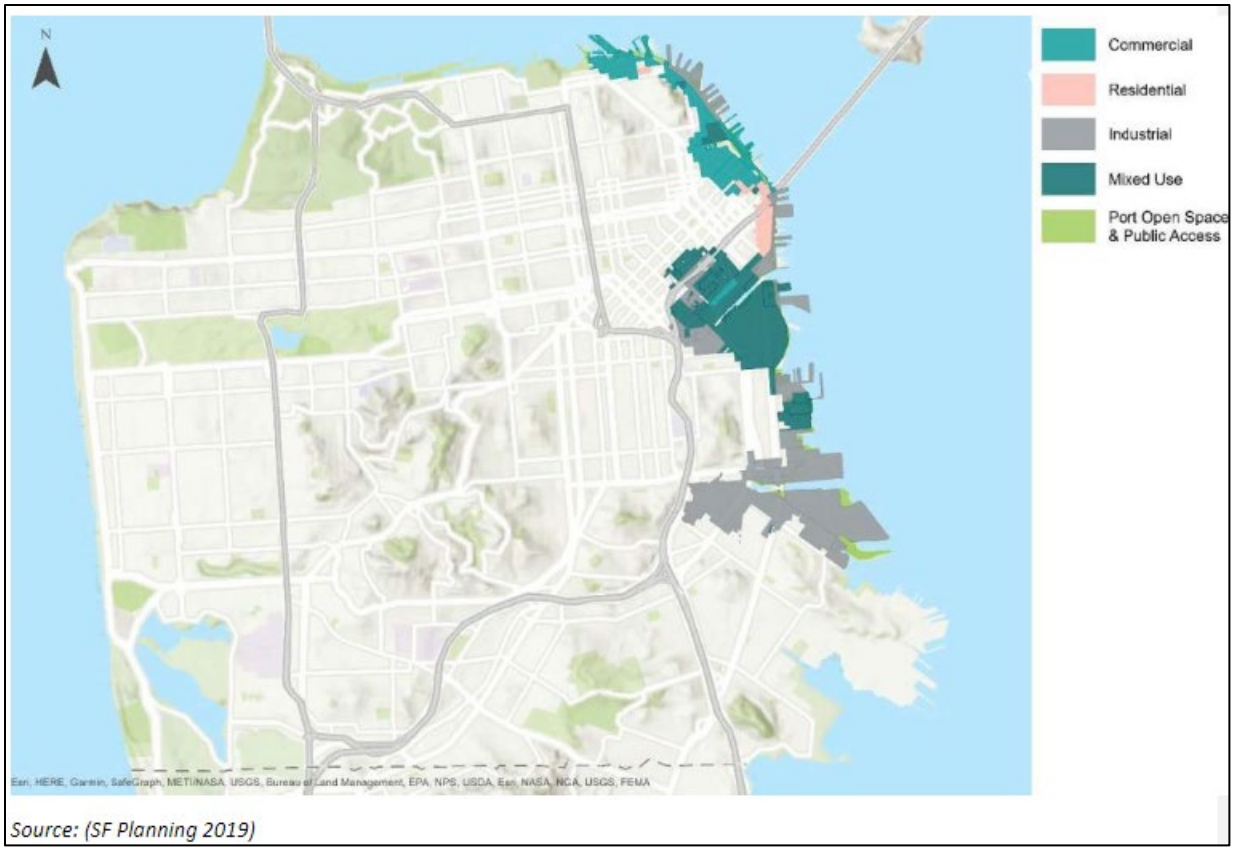


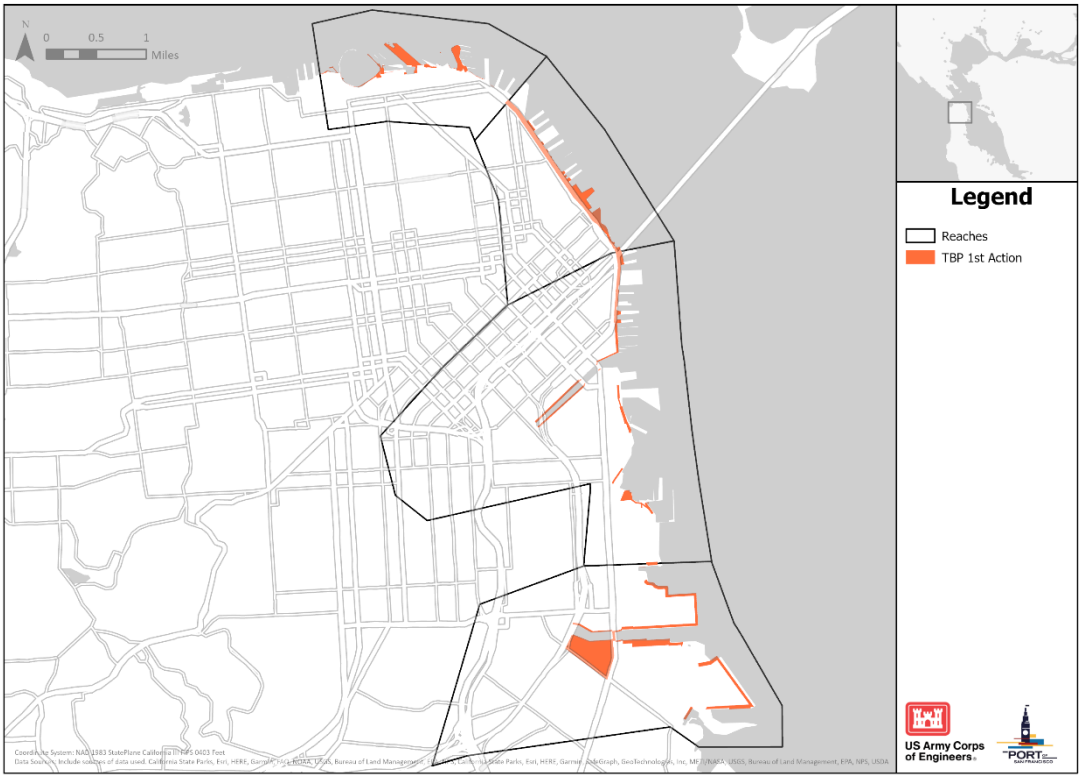
Figure D.1.5-2: Land Use in the Study Area



Figure D.1.5-3: Historic Shoreline and Areas of Reclaimed Land Built on Bay Fill

1.2 Recommended Plan

The Recommended Plan includes a combination of the following measures: floodproofing methods (i.e., elevate or demolition buildings), berms, sea wall/bulkhead walls, raising and rebuilding wharves, deployable flood gates, seismic ground improvement, and Engineering with Nature (EWN) features. The project map provides an overview of where proposed features would occur along the San Francisco waterfront, simplified to lines and polygons of the construction footprint (**Figure D.1.5-4**). Detailed maps are provided in Attachment 1 that define the measures occurring in each reach, with anticipated construction footprint, and include a description of how measures are assumed to be constructed.



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Figure D.1.5-4: Footprint for Measures Proposed for Construction in the First Actions of the Recommended Plan

A description of the construction activities for the proposed action are provided in the following sections below. Approximate spatial extent (e.g., linear feet [LF], acres, square feet [SQFT]) for the construction footprint of measures are provided in **Table D.1.5-1**. A general description of the construction methods and equipment, as well as anticipated duration for construction is provided below.

Table D.1.5-1: Recommended Plan Construction Footprint Quantities

Measure	Total Project		
	LF	ft^2	Acres
Floodproofing	--	2,835,000	65
Deployable	--	50,000	1
Elevate Structures	--	750,000	17
Relocate Structures	--	175,000	4
Remove Structures	--	195,000	4
Curb Wall	51,200	--	--
Elevate Shoreline	11,500	1,030,000	24
Seawall	21,000	--	--
T-wall	1,000	--	--
Elevate/Rebuild Wharf	10,900	660,000	15
Paved Levee	1,800	80,000	2
Planted Levee with EWN Features	11,800	865,000	20
Sheet Pile Wall with EWN Features	2,900	20,000	0
EWN – Marsh/Coarse Beach Restoration	--	225,000	5
EWN – Rocky Intertidal Bluff	--	85,000	2
Living Seawalls	TBD	--	--
Bay Fill	--	395,000	9
Ground Improvements	38,400	--	--

**Note: Linear Feet (LF) is rounded to the nearest 100 feet, and square feet (ft^2) is rounded to the nearest 5,000 ft^2, and acres are rounded to the nearest whole number. Values denoted as "--" indicate the measurement was not calculated or applicable.*

1.2.1 Avoidance and Minimization Measures Incorporated into the Designs

The Recommended Plan avoids a significant amount of unavoidable adverse impacts to ecological habitats by placing the line of defense at or landward of the existing shoreline and designing the project to avoid bay fill to the greatest extent practicable and integrating engineering with nature where feasible. The following is a brief assessment of the avoidance and minimization measures by reach and action.

Of note, Section 1.2 only describes the first actions of the project, while the impact analysis in Sub-Appendix D.1, *Environmental and Cultural Technical Appendix*, discloses expected impacts for the entire project to include adaptable subsequent actions. As such, the avoidance and minimization measures for the project are described in this section separated by first and subsequent actions. Table D.1.5-2provides a high-level overview of first and subsequent actions based on RSLC scenarios by reach.

Table D.1.5-2: Recommended Plan Construction Footprint Quantities

Reach	First Action		Subsequent Action			
	Crest Elevation[1]	Description[2]	Crest Elevation[1]			Description[2]
			Low	Intermediate	High	
1	--	Floodproofing buildings, phased over time (Alternative B)		Only nonstructural action	New defense structure: 19.0 ft NAVD88	*Intermediate*: Floodproof more buildings, phased over time (Alternative B) *High*: Defend at existing shoreline (Alternative G)
2	15.5 feet NAVD88		--	--	19.0 ft NAVD88	*High*: Increase crest elevation of defense structure along existing shoreline (Alternative G)
3	13.5 feet NAVD88		--	15.5 feet NAVD88	19.0 ft NAVD88	Increase crest elevation of defense structure along existing shoreline (Intermediate: Alternative D; High: Alternative E)
4	13.5 feet NAVD88		--	15.5 feet NAVD88	19.0 ft NAVD88	Increase crest elevation of defense structure along existing shoreline (Intermediate: Alternative D; High: Alternative E)

[1]NAVD88 = North America Vertical Datum of 1988[1]Crest elevation columns indicate the assumed structural measures crest elevation for purposes of alternatives evaluation. Actual crest elevations would vary along the waterfront based on local wave conditions, pending further analysis in PED.

[2]First and Subsequent Actions include a mix of structural and nonstructural measures, and NNBFs. The brief description here is intended to highlight key differences by reach.

1.2.1.1 Reach 1

1.2.1.1.1 First Actions

All measures are considered nonstructural, meaning the measure attempts to reduce the flood risk and the damages associated with flooding rather than focusing on reducing or modifying how the water moves through the area. By design, the nonstructural measures realize impacts at the immediate site of the measure which is often isolated to the structure itself (e.g. floodproofing) and do not involve disturbance of ecological habitats. Construction of the 2-foot curb wall around the piers involves minimal construction efforts that would be completed from the pier and would not involve any in-water work, which avoids impacts to any aquatic habitats.

1.2.1.1.2 Subsequent Actions

Under the intermediate relative sea level change (RSLC) scenario, the subsequent actions would include additional non-structural components. Nonstructural measures would not impact any location except at the immediate structure. One acre of building demolition would be completed that would allow the area to be flooded and taken over by RSLC. Here, it is anticipated that intertidal habitat would be naturally created.

For the Subsequent Actions measures under a high RSLC scenario, the seawall alignment and associated seismic ground improvements are landward of the existing shoreline and behind the existing seawall where one currently exists. This design would not require any bayfill or in-water work to construct the features. To maintain the aesthetic quality and accessibility of the waterfront, a gradual slope has been incorporated into the design that will promote unity throughout waterfront that would generally be unnoticeable to the average visitor when the pre-construction and post-construction conditions are compared. The design allows accessibility to all (i.e. fewer steps and gentle slopes) and incorporates and maintains the historic features unique to the waterfront by ensuring the architectural design and materials are consistent with the surrounding environment. This design creates more transportation impacts to achieve the target slope and seawall elevation but fully avoids any impact to aquatic habitats.

With the increase in ground elevation, approximately 3.25 acres of existing wharf would need to be rebuilt to the higher elevation resulting in temporary localized impacts to the aquatic environment during construction. Because of the design, there would be no increase in the footprint of the wharf, all existing wharf material would need to be removed and replaced with new, more eco-friendly materials, and fewer piles would be necessary per square foot than currently exists. Overall long-term benefits to the aquatic environment are expected from the net decrease in bay fill and removal of old materials (e.g. creosote piles) that contribute to poor water quality.

1.2.1.2 Reach 2

1.2.1.2.1 First Actions

Similar to the Subsequent Actions in Reach 1, the First Actions in Reach 2 involves constructing a seawall landward of the existing seawall and rebuilding approximately 8.6 acres of wharf. The design and construction methodology would be identical to the Reach 1 Subsequent Actions and all the same avoidance and minimization efforts and long-term benefits described above would be applicable here. The difference here is that the action would be completed as a First Actions and not a Subsequent Actions. The Reach 2 First Actions also involves construction of a 2-foot curb wall around the piers to be constructed as described in the Reach 1 First Actions, avoiding aquatic impacts. The Ferry Building and bulkhead buildings will be raised in place following construction of new pile supported foundations (wharves). While the footprint of these buildings would not change, the associated bay fill (approximately 9 acres) would require compensatory mitigation.

EWN features, including rocky intertidal bluff and living seawalls, have been incorporated into some of the designs to support the long-term resiliency of the structural measures proposed while providing natural features to enhance the aquatic habitats. EWN measures will minimize the long-term adverse impacts of the engineered structure despite some temporary aquatic impacts during construction. By incorporating Natural and Nature-Based Features (NNBF) into the design, natural processes and materials are used to reduce wave hazards, support nearshore ecology, and provide public water access in lieu of more traditional engineered designs and materials such as concrete, rip rap, or monoculture turf grass, which do not provide any long-term ecological or recreational benefits and are generally less visually desirable. Additionally, implementation of the NNBF avoids conversion of existing habitats into impervious surfaces.

1.2.1.2.2 Subsequent Actions

The Recommended Plan does not include Subsequent Actions in this reach under the intermediate RSLC scenario since the First Action is being constructed at a higher initial scale, unlike the other three reaches. By completing the 3.5-foot target elevation in the First Actions, the significant disturbance to the Embarcadero including transportation, recreation and cultural resource impacts and costs associated with reworking the same area twice are avoided. Under the high RSLC scenario, the Recommended Plan includes increasing the elevation of structures by an additional 3.5-feet in this reach. The First Actions measures have each been designed to be adaptable to future design modifications to address RSLC conditions. Based on the designs at this time, the high RSLC Subsequent Actions would not abandon the First Actions structures and thereby avoids the need for construction or conversion of lands to impervious surfaces outside the First Actions construction footprint. As with the other measures, the designs and construction methodology avoid all aquatic impacts.

1.2.1.3 Reach 3

1.2.1.3.1 First Actions

In Reach 3, all measures are constructed landward of the existing shoreline and would not require any in-water work, thus avoiding the need for bay fill and adverse impacts to aquatic habitats. The creek and Bay shorelines will be elevated to a finished elevation of 13.5 NAVD88 with raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls, NNBF and closure structures. The plan also includes partial reconstruction of the Embarcadero roadway south of the Bay Bridge. All impacts from construction have been avoided on approximately 7,500 linear feet of shoreline because the design was aligned to take advantage of existing high ground to avoid unnecessary construction of additional features. Instead of raising the bridges, deployables are proposed which avoids a significant amount of in-water work and disturbance associated with replacing two bridges.

1.2.1.3.2 Subsequent Actions

The First Actions measures have each been designed to be adaptable to future design modifications to address RSLC conditions. Based on the designs at this time, the Subsequent Actions would not abandon the First Actions structures and thereby avoids the need for construction or conversion of lands to impervious surfaces outside the First Actions construction footprint. As with the other measures, the designs and construction methodology avoid all aquatic impacts.

1.2.1.4 Reach 4

1.2.1.4.1 First Actions

The Reach 4 First Actions consists of raising the shoreline using bulkhead seawalls, levees, natural and nature-based features, floodwalls, closure structures, and tying into existing or planned high ground. Like the other reaches, most all measures are constructed landward of the existing shoreline. Marsh and coarse beach restoration is planned along the Pier 94 wetlands, and levees in this reach will be planted. Roughly 0.4 acres of bayfill would be required at Pier 96, causing adverse impacts to aquatic habitats. Additionally, all impacts from construction have been avoided on approximately 6,500 linear feet of shoreline because the design was aligned to take advantage of existing high ground to avoid unnecessary construction of additional features. Similar to Reach 3, the impacts of raising of existing bridges would be avoided by relying on deployables for flood defense. Similar to Reach 1 First Actions, building demolition would occur allowing these areas to convert to intertidal habitat, sub-tidal habitat, or open space.

1.2.1.4.2 Subsequent Actions

The Subsequent Actions avoidance and minimization measures described for Reach 3 also apply in Reach 4. Additionally, Natural and Nature Based Features (NNBFs) have

been incorporated into the designs that allow for ecological enhancements while supporting and enhancing the performance of the flood defense structures.

2.0 Identification of Impacted Habitats

Since site-specific habitat surveys were not completed during the feasibility phase, habitats in the study area were identified using primarily the California Aquatic Resources Inventory (CARI) version 2.2 (last updated December 23, 2023;SFEI 2022) Geographic Information System (GIS) dataset of aquatic habitats that maps subtidal, beaches, wetlands, streams, and riparian areas. This information was supplemented by Google Earth aerial imagery, site visits, published literature, and other GIS datasets where necessary. CARI is a compilation of local, regional, and statewide aquatic resource GIS datasets into a standardized, seamless, statewide coverage of aquatic resources employing a common wetland classification system.

2.1 Habitats in the Study Area

A total of six CARI mapped ecological habitat types are located within the project footprint including: subtidal, beach, pond and associated vegetation, tidal flat and marsh panne, tidal marsh, and eelgrass (**Figure D.1.5-5**). Only subtidal habitat and tidal flat and marsh panne are expected to have unavoidable adverse impacts as a result of implementing the Recommended Plan.

2.1.1 Subtidal Habitats (Open Water)

Subtidal habitats are submerged areas beneath the San Francisco Bay water surface to the Bay bottom and include mud, shell, sand, rocks, artificial structures, shellfish beds, eelgrass beds, macroalgal beds, and the water column above the bay bottom (Cosentino-Manning et al. 2010). Soft substrate comprises the majority of the bay's bottom (approximately 90%) and ranges between soft mud with high silt and clay content and areas of coarser sand. CARI maps any areas as subtidal if:

> … the area has at least 90 percent open water using a 100 square meters (m2) search area (meaning they have less than 10% vegetation cover). Floating and submerged aquatic vegetation found in open water do not count towards the 10% cover.

All areas, bayward of the existing shoreline are considered open water. The depth of these areas can range from a few feet in Lash Lighter Basin to more than 30 feet at or coming into the working piers. Artificial structures, such as concrete, composite, and wood pier pilings, can be found throughout the San Francisco waterfront and along Mission and Islais creeks.

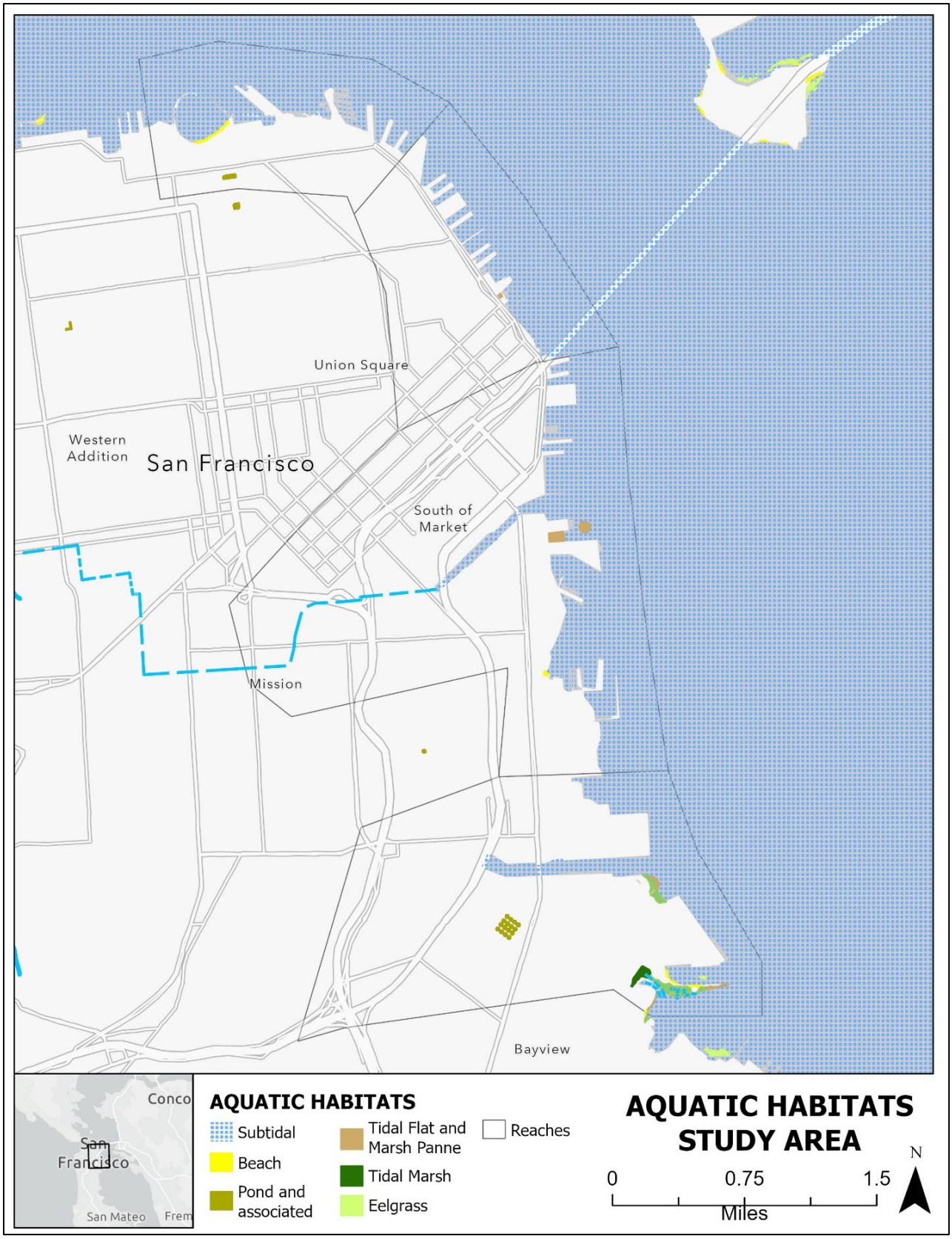


Figure D.1.5-5: Habitats in the Study Area

2.1.2 Eelgrass

CARI defines eelgrass habitats as: Marine or Estuarine areas that are dominated by eelgrass beds. Eelgrass is a native marine plant found globally within soft-bottom bays and estuaries. It is typically found in healthy, shallow bays and estuaries where the depth of occurrence is a function of light penetration. Eelgrass beds are dynamic, expanding and contracting seasonally and annually dependent on habitat quality. Importantly, eelgrass is considered an indicator community for the health of an estuary due to its sensitivity to changes in water quality. It enhances water quality through sediment trapping and habitat stabilization, transforms nutrients, oxygenizes water, and serves as a primary producer, nursery habitat, and forage area for commercially and recreationally important fish, as well as migratory birds.

In the study area, one approximately 0.4-acre eelgrass bed is documented in Lash Lighter Basin just north of Heron's Head. Outside the study area about 0.3 miles south of Heron's Head, a 2.5-acre bed is documented along the southern shoreline of India Basin.

2.1.3 Estuarine Intertidal (Wetland) Habitat

Intertidal habitats are the regions of the bay that lie between low and high tides (NOAA 2022b). CARI defines a wetland as:

> Under normal circumstances, a wetland (1) is saturated by groundwater or inundated by shallow surface water for a duration sufficient to cause anaerobic conditions within the upper substrate; (2) exhibits hydric substrate conditions indicative of such hydrology; and (3) either lacks vegetation or the vegetation is dominated by hydrophytes. Some additional classes including Rocky Intertidal, Beaches, and Dunes are currently nested under Wetland.

A total of four intertidal habitat types are found in the study area (**Table D.1.5-3**). There are three CARI mapped intertidal habitat types in the study area including beaches, tidal flat and marsh panne, and tidal marsh. Often rocky intertidal habitat is noted as occurring along the San Francisco waterfront as well; however, there are no mapped Rocky Intertidal habitats as defined by CARI in the study area. The study team acknowledges that rocky intertidal habitat in the study area often includes artificial structures that would not typically be mapped as habitat and acknowledges the value such artificial structures have on the San Francisco Estuary especially along the waterfront where minimal native habitat exists. Therefore, this analysis has added rocky intertidal (with a modified definition) as a habitat occurring along the waterfront.

Additionally, formal delineation of waters of the U.S., including wetlands, occurred in 2015 along the Port of San Francisco waterfront between the open water basin north of Pier 40 and Heron's Head Park at Pier 98. Two locations were documented as having wetlands but were not in the CARI database. They are included in this analysis.

Table D.1.5-3: Sub-Habitat Types of Estuarine Intertidal Habitat Found in the Study Area

Sub-Habitat Type	Description	Location Found
Beaches	Generally unvegetated open sand/fine gravel areas along the coast that extend from mean low low water (MLLW) up to the dune toe.	Aquatic Cove, Crane Cove Park, Heron's Head, India Basin Park
Tidal Flat and Marsh Panne	Non-vegetated areas that satisfy the hydrology and substrate criteria	CARI Mapped: Beneath Ferry Building Wharf (no longer present), Pier 48 and 50, Pier 94, Heron's Head, India Basin Park Not-Mapped: along north and south banks of Islais and Mission creeks
Tidal Marsh	Emergent vegetation consists of erect rooted herbaceous hydrophytes (excluding mosses and lichens) and is usually dominated by perennial plants. Dominated by salt-tolerant species of emergent vascular vegetation, such as cordgrass (Spartina spp.), pickleweed (Salicornia spp.), and salt grass (Distichlis spp.) along the foreshore of the wetland and along the immediate banks of the larger tidal channels that tend to dewater at low tide.	CARI Mapped: Heron's Head, Pier 94, India Basin Park Not-Mapped: Islais Creek Park, East of Illinois Bridge on north bank of Islais Creek, on north bank of Islais Creek at Islais Creek Muni Park, Warm Water Cove
Artificial Rocky Intertidal	Artificial rock (quarried rip-rap) shoreline armoring, concrete bulkheads	Throughout the waterfront, along the shorelines of Mission and Islais creeks

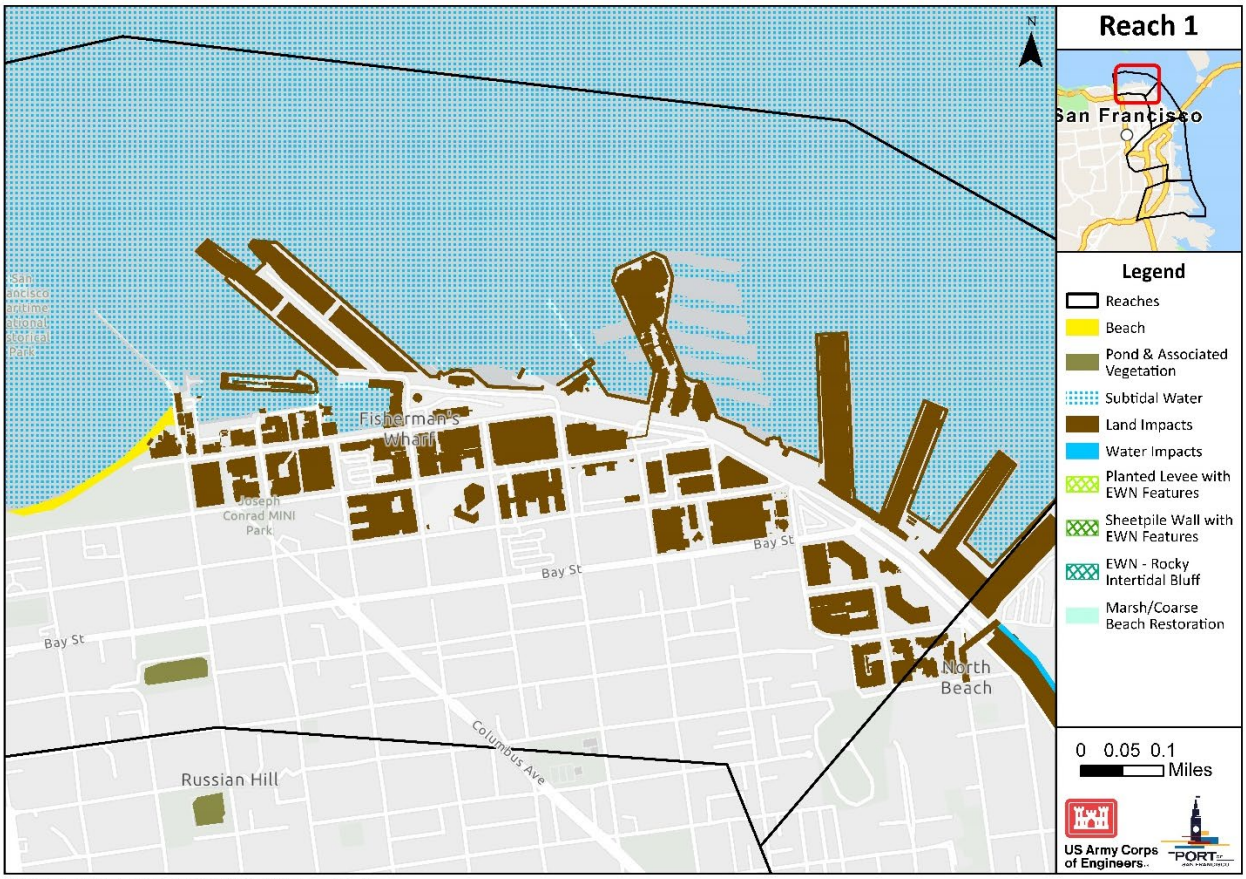
2.1.4 Pond

A pond is defined as an unnatural, unvegetated area of open water. These areas are defined by CARI as depressional wetlands. Depressional Wetlands are features predominantly fed by surface water that form in topographic lows and precipitation, surface runoff, and ground water are their main sources of water. There are two mapped pond locations in the study area including: an approximately 3.0-acre pond at Heron's Head Park, a series of 16 waste treatment ponds at the Southeast Wastewater Treatment Plan. A third location at Francisco Park was also mapped, but when comparing to recent aerial imagery, the pond is not present.

2.2 Impacted Habitats

2.2.1 Reach 1

In Reach 1, beach and subtidal habitats are present. There are no measures that would be constructed within the existing beach habitats (**Figure D.1.5-6**). Floodproofing is the nearest construction activity to the beach habitat; however, it would occur at the immediate structure site and not directly or indirectly affect existing beach.



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Figure D.1.5-6: Aquatic Habitats in Reach 1

2.2.2 Reach 2

In Reach 2, subtidal habitat is the only habitat found in or near the construction footprint (**Figure D.1.5-7**). A 0.25-acre area of tidal flat and marsh panne are mapped beneath the Ferry Building in Reach 2. This site is no longer tidal flat and has converted to subtidal habitat (i.e. the area is permanently submerged now). Therefore, there are no adverse impacts to the tidal flat and marsh panne habitat.

Construction of the seawall and all seismic ground improvements would be constructed landward of the existing shoreline and therefore have no temporary or permanent adverse impacts on existing habitats. Wharf raising and rebuilding will temporarily impact subtidal habitats but is expected to result in no net change in subtidal habitat and may even experience a net benefit by removing old construction materials, such as creosote, that may be contributing to poor water quality and a reduction in bay fill that would provide open more water. Additionally, new pilings are expected to have a textured surface that would increase the surface area for aquatic organisms to attach to.

Permanent adverse impacts are expected to occur in this reach as a result of raising the Ferry Building and bulkhead buildings by construction new pile support foundations (wharves). These features are expected to fill in approximately 8.6 acres of subtidal habitat. The area immediately under the Ferry Building would result in a permanent net loss of 4.6 acres. The construction at Rincon Park will have approximately 0.5 acres of bay fill to accommodate some utility and transportation needs; however, an additional 3.5 acres of bay fill is needed to construct the coarse beach (EWN feature) that will be placed over the utility/transportation bay fill and use ecological processes to protect the site rather than using hardened structures such as rip rap. Over the long-term, adding a coarse beach would be a net gain in a different habitat type (beach or intertidal habitat) in this reach, benefitting nearshore ecology.



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Figure D.1.5-7: Aquatic Habitats in Reach 2

2.2.3 Reach 3

Subtidal, beach, artificial rocky intertidal, and tidal flat and marsh panne habitats are found in Reach 3 (**Figure D.1.5-8**). While not documented in the CARI database and not shown in the figures below, the shoreline of Mission Creek is primarily armored shoreline (artificial rocky intertidal) with pockets of tidal flat and marsh panne.

No Recommended Plan measures are proposed for construction in or near the CARI mapped beach and tidal flat and marsh panne habitats and all nearby measures are proposed landward of the existing shoreline and therefore would have no indirect effects to the habitats from changed hydrologic conditions (**Figure D.1.5-8**). Similar to Reach 2, wharf raising would have temporary adverse impacts on subtidal habitats, but would have a long-term benefit on water quality, hydrology, and aquatic organisms.

Recommended Plan measures are proposed along Mission Creek where artificial rocky intertidal and tidal flat and marsh panne are found. Each of the measures here would be constructed to have the toe of the planted berm to align with the mean high-water line, thus avoiding any bay fill or long-term permanent impacts to the subtidal, artificial rocky intertidal, and tidal flat and marsh panne habitats. However, during the design phase, site-specific habitat surveys should be completed to confirm that this assumption remains valid. If during those surveys the design is found to disturb or replace any of these habitats, minimization measures should be considered and could include features such as adding ecological armoring instead of rip rap or other toe and slope protection materials, redesigning the planted berm to be an ecotone levee where marsh and other intertidal habitats can be incorporated to protect the toe, or realigning the berm to avoid at a minimum bay fill and tidal pane and marsh habitat.

No permanent adverse impacts to any of the aquatic habitats in Reach 3.



Figure D.1.5-8: Aquatic Habitats in Reach 3

2.2.4 Reach 4

All aquatic habitat types are found in Reach 4 (**Figure D.1.5-9**). However, the Recommended Plan measures avoid construction in or near the beach, tidal flat and marsh panne, tidal marsh, eelgrass, and pond habitats. There is one measure (EWN ecotone levee) that would be constructed just south of the Pier 94 wetlands. Since this feature is an ecotone levee, over the long-term the constructed feature would be complementary to the existing tidal marsh and tidal flat and marsh panne habitats. While constructing the ecotone levee, BMPs would be incorporated to prevent movement of sediment into the existing habitats from the construction site and no surface waters would be diverted from or into those habitats that were not there prior to construction. Additionally, there would be stipulations that no staging areas, access roads, construction footprints would be sited in aquatic habitats. As a result, there would be no direct or indirect loss of the habitats at Pier 94.

Areas of tidal flat and marsh panne habitat and tidal marsh are present along the north bank of Islais Creek where Recommended Plan measures are proposed. Similar to reach 3, as of now the planted levee design that could affect the area of habitat east of

Illinois Bridge avoids construction below the mean high-water line. Construction and long-term operation of the structure should avoid any direct or indirect disturbance or loss of these habitats. During the design phase, additional site-specific surveys need to be completed and, if necessary, avoidance or minimization measures incorporated into the final design.

At the Islais Creek Muni Park site, existing habitats would be temporarily filled in or trampled to construct the ecotone levee. These habitats would be replaced as part of the EWN ecotone levee design and the habitat loss would be considered temporary until the restored vegetation reaches maturity and the intertidal habitat becomes fully functioning. The length between loss and restoration is dependent on how long construction takes at the immediate site, type of plants used, and growing conditions, but is anticipated to reach pre-construction conditions or better within one to three growing seasons after a one-year period of construction or two to five years. The purpose of the measure is to support the overall performance of the flood defense feature using natural processes. As a result, these features also provide habitat enhancements that are anticipated to result in a net increase in quantity and quality of intertidal and tidal marsh habitats.

Existing tidal marsh and tidal flat and marsh panne found at Islais Creek Park would be avoided to the greatest extent practicable while constructing the 42.75-acre EWN feature. This measure would remove all existing structures, concrete and pavement from the area and create an open space composed of intertidal habitat at the lower elevations and grading to upland habitat further inland. Over the long-term this will be a significant net increase in tidal marsh and intertidal habitats; however, the exact extent is unknown because site-specific elevation and designs have not been developed to understand the widths of each zone of habitat that would be created after construction is complete. Additionally, as sea levels rise, it is anticipated that each of the aquatic habitats would retreat inland and convert the upland habitats to tidal marsh and additional intertidal habitat would be created, resulting in additional increase in aquatic habitats.

Similar to Reach 2 and 3, wharf raising would have temporary adverse impacts on subtidal habitats, but would have a long-term benefit on water quality, hydrology, and aquatic organisms.

Overall, the Recommended Plan measures are not expected to have any unavoidable adverse impacts and would over the long-term increase the quality and quantity of aquatic habitats in Reach 4.

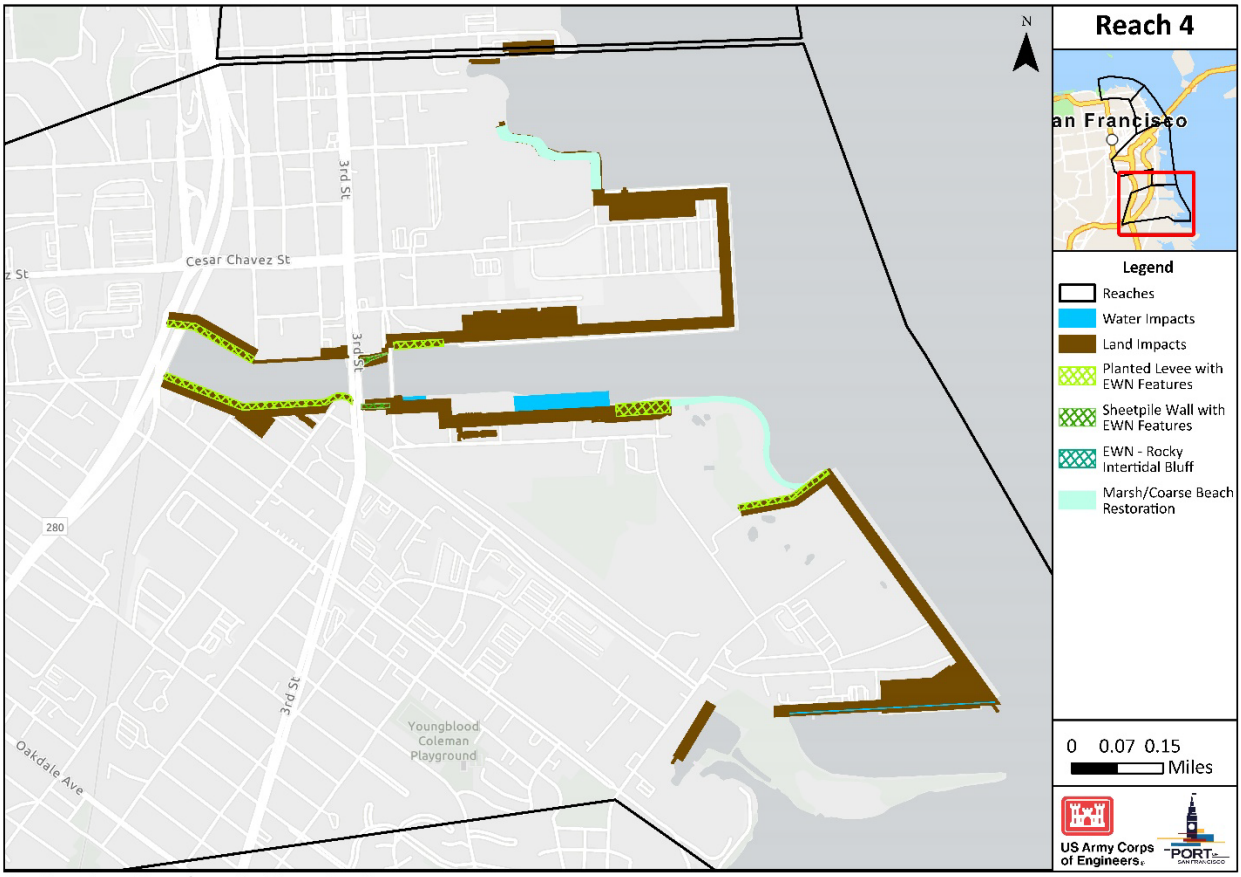


Figure D.1.5-9: Aquatic Habitats in Reach 4

2.2.5 Summary

Unavoidable adverse impacts to subtidal habitat are expected from 9.0 acres of bay fill.

3.0 Habitat Modeling

For purposes of this phase of feasibility, the worst-case scenario of implementation was assumed and included construction and long-term operation of the Recommended Plan measures. Because this is a worse-case scenario conceptual mitigation plan, there is no consideration of the net benefits from implantation of EWN features or the likely decrease in fill from wharf rebuilding. Additional coordination with the resource agencies will occur during the design phase to better understand what is an appropriate assumption for the quantity of tidal marsh and intertidal habitat that would be restored/created and how that could contribute to project benefits that would offset the impacts of bay fill as part of the total project design. As a result, only the bay fill impacts to subtidal and tidal flat and marsh panne habitats were modeled.

3.1 Habitat Equivalency Analysis

Habitat Equivalency Analysis (HEA) is a method developed by the National Oceanographic and Atmospheric Administration (NOAA) to scale compensation for habitat damage resulting from oil spills and other damage-related impacts (NOAA 1997). HEA is currently only approved on a project-by-project basis. Single-use model certification was approved by the USACE's Ecosystem Restoration Center of Expertise (Eco-PCX) on 10 June 2025.

HEA focuses on complete, in-kind replacement of services lost between the time of impact and when the restored or created habitat becomes fully functional (**Figure D.1.5-10**). HEA accomplishes this by incorporating the concept of discounting from economic theory (i.e. services for future years have a lower value on benefits because they take longer to accrue).

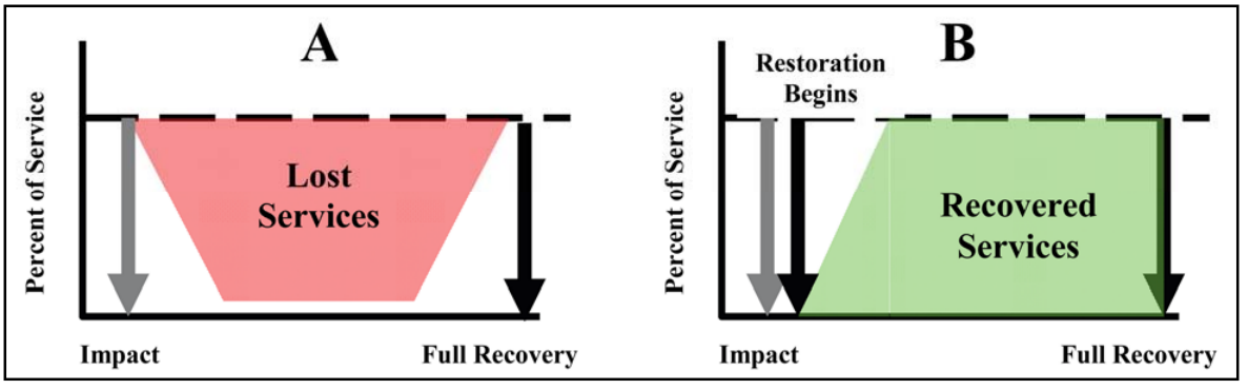


Figure D.1.5-10: Estimation of (a) Lost Services, and (b) Recovered Services (after King 1997)

The structure of HEA is relatively simple. Calculations of how much habitat to restore or replace are based on estimates of the total loss in services supplied by the damaged or lost habitat. Total loss is estimated from the degree of initial damage to the resource and the loss in service that occurs during the time between the initial damage and when the restored or replaced habitat becomes fully functional. The basic unit of measurement for this approach is typically a discounted-service-acre-year (DSAY). A DSAY represents the value of all the ecosystem services provided by one acre of the habitat in one year. Once the DSAYs are calculated for the impacted habitat, the compensatory mitigation need can be established and adequate compensatory mitigation identified to offset the DSAYs in the form of acres of restored habitat.

The implicit assumption of HEA is that the public is willing to accept a one-to-one trade-off between a unit of lost habitat services and a unit of restoration project services so long as the services provided are comparable. The assumption of comparable services is met when the proposed restoration action provides services of the same type and quality, and of comparable value as those impacted.

Three critical pieces of information are necessary to complete the analysis: 1) the nature of the service that has been impacted or lost; 2) the extent of the initial damage, and 3) the rate at which recovery is likely to occur. Determining which service is most appropriate to replace and the degree to which the study area provided this service prior to impact are the most important steps in the HEA process. Information on the recovery rate of the service is also necessary to accurately assess losses that occur while the restored habitat is developing to its maximum possible functionality. Together with the estimated initial losses, this information yields the total amount of service lost over the period of the project is used to scale the estimate of how much habitat much is constructed or restored. This method assumes that equivalent habitats will provide equivalent services, meaning that the years of lost services can be compensated for by providing acres of additional habitat.

3.2 HEA Steps

HEA proceeds in seven steps including:

1) Determine the area of the impacted habitat.
2) Select an appropriate service to replace and a metric to represent the service.
3) Estimate the loss in service of the impacted habitat.
4) Determine the shape of the recovery curve.
5) Estimate losses occurring while recovery proceeds.
6) Estimate total losses.
7) Calculate the amount of restored habitat necessary to offset total losses.

First the area of the impacted site is estimated and a determination is made as to which service is to be the focus of compensation. It should be noted that while the basic calculations utilize a single service, the metric selected to represent the service may result in multiple services being effectively covered. After selecting the service and metric, the extent of immediate loss in service to the impacted habitat is estimated. Next, the shape of the recovery curve is determined and losses incurred while the habitat recovers or develops are estimated. The immediate and during-recovery loss estimates are summed and the area of restored habitat necessary to offset all losses is calculated. Estimates of how much habitat to restore (scaling) are made by making total losses (*L*) equal total gains (*G*). The following equations are used to calculate total losses and total gains using the following equation:

$$\text{Total Losses } (L) = V_L * \sum_{t=i}^{B} A_L * (1+d)^{(T-i)}$$

where

V_L = value per unit area of impacted habitat

A_L = area of impacted habitat

B = year in which services are finally recouped

i = year of impact

t = number of years between impact and start of restoration

T = base year

d = discount rate (usually 3 percent)

Gains are calculated from a similar equation,

$$\text{Total Gains } (G) = V_G * \sum_{t=j}^{M} S_t * (1+d)^{(T-i)}$$

where

V_G = value per unit area of restored

S_t = additional area of restored habitat constructed in year *t*

B = year in which services are finally recouped

j = year when gains begin

M = year in which services are finally recouped

T = base year

d = discount rate (usually 3 percent)

To perform the HEA calculations for the SFWCFS, Visual_HEA, a free computer software available online, was used (Sylvain et al. 2017, Kohler and Dodge 2006). Visual_HEA is a computer program developed to calculate the amount of required compensation. The program accepts input of parameters necessary to determine long-term service loss from the injury (injured area size and degree; times of injury, functional shape, and equilibrium; post-injury recovery); parameters to determine long-term service gain from compensatory restoration actions (times of restoration beginning and equilibrium; maximum service level; service gain function shape); and general program parameters (relative value of lost and gained services, baseline level of lost and gained services, discount rate).

3.2.1 Visual_HEA Inputs

The input parameters needed to perform a Visual_HEA analysis (**Table D.1.5-4**) include the relative value of pre-injury services and compensatory services (this is a ratio), baseline levels of services (expressed as a percent), discount rate, year of claim, service loss parameters from the injury (size of injury site and time history of the loss), and service gain parameters from the compensatory mitigation (duration and levels of services gained).

Subtidal habitats would be converted to hard bottom and filled in beginning in 2035 when construction begins. It is assumed that 100 percent of the 9.0 acres of subtidal habitat are lost in 2035 and the loss would continue in perpetuity. For purposes of this

analysis and to be conservative given that the construction sequencing is unknown at this time, the impacts are assumed to occur simultaneously in all impacted areas even though construction will take many years and bay fill will likely occur over multiple years.

Table D.1.5-4: Input Parameters for Visual_HEA

Parameter	Description	Entered Value	Rationale/ Assumptions
Site Name	Name of analysis site, analysis, etc.	San Francisco Waterfront Flood Study	Study Name
Present Year	Year of Analysis. This gives the reference time from which discounted service losses and gains are calculated.	2035	Beginning of construction when the anticipated loss is expected to occur
Number of Injured Area Units	Size of impacted site in spatial units	9.0	Calculated based on feasibility level design and bay fill estimates
Discount Rate (%) per time unit	Amount of discounting to reflect the relative value of present versus future service levels	0.0001%	Discounting is supposed to be 0; however, the software will not allow 0. Sensitivity to changes was run. At 0.001 and 0.00001 the DSUYs changed by hundredths. 0.0001 was selected because it was closest to a whole number.
Baseline level of services	Level of service provided by the injured area prior to injury, expressed as a percentage	50%	The area of injury is currently degraded by the presence of artificial structures which reduces the service level when compared to non-degraded subtidal habitats. See section 3.2.2
Initial compensatory service level	Level of Services provided by the compensatory action area at the onset of the compensation.	Pier Demolition: 50% Piling Removal: 75%	Value is based on whether or not current site is capable of light penetration (i.e. decking present). See section 3.2.2
Area and time units		Acres, years	
Service loss display years	Time span of service loss to be displayed on the graphs (and to have as discrete calculation results in the printouts)	2035 - 2135	Planning horizon for the study is 100 years.

Parameter	Description	Entered Value	Rationale/ Assumptions
Nodes of Service gain and loss		Bay Fill (Injury): Services at 50% in 2034 and 0% at 2035 (continues in perpetuity). Piling Removal (Compensatory): Services at 75% in 2035 and 100% in 2036 (continues in perpetuity). Pier Demolition (Injury and compensatory): Services at 50% in 2035 and 100% in 2037 (continues in perpetuity)	See Assumptions documented in section 3.2.2.

3.2.2 Assumptions

3.2.2.1 Ratio of the Value of Services

The ratio of the value of services of the impacted area versus the mitigation site (after it reaches full services) was 1.0 (i.e. the value of services per acre of subtidal before the impact was equal to the value of the services per acre provided at the mitigation site).

3.2.2.2 Services

Artificial structures such as piers, pilings, bulkheads, mooring areas, and other structures contribute to lower quality subtidal habitat and supports fewer species than natural substrate habitats. Artificial substrates create hard substrates habitats where hard substrate might not have been previously; however, pier pilings provide habitat conditions that differ greatly from natural substrates and have been found to support different assemblages of aquatic biota often dominated by exotic species (Cohen 2008). Pilings can reduce the C:N ratio of adjacent sediments and pier decking or the presence of other materials that cast shade on sediments around the structure can decrease primary productivity and reduce the uptake of water column nutrients (Martinez et al. 2022). Additionally, structures built in the water can alter water flows and patterns of sediment erosion and deposition. All of these changes in environmental conditions have the potential to interfere with important functions of soft bottom ecosystems such as benthic community respiration, primary productivity, and sediment-water nutrient cycling.

Conversely, studies have shown that pilings and other artificial structures provide some habitat for invertebrates, roosts for birds, and spawning areas for herring. Studies have not quantified the extent to which animals benefit from or depend on hard substrates. (SFEI 2010)

When taking into consideration the adverse and beneficial impacts of the artificial structures on subtidal habitat, the amount of light penetration was the driver for determining the amount of service life the injured or compensation site provided. For purposes of this analysis, the following were assumed:

- All sites provided a minimum of 50% of that of a natural, unaltered subtidal environment in San Francisco Bay.
- For sites with overwater decking that precluded light penetration or provided significant shading, the service life was assumed to remain at 50%.
- For areas where only the pilings remained, the service life was assumed to increase to 75% due to an increase in the availability of light that influences sediment fluxes and nutrient cycling. Locations with pilings but no overwater decking are assumed to not reach 100% due to the structure presence and the modified water flows and currents that remain.
- Locations with no artificial structures present are assumed to achieve 100% service life.

The length of time it takes for the compensatory action to reach maximum level of service (100%) was again dependent on how much light is present pre-restoration. For pier removal, it is assumed that the site will reach full service life after 2 years. This assumes that it will take one year for the hydrology to rework the sediments and for light to restore nutrient cycling more similar to adjacent non-modified subtidal habitats. After one year, it is assumed that the benthic organism and primary producers will begin to recolonize the area and reach comparable conditions to non-modified subtidal habitats. For pile removal, it is assumed that the sediments are not as degraded as the pier removal and thus will take less time stabilize under the new hydrologic conditions and recolonize with benthic organisms and primary producers.

3.3 Results

The Visual_HEA model was run to determine the total discounted service unit years (DSUY) of the bay fill (injured site) and two potential compensatory sites including pile removal and pier removal. For each 1.0 acre of bay fill a total of 500,000 DSAY (denoted as DSUY in the figures) are lost (**Figure D.1.5-11** and **Table D.1.5-5**), which totals 4,500,000 DSAY lost for the 9.0 acres of bay fill associated with construction of a new seawall at the Ferry Plaza (Pier 0), Rincon Park, and Pier 96.

To compensate for the lost DSAY of subtidal habitat, 1.0 acre of pier removal (**Figure D.1.5-11**) or 1.67 acres of pile removal (**Figure D.1.5-12**) would be needed. A total of 9.0 acres of pier removal would be needed if pier removal is the only form of compensation to compensate for the 4,500,000 DSAY mitigation need. A total of 15.0 acres of pile removal would be needed if pile removal is the only form of compensation to compensate for the 4,500,000 DSAY mitigation need.

Table D.1.5-5: HEA Results

Injury/Restoration	DSAY/ac	Injured Units: Replacement Habitat Size
Bay Fill	500,000	--
Pier Removal	499,999	1:1
Pile Removal	299,999	1:1.67

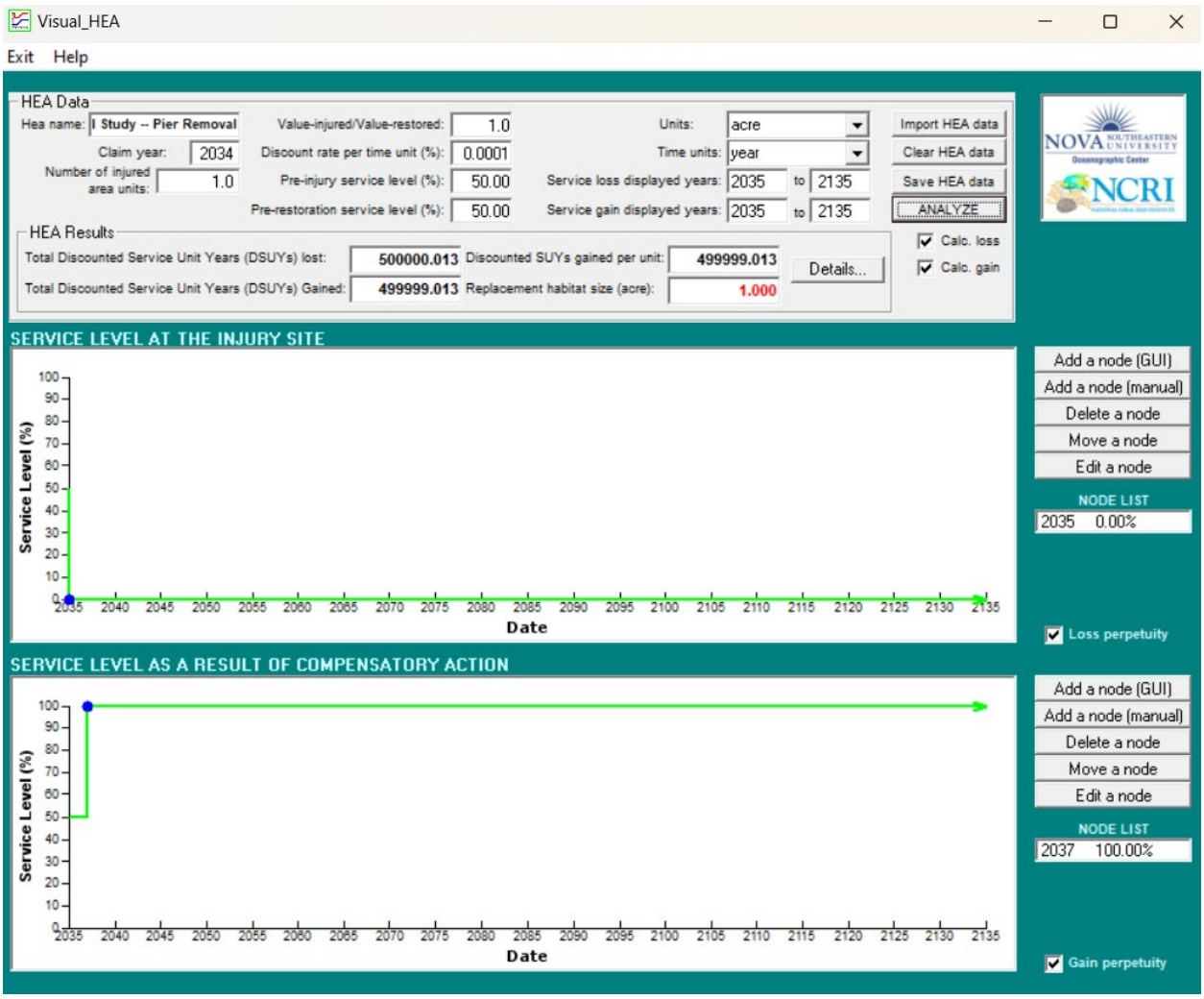


Figure D.1.5-11: Loss of Services Associated with 1.0 Acre of Bay Fill and Gains Associated with 1.0 Acre of Pier Removal

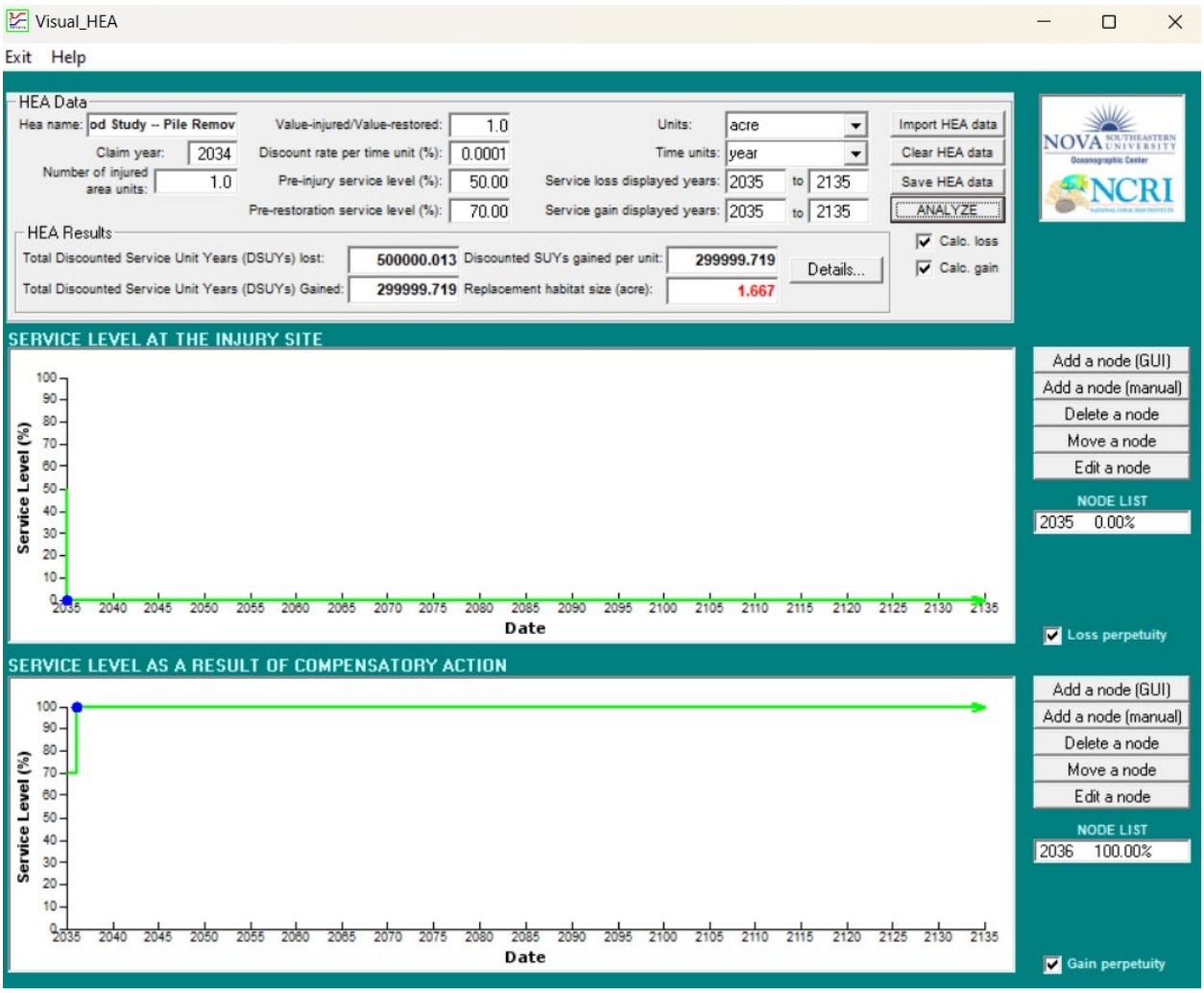


Figure D.1.5-12: Loss of Services Associated with 1.0 Acre of Bay Fill and Gains Associated with 1.0 Acre of Pile Removal

4.0 Conclusion

A total of 4,500,000 DSAY of subtidal habitat is lost and require compensatory mitigation as a result of 9.0 acres of bay fill associated with construction of the Recommended Plan (injury). One acre of pier removal would compensate for 499,999 DSAY, while one acre of pile removal would compensate for 299,999 DSUY.

5.0 References

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Attachment 1: Detailed Maps of Recommended Plan



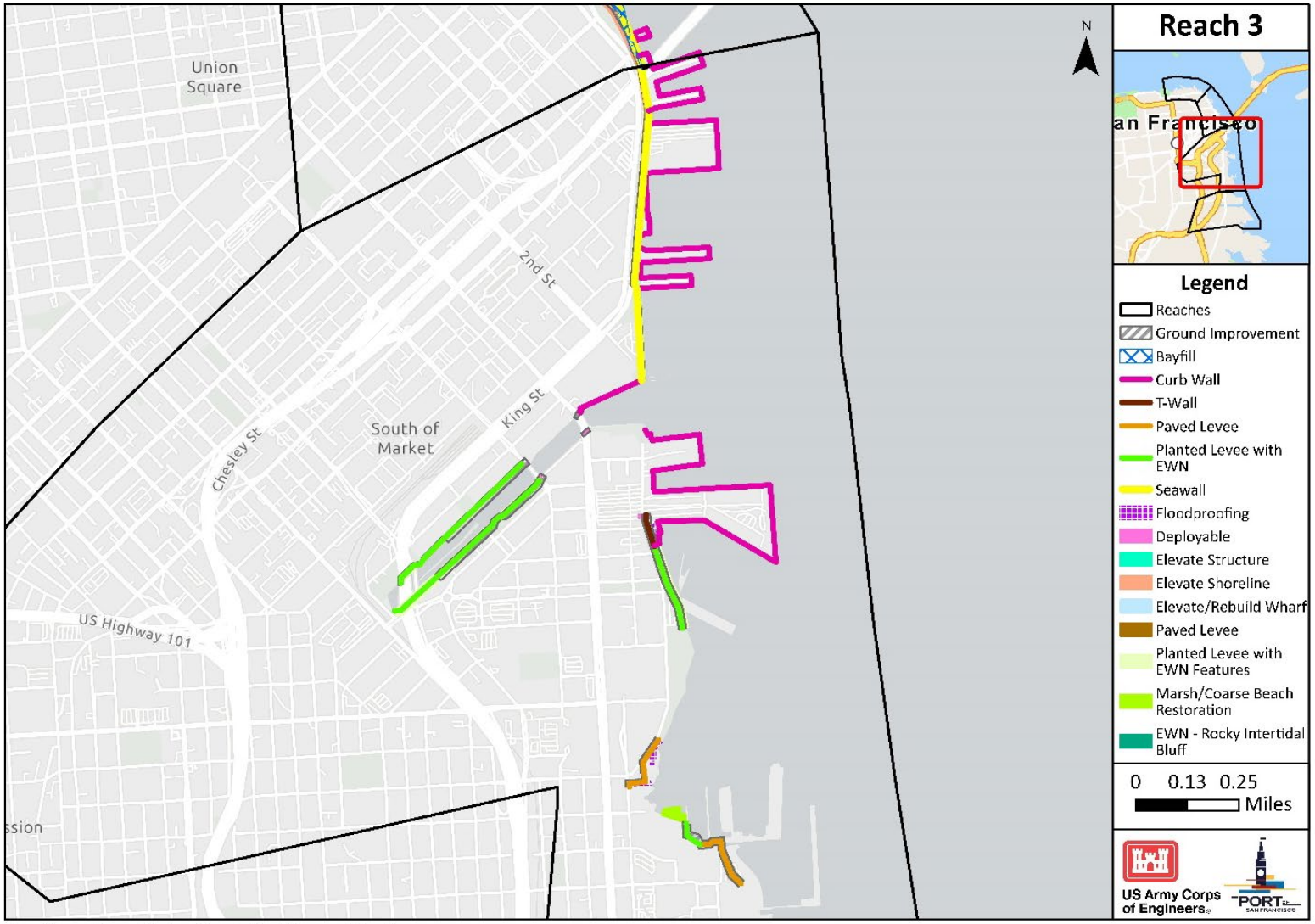
San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Attachment 1 Figure 1: Recommended Plan Reach 1 (First Actions)



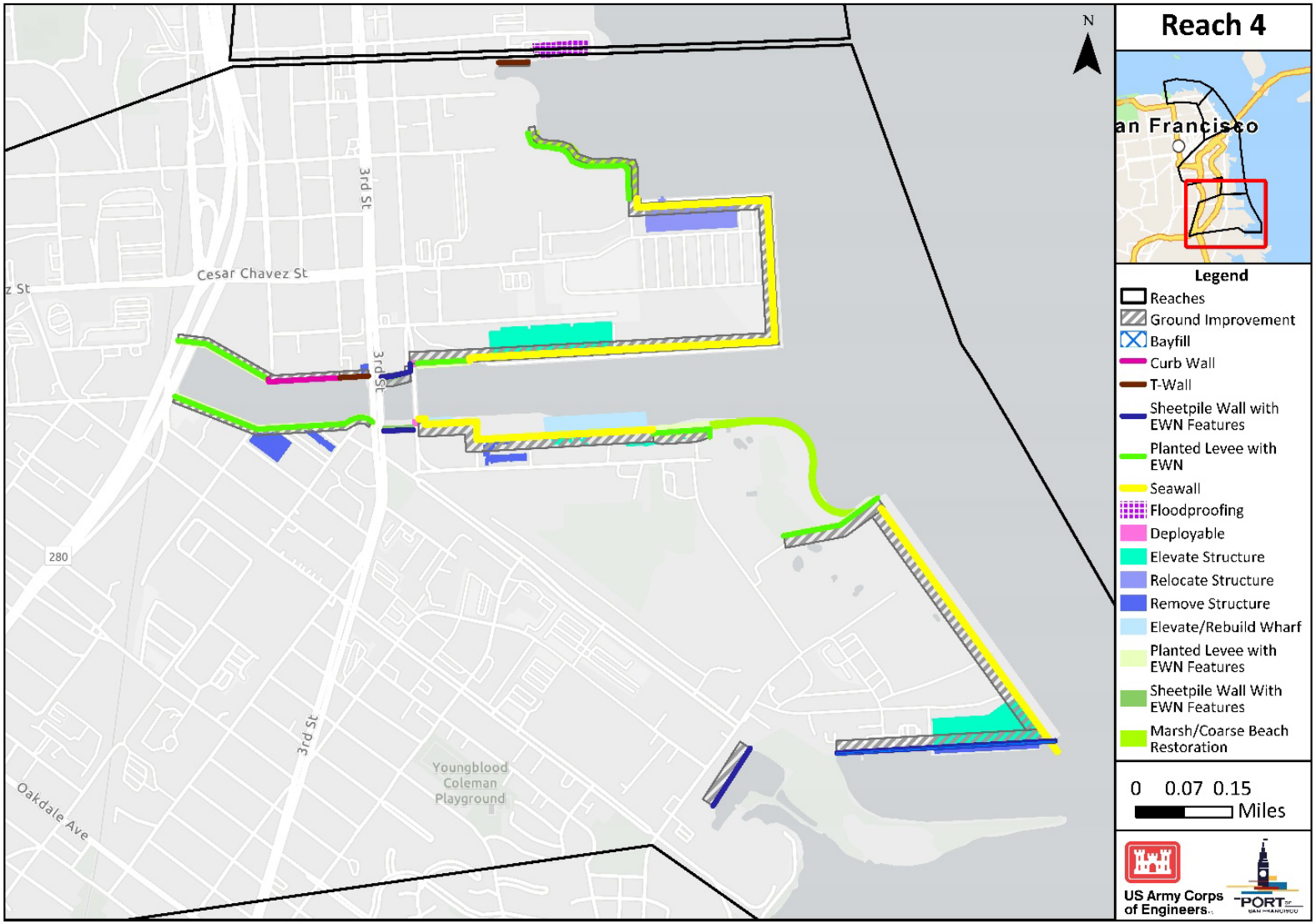
San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Attachment 1 Figure 2: Recommended Plan Reach 2 (First Actions)



San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Attachment 1 Figure 3: Recommended Plan Reach 3 (First Actions)



San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Attachment 1 Figure 4: Recommended Plan Reach 4 (First Actions)

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.1.6 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Flowchart 2: NFS Soil Management Process

1.0 Affected Environment

The following sections describe the Federal and State regulatory setting for hazardous, toxic, and radioactive waste in the study area.

1.1 Regulatory Setting

1.1.1 Federal

The Federal agencies that act to regulate hazardous, toxic, and radioactive waste include the United States Environmental Protection Agency (USEPA), the Occupational Safety and Health Administration (OSHA), the Nuclear Regulatory Commission (NRC), the U.S. Department of Transportation (USDOT), and the Department of Health and Human Services. At the Federal level, the Resource Conservation and Recovery Act (RCRA), provides the regulatory framework for the USEPA to regulate waste management including the generation, transport, and disposal of hazardous substances. The USEPA regulates hazardous substance sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA provides the USEPA a means to regulate hazardous substances through the Federal regulations contained primarily in Titles 29, 40, and 49 of the Code of Federal Regulations (CFR). The primary Federal laws and guidelines governing hazardous substances are summarized below.

1.1.1.1 Pollution Prevention Act (42 USC 13101 et seq.)

The Pollution Prevention Act focuses on reducing the amount of hazardous substances, through cost-effective changes in production, operation, and raw materials use. Opportunities for source reduction are often not realized because existing regulations, and the industrial resources required for compliance, focus on treatment and disposal. Source reduction is fundamentally different and more desirable than waste management or pollution control.

Pollution prevention includes practices that increase efficiency in the use of energy, water, or other natural resources, and protects the U.S. resource base through conservation.

1.1.1.2 Clean Water Act Section 311

The Clean Water Act (CWA) regulates the discharge of oil and other hazardous substances into surface waters of the United States including lakes, rivers, streams, wetlands, and coastal areas. Regulation of the CWA is through the Environmental Protection Agency.

1.1.1.3 Occupational Safety and Health Act (29 USC 651 et seq./29 CFR Part 1910)

OSHA provides the regulatory guidance to ensure that employers implement occupational health and safety standards that provide their workers with a safe work environment that is free of recognized hazards such as exposure to toxic chemicals, or other hazards that could cause serious physical harm. The California Occupational Safety and Health Administration (Cal/OSHA) is the agency responsible for administering this Federal act.

1.1.1.4 Comprehensive Environmental Response, Compensation, and Liability Act 42 USC 9601 et seq./40 CFR Part 300)

CERCLA, commonly referred to as Superfund, provides for liability of owners and operators of contaminated sites responsible for releases of hazardous waste at a given site, establishes prohibitions and requirements concerning closed and abandoned hazardous waste sites, and establishes a trust fund for cleanup when a responsible party cannot be identified. Section 105(a)(8)(B) of CERCLA implements a Hazard Ranking System (HRS) to screen which contaminated sites are placed on the National Priorities List (NPL), and subsequently eligible for remedial action. The USEPA is the responsible agency for administering CERCLA.

The Superfund Amendments and Reauthorization Act (SARA) amended CERCLA on October 17, 1986. SARA emphasizes the importance of permanent remedies and innovative treatment technologies in cleaning up hazardous waste sites, requires Superfund actions to consider the standards and requirements found in other Federal and State environmental laws and regulations, provides new enforcement authorities and settlement tools, increases state involvement in every phase of the Superfund program, increases the focus on human health problems posed by hazardous waste sites, encourages greater citizen participation in making decisions on how sites should be cleaned up, and increases the size of the Superfund trust fund to $8.5 billion.

SARA also requires USEPA to revise the hazard-ranking system so that it accurately assesses the relative degree of risk to human health and the environment posed by uncontrolled hazardous waste sites that may be placed on the NPL.

1.1.1.5 Resource Conservation and Recovery Act (42 USC 6901 et seq./40 CFR Part 261-265)

RCRA is a Federal statute that provides authority to the USEPA to control hazardous waste from “cradle to grave”. This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. Although hazardous waste is regulated by USEPA through RCRA, under Subtitle C, USEPA authorizes the State of California to enforce RCRA provisions. RCRA Subtitle C sets criteria for hazardous waste generators, transporters, and treatment, storage and disposal facilities, including permitting requirements, enforcement and corrective action or cleanup. The primary authority enforcing the RCRA hazardous waste requirements in California is the California State Department of Toxic Substances Control (DTSC).

1.1.1.6 Toxic Substances Control Act (15 USC 2601 et seq./40 CFR Parts 700-799)

The Toxic Substances Control Act (TSCA) of 1976 provides USEPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. TSCA addresses the production, importation, use, and disposal of specific chemicals including polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paint. In 1978, TSCA specifically banned the manufacture, processing, or distribution of any PCBs other than in a totally enclosed manner (15 USC 2605). Although DTSC is a lead regulatory agency for site cleanups in California, engagement with the USEPA is required when addressing PCB-contaminated sites (40 CFR Part 761).

1.1.2 Local Bay Protection and Toxic Cleanup Program Legislation of 1989

The California State Legislature established the Bay Protection Toxic Cleanup Program (BPTCP) in 1989 to comply with the California Water Code, Division 7, Chapter 5.6, Sections 13390-13396.5. The goals of the BPTCP related to hazardous, toxic, and radioactive waste include:

- Protect existing and future beneficial uses of bay and estuarine waters.
- Identify and characterize toxic hot spots
- Plan for the prevention and control of further pollution at toxic hot spots
- Develop plans for remedial actions of existing toxic hot spots and prevent the creation of new toxic hot spots.

The BPTCP is a comprehensive effort led by the State Water Resources Control Board (SWRCB) to programmatically link environmental monitoring and remediation planning. The BPTCP efforts and main activities related to hazardous, toxic, and radioactive waste include the following:

- Development and implementation of regional monitoring programs designed to identify toxic hot spots. These monitoring programs include analysis for a variety of chemicals, toxicity tests, measurements of biological communities, and various special studies to support the program.
- Development of a consolidated database that contains information pertinent to describing and managing toxic hot spots.
- Preparation of criteria to rank toxic hot spots that are based on the severity of water and sediment quality impacts.
- Development of Regional and Statewide Toxic Hot Spot Cleanup Plans that include identification and priority ranking of toxic hot spots, identification of pollutant sources, identification of actions already initiated, strategies for preventing formation of new toxic hot spots, and cost estimates for recommended remedial actions.

1.1.3 USACE HTRW Regulations

ER 1165-2-132 governs USACE activities in water resources projects. ER 1165-2-132 defines Hazardous, Toxic and Radioactive Wastes (HTRW) as follows:

> (1) Except for dredged material and sediments beneath navigable waters proposed for dredging, for purposes of this guidance, HTRW includes any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 et seq (CERCLA). (See 42 U.S.C. 9601(14).) Hazardous substances regulated under CERCLA include "hazardous wastes" under Sec. 3001 of the Resource Conservation and Recovery Act, 42 U.S.C. 6921 et seq; "hazardous substances" identified under Section 311 of the Clean Air Act, 33 U.S.C. 1321, "toxic pollutants" designated under Section 307 of the Clean Water Act, 33 U.S.C. 1317, "hazardous air pollutants" designated under Section 112 of the Clean Air Act, 42 U.S.C. 7412; and "imminently hazardous chemical substances or mixtures" on which EPA has taken action under Section 7 of the Toxic Substance Control Act, 15 U.S.C. 2606; these do not include petroleum or natural gas unless already included in the above categories. (See 42 U.S.C. 9601(14).)

ER 1165-2-132 sets forth policy guidelines related to investigation and treatment and handling of HTRW:

- Civil Works project funds are not to be employed for HTRW related activities except as provided herein, or otherwise specifically provided in law.
- Construction of Civil Works projects in HTRW-contaminated area should be avoided where practicable.
- Where HTRW contaminated areas or impacts cannot be avoided, response actions must be acceptable to EPA and applicable state regulatory agencies.
- For cost-shared projects, the local sponsor shall be responsible for ensuring that the development and execution of Federal, state, and/or locally required HTRW response actions are accomplished at 100 percent non-project cost. No cost sharing credit will be given for the cost of response actions.
- During the Feasibility Phase, alternative project plans may consider avoidance of HTRW as well as possible responses. At least one alternative plan should be formulated to avoid HTRW sites to the maximum extent possible, consistent with project objectives. These assessments, conducted during the feasibility stage, are shared with the local sponsor for cost-shared studies.

1.2 Existing Conditions

The existing conditions for hazardous, toxic, and radioactive waste is described below. The study area for hazardous, toxic, and radioactive waste in this EIS is the Project footprint. A records search was performed to identify the hazardous sites, toxic waste

sites, or radioactive waste sites in the Project footprint. The sites identified include locations where releases of hazardous substances or petroleum products have occurred into the soil, groundwater, or surface water. This section addresses potential contaminants in the soil.

The evaluation included Federal, state, and local databases to identify sites where the presence of hazardous, toxic, or radioactive waste has been previously documented. No environmental sampling of soil or groundwater was performed as part of this evaluation. The results of the records search identified over 157 potential environmental contamination sites within the study area. Of the potential sites identified, approximately 61 are located within the project area with known impacts to the soil or groundwater due to hazardous substances.

For the sites located within the study area, additional information was obtained from the EnviroStor and GeoTracker databases maintained by DTSC and SWRCB respectively for the purpose of determining potential impacts from these sites in relation to potential future construction activities. The potential for these sites to impact the construction activities was determined based on the presence of suspected soil and/or groundwater contamination, mobility within the soil-groundwater-air matrix, and the potential for construction activities to affect the contaminated media. As a result of the screening of the sites, 18 sites were identified within the Project footprint with the potential to impact the future construction activities. These sites are listed below in **Table D.1.6-1** and shown on **Figure D.1.6-1**. An additional 34 Leaking Underground Storage Tank (LUST) Sites that have received regulatory closure were identified within the project footprint. Although these LUST sites have received regulatory closure, there is potential for waste/contamination to remain in the soil and groundwater that may require special management and disposal related to future construction activities.

Table D.1.6-1: Hazardous Materials Release Listings for San Francisco Waterfront Flood Resiliency Study

Department of Toxic Substances Control Sites					
Map ID	**Site Name/ Address**	**EnviroStor ID or Global ID**	**Program Type**	**Status**	**Description**
1	Site K (Sea Wall Lot 333), 1-59 & 1/2 Townsend Street	38750002	State Response	Certified O&M – Land Use Restrictions Only	Site K is located at 1 through 59 1/2 Townsend Street in San Francisco and is owned by the San Francisco Redevelopment Agency. The site was underwater during the 1800's but filled with soil and construction debris by 1913. Previous site occupants included a paint warehouse, ship service companies, and a forklift service company. Approved RA. The removal activities at the site consisted of excavation and bioremediation of soil containing petroleum cap. Approximately 246 cubic yards of petroleum hydrocarbon contaminated soil were biotreated on an asphalt paved lot and subsequently used as backfill. The cap covers all portions of the property and consists of a layer of 10 mils Visqueen plastic and a 4-inch-thick concrete slab. A 3-story residential building and 1-story at-grade parking lot has been constructed on site. Approved PEA. Documented fuel leaks at the site impacted the soil and groundwater. DTSC approved a hazardous waste management plan on May 6, 1991. Recorded Deed Restriction. Certified Site. Site Screening noted 5 underground tanks removed. hydrocarbons above 1,000 mg/kg and the placement of a concrete slab.
2	PG&E Former Beach Street Manufactured Gas Plant 250 Beach Street		Voluntary Cleanup	Active	The former Beach Street manufactured gas plant (MGP) site is in what is known as the Fisherman's Wharf area of San Francisco. The site occupies the city block bounded by Beach Street, Mason Street, Jefferson Street, and Powell Street. Gas plant operations were conducted on-site from about 1899 until about 1931. The MGP was not significantly damaged by the 1906 earthquake

					and fire. PG&E purchased the property in 1911 and operated the MGP until around 1931, when usage of manufactured gas in San Francisco was replaced by natural gas. The gas holders from the MGP were used for natural gas storage until 1956-1957, at which point PG&E sold the property. The site was subsequently redeveloped for commercial use. Groundwater monitoring is ongoing with additional groundwater monitoring well installation planned for fourth quarter 2019 and first quarter 2020. (JT August 14, 2019).
3	Pier 39 Marina Sediment	60001256	Cleanup Program Site	Open - Remediation	Pier 39 is owned by the Port of San Francisco (the Port). Pier 39 periodically needs to be dredged to maintain vessel navigation depths. Polycyclic aromatic hydrocarbons (PAHs) have been detected in Pier 39 marina sediment. The concentrations and proportions of individual PAH compounds are consistent with manufactured gas plant (MGP) residues. The suspected source of PAHs, the former Beach Street MGP and upland area, is located about 100 feet south of Piers 41 and 43 and is overseen by the Department of Toxic Substances Control (DTSC) (Envirostor Number 60001256). PG&E is addressing the MGP residues in sediment. The final Remedial Investigation Report was submitted in January 2020. MGP impacts to sediment extend from Pier 39 East Basin Marina (inclusive) on the east to Pier 45 (exclusive) on the west. A draft feasibility study and remedial action plan (FS/RAP) was circulated for public comment during fall 2021. The next steps include addressing the comments, finalizing the FS/RAP, and issuance of a site cleanup requirements order.
4	Mission Bay - PIER 64/MISSION BAY Redevelopment Center	SL18397817	Cleanup Program Site	Open - Verification Monitoring	Former bulk petroleum facilities were located along and near 16th Street that were supplied by petroleum pipelines. On the eastern terminus of 16th Street, a marine terminal was used to transfer

					petroleum fuels via pipelines. The former bulk fuel storage facility was previously operated by Associated Oil, Tidewater Oil, and Phillips Petroleum on the northeast corner of 16th Street and Illinois Street. On the southeast corner of 16th Street and Illinois Street, Union Oil Company operated a former bulk fuel storage facility. Potential contaminants of concern at this site include metals/heavy metals, petroleum/fuels/oils, and PAHs. Diesel, Gasoline, Heating Oil / Fuel Oil, Lead, Asbestos. A May 21, 1999, Risk Management Plan (RMP) was approved by the Regional Water Board for the 300-acre Mission Bay Redevelopment Area. The RMP describes risk management procedures prior to development, during development, and after development. The purpose of the procedures is to protect people from exposure to poor quality fill materials and lower-level, widespread environmental pollution that could not be feasibly cleaned up. On March 21, 2000, a covenant and environmental restriction ("deed restriction") on the property was executed. The deed restriction obligates future landowners to comply with the RMP. Prior to 1906, the Development Project Area was part of the San Francisco Bay. In 1906, the land was created by filling in the marshlands and shallow tidal flats at the San Francisco Bay margin with serpentine rock and soils from the nearby Potrero Hill. Serpentine is a type of ultramafic rock that commonly contains naturally occurring asbestos. An 8-acre area near the vicinity of former Pier 64 was remediated in 2005 to remove separate-phase petroleum pursuant to Board Site Cleanup Order No. R2-2005-0028.
5	Pier 70, Crane Cove Park, Upland And Sediment		Cleanup Program Area	Open - Verification Monitoring	Crane Cove Park is a portion of the Port of San Francisco's Pier 70 property. In 2002, there was a release of polychlorinated biphenyls (PCB) transformer oil, and the Port

					initiated an emergency clean up response. Remedial activities for the PCBs were overseen by US EPA in accordance with TSCA. Concentrations of PCBs in soil remain at approximately 10 feet below surface. Sediment data adjacent to Crane Cove Park identified concentrations of metals, petroleum hydrocarbons, polyaromatic hydrocarbons (PAHs), PCBs, and dioxins and furans. The sediments were capped in 2020, and the Port is currently conducting bathymetric annual cap inspections to verify its presence.
6	8 22nd (Pier 70), 8 22nd Street,	T10000016753	LUST Cleanup Site	Open - Assessment & Interim Remedial Action	This 12,000-gallon Leaking Underground Storage Tank (LUST) site was identified on May 25, 2020. Historical records from 1945 indicate that the tank was formerly connected to a boiler system used by Bethlehem Steel Company. The LUST was removed in July 20 to July 22, 2020. The SWRCB indicates that the groundwater is impacted by total petroleum hydrocarbons (TPH).
7	Islais Creek			Unknown	The western portion of Islais Creek (west of the 3rd Street Bridge) was designated as “toxic hot spot” by RWQCB in 1999 due to elevated concentrations of metals, PAHs, PCBs, and pesticides in sediment and observed toxicity to aquatic organisms in toxicity tests. Sediment samples from the eastern portion of Islais Creek, from 3rd Street Bridge to the Bay, contained lesser concentrations of COCs, so the site was not designated a toxic hot spot. Discharges from four combined sewer overflows and a wastewater outfall to the creek are the primary sources of contaminants to Islais Creek (RWQCB 1999). This site is under water today.
8	PG&E Potrero, 1201 Illinois Street	38490009	Cleanup Program Site	Open Verification Monitoring	The former Potrero Power Plant site occupies 34 acres. The site has been used for industrial activities since the mid-1800s. Historical uses have included the manufacture and repair of ships,

					metal foundries, refining of sugar, and making of barrels. A manufactured gas plant (MGP) operated in the northern portion of the site from the 1870s to 1930. The area of the site associated with the electric generating Potrero Power Plant was constructed in the 1910s and was closed in March 2011. Potential contaminants of concern identified in the soil and/or groundwater include 1,1,1-trichloroethane (TCA), arsenic, asbestos - NOA, dichloroethane, (DCA), dichloroethene (DCE), lead, PAHs, tetrachloroethylene (PCE), trichloroethylene (TCE), and vinyl chloride. There are Deed Restrictions in place for this site specifying the type of approved development and uses.
9	Transbay Cable - SF Converter Station	SL0607510024	Cleanup Program Site	Case Closed	Since the 1870s, the site has been used for sugar refining, bulk petroleum storage, and various mixed industrial and warehousing operations. Remedial activities were performed at the site in 2008. The site is subject to a Deed Restriction related to subsurface soil that may contain residual concentrations of TPHs, PAHs, and metals. The site is currently occupied by Transbay Cable for use as an electric convertor station.
10	Western Pacific Railroad Yard, 25th and Illinois Streets	38400001	Historical	Refer SWRCB	A MGP operated on the northeast portion of the site from 1872 until 1930. The MGP was dismantled in the early 1960's and consisted of gas holders, purifiers, lampblack separators and pits, generator houses, tar storage facilities, retort houses and several aboveground storage tanks. From the 1950's until 1999, PG&E owned and operated a power plant at the site. The power plant property was sold to Southern Energy Potrero LLC (now "Mirant Potrero LLC"). Subsurface soil may contain residual concentrations of Arsenic, halogenated solvents, hydrocarbon solvents, lead, and unspecified solvent mixtures.
11	SF Electric Reliability	SL0607583505	Cleanup Program	Open - Inactive	The site was formerly used by Western Pacific Railroad as a

	Project		Site		switchyard for rail cars. The soil and groundwater at the site are contaminated with inorganic and organic chemicals including lead, arsenic, chromium, cobalt, PAHs, and volatile organic compounds (VOCs). The contamination may have been caused by previous operations and/or by the nature of artificial fill material, composed of crushed bedrock building debris, sand, and other typical fill material. The case remains open but inactive. Deed restrictions at this site prohibit disturbing the remedy and monitoring system that is in place. Additional restrictions limit the types of permitted uses at the site.
12	CCSF - Pier 80, 0 Cesar Chavez St/Pier 80 San Francisco, CA 94124	T0607500270	LUST Cleanup Site	Open - Eligible for Closure	This site was associated with a former vehicle maintenance facility. Two USTs were located at this site, a 2,000-gallon gasoline tank and a 10,000-gallon diesel tank. These USTs were removed in 1987. During the UST removal, the diesel tank was discovered to be leaking which had impacted the soil and groundwater. After remedial activities in 2012 and follow-up sampling of the soil and groundwater, the site is pending closure approval by the SWRCB.
13	Islais Creek Area, Pier 90, BTW Cargo WY & Amador Street Near Pier 94 & 92	38490005	Cleanup Program Site	Open – Remediation as of 3/1/2022	This location is reported by DTSC as a Special Program RCRA 312 – Past Hazardous Waste Disposal Inventory Site. The project property is on Pier 90 located along the south side of Islais Creek Channel, at the northeast intersection of Amador and Illinois streets and Cargo Way. The site is a former Exxon Mobil bulk oil facility with prior operations by Texaco and General Petroleum Corporation. The area was used for oil storage and transport from at least 1924 to sometime between 1975 and 1989. Multiple large above ground storage tanks and the associated piping were located on the property. The tanks had been removed by 1989. Review additional site characterization letter describes the

					Installation of six monitoring wells. The utility corridors may act as preferential pathways for contaminant migration. Contaminants: Arsenic, copper, diesel, gasoline, lead, nickel, total petroleum hydrocarbons, Waste oil / motor / hydraulic / lubricating, zinc.
14	SF Energy Company Cogeneration Project Seawall Lot 344	38490011	Voluntary Cleanup	Not reported	The site is a proposed cogeneration facility in San Francisco's Hunter's Point neighborhood. Analytical results of soil samples contain lead up to 2,000 ppm, TPH and low levels of pesticides, PAHs, and PCBs in the fill material. Currently, the site is essentially an open field which has been used for construction material storage. The site is currently fenced, restricting access. A Removal Action Workplan requires that the site be capped with a combination of asphalt, concrete, and clean fill material.
15	Pier 94 Fill Site	L10008948177	Land Disposal Site	Open - Closing/with Monitoring	In 1961, the Port initiated construction of what was intended to be a marine terminal in the area now designated as Piers 94 and 96 by placing fill material, primarily clean soil, rock, dredged material, and construction debris behind a perimeter debris dike. Future development at the site would require a Site Mitigation Plan (SMP) to outline proper soil and groundwater handling procedures and appropriate site capping requirements to mitigate human and ecological exposure to the hazardous materials identified during the site investigation. Previous investigations identified soil impacted by metals and base/neutral compounds, and groundwater with TPH diesel range (TPH-d).
16	Pier 98 Fill Site	L10006608309	Land Disposal Site	Open	Heron’s Head Park (the Site) is an approximately 26-acre park built on a peninsula of land jutting into India Basin in southeast San Francisco. Owned by the Port of San Francisco, this park began its life as “Pier 98” land comprised of fill

					placed in San Francisco Bay to construct a container terminal in the early 1970s. Toxicity tests on groundwater and soil found no significant potential for the site to impact water quality. A Geosynthetic Clay Liner (GCL) has been constructed over portions of the landfill to minimize potential for leachate generation in a portion of the Site where organic material had been placed along with inert fill material. In July 2009, a Post-Closure Land Use Plan (PLUP) for the former Pier 98 landfill was completed describing the Port's maintenance and monitoring program for the former landfill area, including landfill cover (vegetated cover), drainage, settlement, ponding and erosion.
17	Pier 70 Fill Site	L10007414613	Land Disposal Site	Open	The SWRCB indicated no specific contaminants of concern at this municipal solid waste landfill. No additional site history provided by the SWRCB.
18	PG & E Hunters Point, 1000 Evans Ave Hunters Point Power Plant	38490002	Voluntary Cleanup	Certified O&M – Land Use Restrictions Only	The 38-acre site was used for ship and barge building in the early 1900s. The original power generation plant was constructed on the site in the 1920s and utilized fuel oil. The Plant was shut down on May 15, 2006. The soil and/or groundwater at this site are contaminated with hazardous substances, including TPH, PAHs, metals, and PCBs. Much of the site contains fill material derived from local serpentine rock which contains NOA and the metals, nickel, chromium and cobalt. This site has a cap and the cap should not be disturbed.
Source: California Department of Toxic Substances Control (DTSC). 2022. Envirostor website (https://www.envirostor.dtsc.ca.gov/public/). Accessed December 2022; SWRCB. 2022. GeoTracker website (https://geotracker.waterboards.ca.gov/). Accessed December 2022.					

Of the 18 hazardous materials release listings, two are further described below based on the higher potential to impact future construction activities.

Port of San Francisco, Pier 70. Most of Pier 70 is listed on the National Register of Historic Places as the Union Iron Works Historic District and is home to the

headquarters for both Union Iron Works and Bethlehem Steel. Pier 70 has been the home of shipbuilding and repair operations from the time of the Spanish American War in 1898 through today, supporting multiple war efforts. Pier 70, and much of San Francisco's eastern waterfront, is comprised largely of fill that was historically placed in the Bay to construct new land. These "fill soils" contain chemical constituents that were present in the debris, soil, and native serpentine rock that comprise the fill. In some areas, the soil was also impacted by the former industrial uses and legacy shipbuilding activities. The constituents found in the Pier 70 soils include naturally occurring and introduced metals (lead, arsenic, cadmium), petroleum hydrocarbons, PCBs, and asbestos. Some contaminants may be present at concentrations above environmental screening levels. Historic buildings at Pier 70 may also contain hazardous building materials such as lead-based paint and asbestos. The soil within the Pier 70 area is subject to a "Risk Management Plan" that functions as the remedial action plan for the site and ensures that contaminants in the existing soil do not pose a risk to human health or the environment. The remedial action includes installation of durable cover over contaminated soil areas to prevent exposure to, or dispersion of, the soil by wind, water, or construction activities. The required durable cover also mitigates the potential for soil mobilization during a flood event.

PG&E Potrero, 1201 Illinois Street. The former Potrero Power Plant site occupies 34 acres. The site has been used for industrial activities since the mid-1800s. Historical uses have included the manufacture and repair of ships, metal foundries, refining of sugar, and making of barrels. A Manufactured Gas Plant (MGP) operated in the northern portion of the site from the 1870s to 1930. The MGP used coal and oil to produce a form of natural gas. The area of the site associated with the electric generating Potrero Power Plant was constructed in the 1910s and was expanded in the 1960s. In March 2011, the power plant was permanently retired.

Environmental investigations that have been performed at the site have identified residual contamination in the soil, soil vapor, and groundwater from the past activities that have occurred at the site. The remedial areas identified at the site include Station A Area, Unit 3 Area, Tank Farm Area, Northeast Area, PG&E's Switchyard and Construction Yard, and Offshore Area. Potential contaminants of concern identified in the soil and/or groundwater at these remedial areas include arsenic, asbestos - NOA, cyanide, DCA, DCE, lead, metals, PAHs, PCBs, pesticides, phenols, VOCs, semi-volatile organic compounds (SVOCs), TCA, and TPH. Various remedies for the site include: active remediation, engineering controls (including durable covers), institutional controls, compliance with the sitewide Risk Mitigation Plan, and compliance with O&M Plans. There are deed restrictions in place for this site specifying the type of approved development and uses.

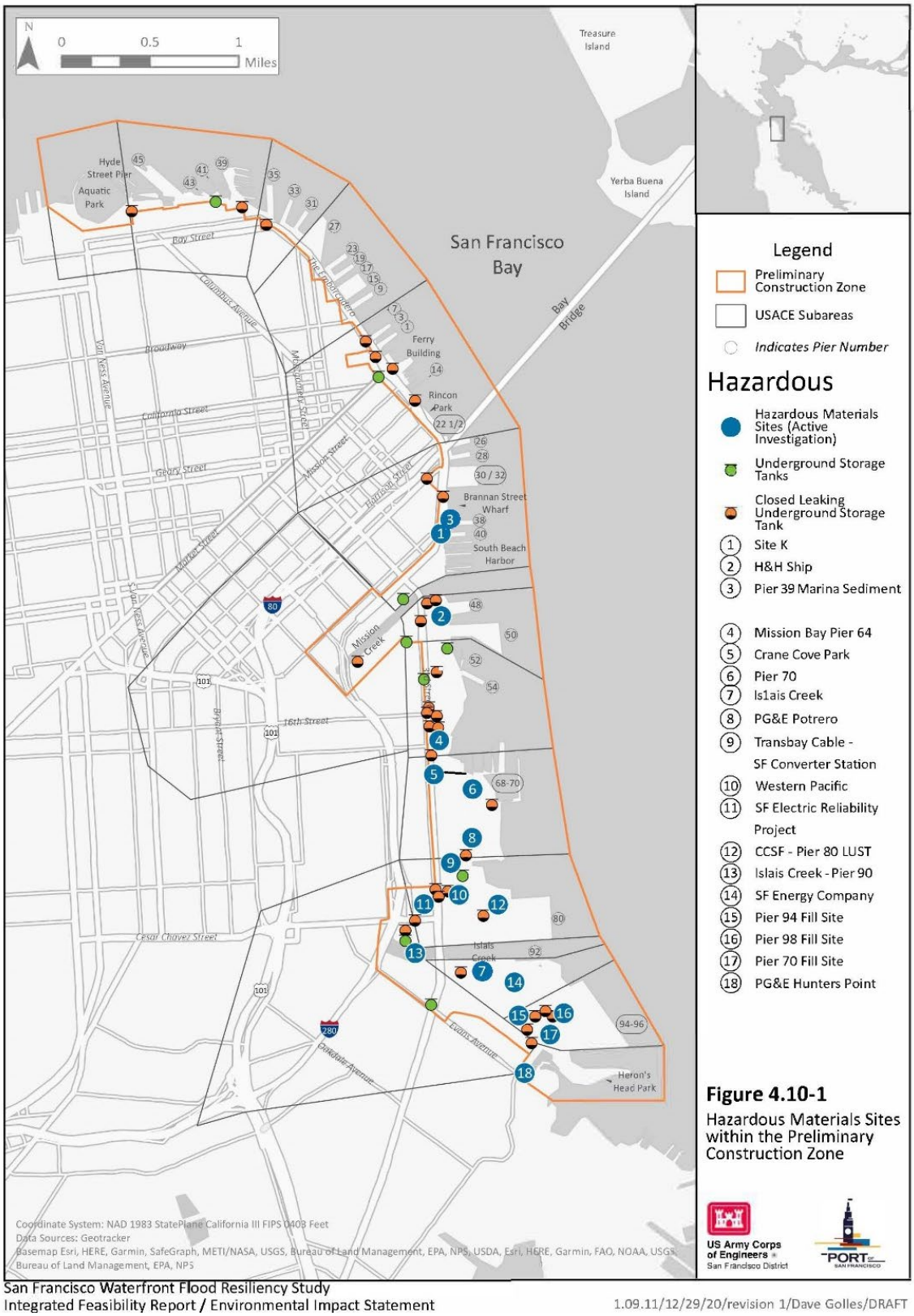


Figure D.1.6-1: Hazardous Materials Sites within the Project Footprint

1.2.1 Port of San Francisco HTRW Review

Note: This Annex is called Hazardous, Toxic and Radioactive Waste. While there are multiple contaminated sites on Port property as documented in this Annex, the fill and use history of the Port does not suggest the presence of any radioactive waste on Port property and thus, as a result, no investigation as to the presence of radioactive waste has been conducted, nor has any radioactive waste been identified on Port property.

1.2.1.1 Embarcadero Seawall Environmental Risk Assessment Report

In May 2020, the Port of San Francisco prepared its Environmental Risk Assessment Report as part of its Embarcadero Seawall Multi-Hazard Risk Assessment.

Contaminated soils along the waterfront create the potential for mobilization of such materials into the nearshore environments in the event of seismic or flood events. This in turn could compromise commercial water use, water-related recreation, and ecological assets and functions.

Onshore terrestrial contaminated areas were identified through an Environmental Data Resources (EDR) search of existing local, state, and federal databases for the area from Aquatic Park to Oracle Park, including all port facilities, the Embarcadero, and land area up to the first inland row of buildings (EDR, 2018). Because these local, state, and federal records cover spills, accidents, and investigations only over the last three decades (nominally since 1990), areas of potential onshore terrestrial contamination related to prior industrial uses of the waterfront were identified through a general review of port history. In addition, information on creosote piles was obtained from the California Coastal Conservancy (Werme et al., 2010).

The San Francisco waterfront area has been used for a great variety of activities since the middle of the 19th century when fill activities started (in the 1840s and 1850s). The waterfront has a history of industrial and port uses, including ship berthing, ship and vehicle fueling, storage and transfer of petroleum and other hazardous materials, and railroad and vehicle operations. The project area would have experienced a variety of spills into soils, water, and sediments related to those activities. In addition, the former Embarcadero Freeway ran along portions of the waterfront from the Bay Bridge to Broadway Avenue prior to demolition after the 1989 Loma Prieta earthquake. Contaminants associated with freeway use include oil, grease, polycyclic aromatic hydrocarbons (PAHs), cadmium (from vehicle brakes), other heavy metals (such as nickel, copper, and zinc) and aerially deposited lead (from leaded fuel), leaving vehicle-related road runoff remnants.

As a result of this historic activity and as shown in database records showing prior spills, at least some areas of groundwater and soil under the Embarcadero and surrounding area are contaminated.[1] A review of environmental databases indicates this contamination includes diesel, gasoline, heavy metals, PAHs, and other contaminants (EDR, 2018). Contaminated sites are present along the waterfront, including those

[1] A complete delineation of the entire waterfront would require sampling investigation beyond the scope of this study.

associated with former leaking underground storage tanks (LUSTs) as shown on **Figure D.1.6-2**.

Creosote was used for many years as a method for preserving maritime structures from decay. As a result, there is concern that chemicals leaching from existing creosote-treated structures pose environmental risks, including biological impacts on organisms such as Pacific herring. Creosote-treated piles are located throughout the San Francisco waterfront, including areas near Aquatic Park Cove, Pier 43, Pier 35, Pier 33, Pier 31, Pier 29, Pier 23, Pier 19, Pier 17, Pier 15, Pier 3, Pier 1, Fire Department Station 35, Pier 26, Pier 28, Piers 30–32, and Pier 38 (Werme et al., 2010).

Figure D.1.6-2 shows the location of reported LUSTs and creosote piles along the project area.

1.2.1.2 Contaminated Lands: Mission Creek/Mission Bay and Islais Creek/Bayview

In January 2023, the Port of San Francisco prepared its report on Contaminated Lands: Mission Creek/Mission Bay and Islais Creek/Bayview.

San Francisco's Southern Waterfront has a long history of industrial uses and activities that have left a legacy of contamination underground and in the shallow groundwater. Many contaminated sites have been remediated (cleaned up to reduce or prevent environmental damage) under the authority of California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) and the Regional Water Quality Control Board (RWQCB) which regulate cleanup of polluted and contaminated sites in California. Approved remediation methods often allow residual concentration of contaminants to remain underground, underneath a concrete or asphalt cap, a thick layer of clean soil, or other barrier to prevent environmental or public exposure to residual contaminants. These sites also retain institutional controls, which are administrative and legal controls that minimize the potential for human exposure to contamination and protect the integrity of the remediation efforts. For example, institutional controls may limit or restrict land use on a contaminated site, such as residential uses or schools, that are not consistent with the level of cleanup completed.

Many existing regulations and remediation methods do not yet consider changing meteorological conditions. As sea levels rise and shallow groundwater tables rise, contaminated sites in low-lying nearshore areas could be exposed to sea level rise-driven flood hazards and higher groundwater tables that exceed the original remediation design conditions. In areas of Bay fill and sandy soils, higher groundwater tables can also increase the liquefaction risk in response to seismic events. These changing hazards could create unintended human health and environmental exposure pathways. The exposure risk varies by type of contaminant, concentration, and frequency or severity of the hazard.

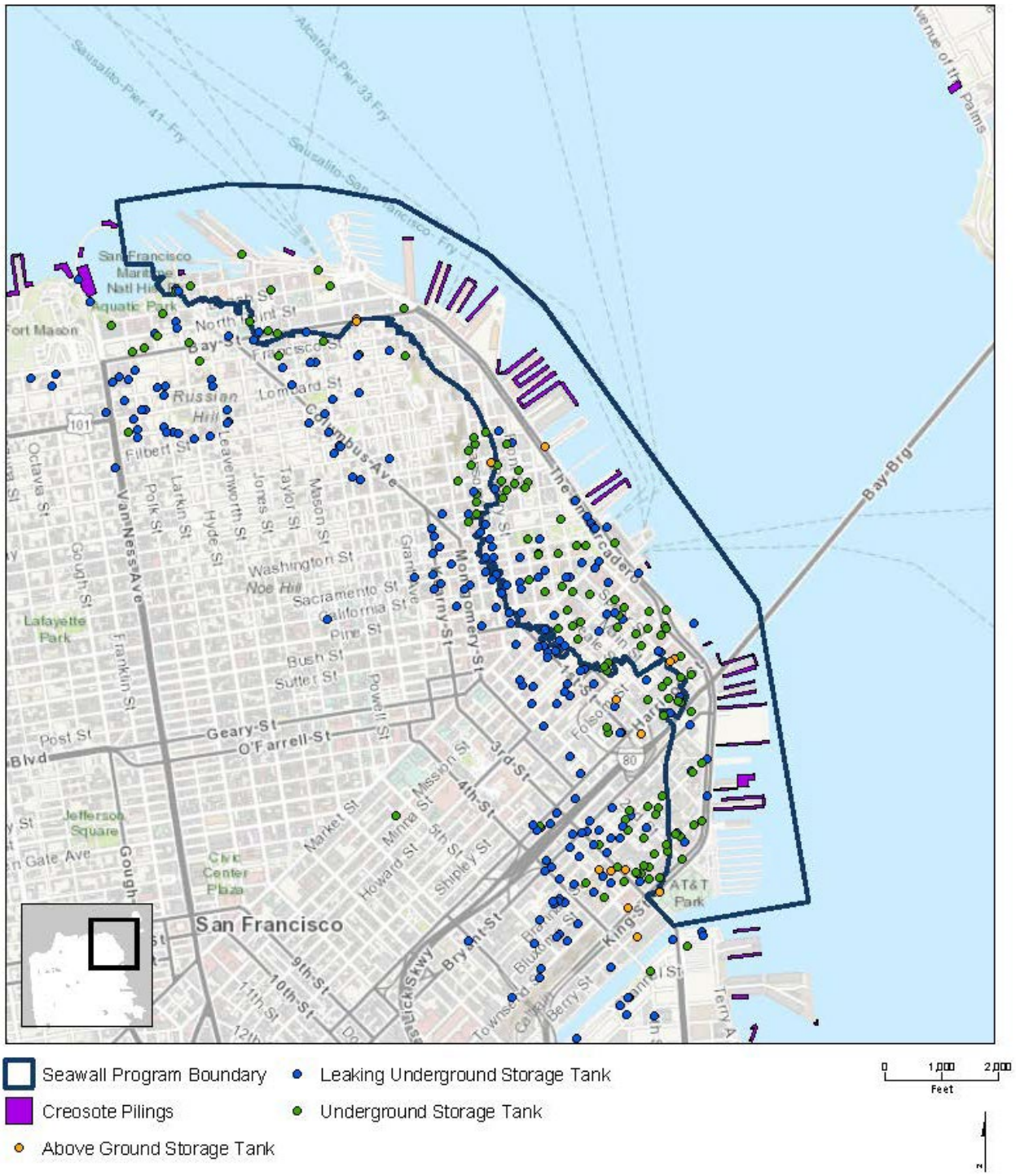
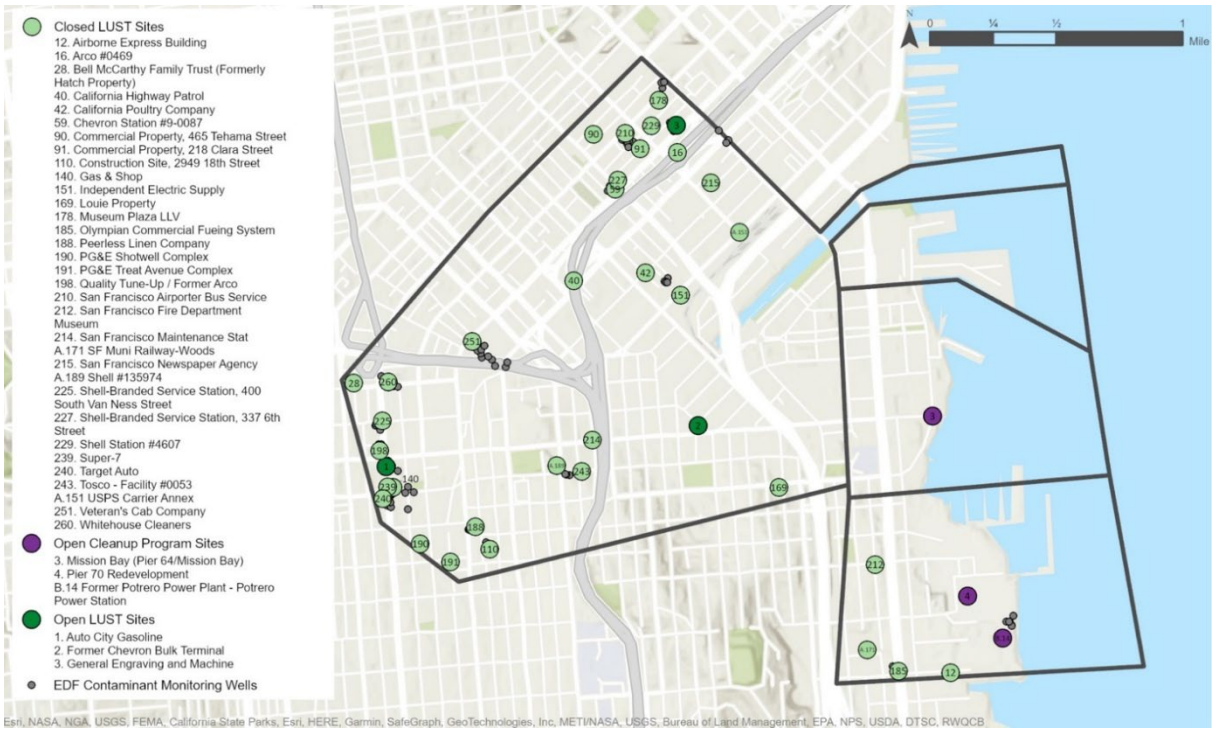


Figure D.1.6-2: Embarcadero Hazardous Sites

This review included sites regulated by DTSC and RWQCB and cataloging the source of the contamination, contaminants of concern, remediation status, remediation methods used, and any institution controls that remain in place. This review did not include potential contaminated sites under the authority of the City of San Francisco, such as the Maher and Voluntary Remedial Action Program (VRAP).

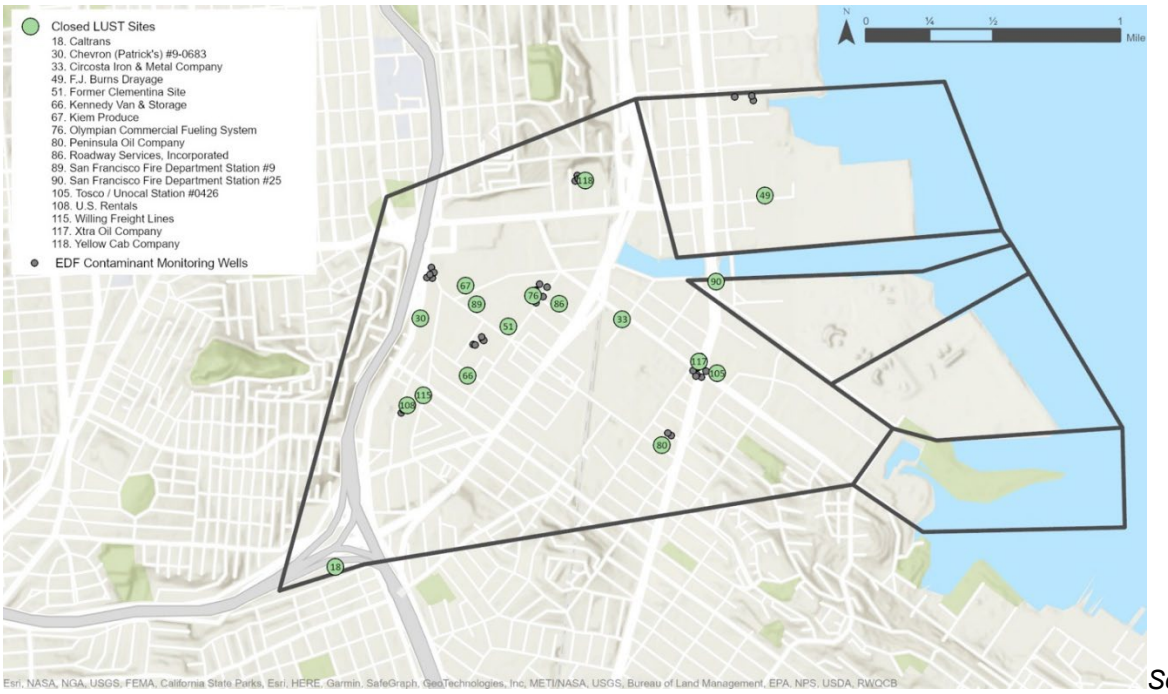
This study also includes an initial assessment of the depth to the shallow groundwater table at the identified sites, including the amount of sea level rise that could result in the groundwater table rising above the ground surface (that is, emergent groundwater). The following provides a high-level summary of the sites cataloged **(Figure D.1.6-3** through **Figure D.1.6-6**).

- DTSC Sites:
    - 17 DTSC Sites were identified in the Mission Creek/Mission Bay geography and 11 sites were identified in the Islais Creek/Bayview geography.
    - With 84-inches sea level rise (an upper-end estimate of sea level rise that could occur by 2100), seven (7) sites could be exposed to coastal flooding from direct overtopping of the shoreline by coastal floodwaters, ten (10) could experience emergent groundwater, and 18 could have shallow groundwater table within 6 feet of the ground surface.
- RWQCB Sites:
    - 36 Open Cleanup Program Sites were identified in the Mission Creek/Mission Bay geography and 5 were identified in the Islais Creek/Bayview geography.
    - Three (3) Closed Cleanup Program Sites were identified in the Mission Creek/Mission Bay geography, and three (3) were identified in the Islais Creek/Bayview geography.
    - Four (4) Open Leaking Underground Storage Tank (LUST) sites were identified in the Mission Creek/Mission Bay geography, and three (3) were identified in the Islais Creek/Bayview geography.
    - 282 Closed LUST Sites were identified in the Mission Creek/Mission Bay geography, and 162 sites were identified in the Islais Creek/Bayview geography.



Source: (RWQCB 2022)

Figure D.1.6-3: Mission Creek/Mission Bay EDF Contaminant Monitoring Wells with Associated RWQCB Sites



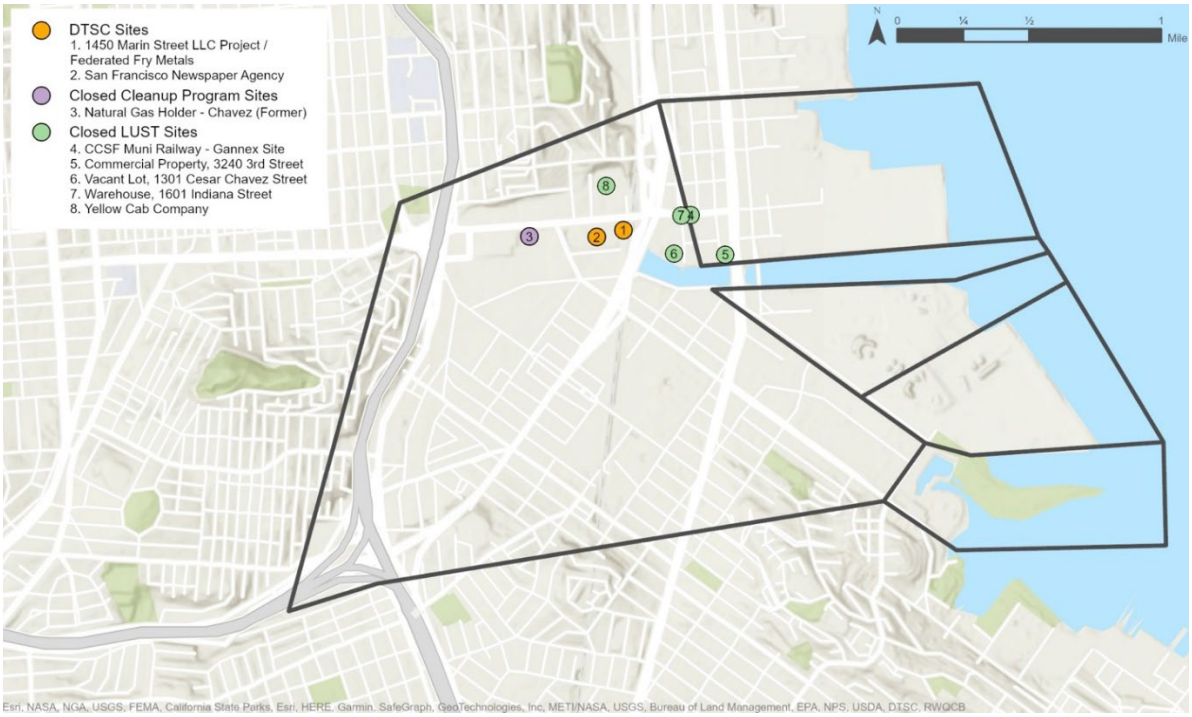
Source: (RWQCB 2022)

Figure D.1.6-4: Islais Creek/Bayview EDF Contaminant Monitoring Wells with Associated RWQCB Sites



Source: DTSC, 2022; SWRCB, 2022

Figure D.1.6-5: DTSC and RWQCB Sites under Institutional Controls Mission Creek/Mission Bay



Source: DTSC, 2022; SWRCB, 2022

Figure D.1.6-6: DTSC and RWQCB Sites under Institutional Controls Islais Creek/Bayview

The report on Contaminated Lands: Mission Creek/Mission Bay and Islais Creek/Bayview provides a starting point for addressing potential concerns related to contaminated sites and climate change, with a focus on sea level rise and rising groundwater. However, this report does not identify the contaminated sites of greatest concern, nor does it provide recommendations for additional analysis, monitoring or remediation that may be required for some sites.

The report recommended potential next steps including:

- Step 1 - Establishing criteria to evaluate, rank, and prioritize the contaminated sites that require further action. Such criteria may include features or details such as:
    - What contaminants (such as, heavy metals, volatile constituents, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, polychlorinated biphenyls) have the greatest potential to be mobilized with rising groundwater levels?
    - What types of human health or ecological exposure risks could be created or made worse with rising groundwater levels, such as human health risk from dermal contact, increased risk of vapor intrusion, or increased risk to ecological receptors?
    - Are existing buildings present such that impacts related to vapor intrusion are of concern?
    - Are the environmental impacts resulting from coastal flooding or rising groundwater short- or long-term impacts (for example, would the impacts result in the need for mitigation or remediation, or would the impacts be short-lived and not require aggressive actions).
    - Is there the potential for a “regulatory re-opener” (for example, sites with institutional controls or residual contamination could trigger regulatory involvement)?
- Step 2 - Apply the criteria to the cataloged sites and organize the sites by ranking and priority:
    - Develop a ranking or scoring system (using either a simple set of questions or weighted scoring system) using the established set of criteria.
    - Rank or score each site using the criteria.
    - Identify the sites with the most critical and/or immediate concerns.
- Step 3 - Provide recommendations and next steps for the highest-priority sites:
    - Summarize the prioritized sites.
    - Develop and provide recommended actions, strategies, and next steps for each prioritized site.

- Document the results and findings of Steps 1, 2, and 3.

The Port is pursuing additional funding to advance this field of study.

2.0 Environmental Consequences

2.1 Impacts on the Nonstructural and Action Alternatives

Under the no action alternative, capped and un-capped HTRW areas would be exposed to flooding and erosion from RSLC, which could result in releasing contaminants that impact water, soil, and sediment quality, as well as human health. Additionally, exposure may also occur where the lines of defense for alternatives are constructed landward of any HTRW sites. **Table D.1.6-2** provides a summary of potential HTRW impacts for the action alternatives. Additional investigation and testing will be required prior to construction. The existence of any HTRW will be identified in a future Phase 2 environmental site assessment that will be conducted in subsequent phases of this project and appropriately addressed. *Flowchart 1: Environmental Site Assessment and Risk Management Process* outlines the process for evaluating project sites with known or suspected contamination, including characterization of site conditions through Phase I and Phase II Environmental Site Assessments (ESAs) and risk evaluation to determine whether cleanup, site management, or no further action is warranted.The extent of contamination, performance and costs of HTRW cleanup and response are not included as part of the Federal project. *Flowchart 2: Soil Management Process* describes the process for further investigating and managing soil with known or suspected contamination. It provides a higher level framework for determining whether the material is regulated or hazardous waste and selecting appropriate disposal methods formed from waste characterization testing results or the appropriate reuse pathway based on total analysis and comparison to residential and commercial/industrial screening criteria. This framework will be adjusted for specific site and disposal conditions through active coordination with regulatory agencies and to ensure compliance with USACE regulation to allow for construction to commence.

Table D.1.6-2: Evaluation of HTRW for Each Alternative

Alternative B – NED Intermediate Curve	**Alternative F – Combination of Structural, Nonstructural and NNBFs**	**Alternative G – NED High Curve**	**Recommended Plan**
Pier removal, demolition, and relocation are anticipated to have ***less than significant*** impacts to HTRW. Demolition and relocation activities could result in wind-driven dust or run off that could impact air and water quality. Pier removal would temporarily increase turbidity and sediment suspension. Overall, pier removal is likely to have long-term ***beneficial*** impacts by removing creosote-laden pilings, thereby lessening the risk of contamination.	HTRW would be impacted during wharf replacement and new seawall construction during pile driving activities. These are anticipated to be ***less than significant*** as many HTRW sites can be mitigated. In-bay fill would diminish risk of contamination from contaminated soils and sediments. Addition of EWN features (e.g., marsh enhancement, ecological armoring) would be expected to decrease contamination risks in localized areas, offering ***beneficial*** impacts.	FRM features would be constructed along the shoreline in Reaches 1 and 2, while they would be constructed landward in Reaches 3 and 4 to allow for flooding in front of the measures. This would allow for more flooding in the southern reaches and thereby increase risk of contamination from the numerous HTRW sites located in the southern reaches. Construction would have temporary impacts to HTRW that can be mitigated or avoided and would be ***less than significant.***	HTRW would be impacted during wharf replacement and localized areas of new seawall construction during pile driving activities. These are anticipated to be ***less than significant*** as many HTRW sites can be mitigated or avoided. In-bay fill would diminish risk of contamination from contaminated soils and sediments. Addition of EWN features (e.g., marsh enhancement, ecological armoring) would be expected to decrease contamination risks in localized areas, offering ***beneficial*** impacts.

Table D.1.6-3 provides information on known HTRW concerns within the project area and an evaluation of potential actions to limit impacts for alternatives. The following recommendation is based on the review described in Section 2.0 above. Avoidance is recommended for many of these sites, however, if that is not possible then mitigation methods will need to be proposed and agreed on by the EPA or its subsidiary for each of the noted locations. Subsequent phases of this project will likely need more in-depth site investigations, such as a Phase 2 environmental site assessment that includes testing of the different materials, where possible.

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Table D.1.6-3: Evaluation of HTRW Sites in the Study Area

Site ID	Alternative	Description	Evaluation
Buildings constructed prior to 1980	All	A large number of Buildings within the project footprints were constructed prior to 1980 and may have asbestos, lead and/or other regulated materials present which will need to be remediated prior to construction.	Recommend ascertaining the status of these buildings with either a survey by a licensed inspector or records of abatement and previous survey that clears the buildings.
Hyde Street Harbor 482 Jefferson St.	G 2040 Final & Construction G 2090 Final & Construction F 2040 LOD F 2040 T Wall E Sect 2- Embarcadero Wharf fill C	Site Type: Cleanup Program Site Status: Open - Assessment & Interim Remedial Action In April 2020, the Port reported hydrocarbon sheen on the surface water of San Francisco Bay at the Hyde Street Harbor (HSH). The Port identified the source of the sheen as a release of R-99 diesel fuel (also referred to as renewable diesel) from the piping associated with the fueling station at the Property. The sheen was identified about 35 feet from the San Francisco Bay shoreline. The soil, groundwater, and the surface water of San Francisco Bay have been impacted by the release of R-99. In addition, light nonaqueous-phase liquid has been measured floating on the groundwater in the onshore area where the release occurred. The U.S. Environmental Protection Agency's Office of Emergency Services (OES) responded to the initial release and provided regulatory oversight of response actions conducted by Pilot Thomas and the Port. Those activities were focused on impact assessment and fuel recovery. The Vapor Intrusion Work Plan has been prepared to evaluate the threat of vapor intrusion at nearby buildings and the risk to building occupants.	Prior to construction this site will need to be certified as "clean" by the EPA in accordance with ER 1165-2-132. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW) present in the soil and groundwater. Recommend avoidance.
PG&E Former Beach Street Manufactured Gas Plant 250 Beach Street	G 2040 Construction Footprint	Site Type: Voluntary Agreement Cleanup Program Site Status: Active The former Beach Street manufactured gas plant (MGP) site is located in what is known as the Fisherman's Wharf area of San Francisco. The site occupies the city block bounded by Beach Street, Mason Street, Jefferson Street, and Powell Street. Gas plant operations were conducted on-site from about 1899 until about 1931. The MGP was not significantly damaged by the 1906 earthquake and fire. PG&E purchased the property in 1911 and operated the MGP until around 1931, when usage of manufactured gas in San Francisco was replaced by natural gas. The gas holders from the MGP were used for natural gas storage until 1956-1957, at which point PG&E sold the property. The site was subsequently redeveloped for commercial use. Groundwater monitoring is ongoing with additional groundwater	Recommend Avoidance of this area – Construction footprint overlaps a small corner of this site and may be easily re-routed.

Site ID	Alternative	Description	Evaluation
		monitoring well installation planned for fourth quarter 2019 and first quarter 2020. (JT August 14, 2019).	
Pier 39 Marina Sediment	G 2040 Final & Construction G 2090 Final & Construction – adj. (Adjacent only) F 2040 T Wall, LOD & Cantilever– adj E Sect. 2 – Embarcadero Wharf fill D 2090 D 2040 Fill & Wharf	Site Type: Cleanup Program Site Status: Open Remediation Pier 39 is owned by the Port of San Francisco (the Port). Pier 39 periodically needs to be dredged to maintain vessel navigation depths. Polycyclic aromatic hydrocarbons (PAHs) have been detected in Pier 39 marina sediment. The concentrations and proportions of individual PAH compounds are consistent with manufactured gas plant (MGP) residues. The suspected source of PAHs, the former Beach Street MGP and upland area, is located about 100 feet south of Piers 41 and 43, and is overseen by the Department of Toxic Substances Control (DTSC) (Envirostor Number 60001256). PG&E is addressing the MGP residues in sediment. The final Remedial Investigation Report was submitted in January 2020. MGP impacts to sediment extend from Pier 39 East Basin Marina (inclusive) on the east to Pier 45 (exclusive) on the west. A draft feasibility study and remedial action plan (FS/RAP) was circulated for public comment during fall 2021. The next steps include addressing the comments, finalizing the FS/RAP, and issuance of a site cleanup requirements order.	Recommend avoidance. Alternatives G 2040 Construction footprint and E Section 2 – Embarcadero Wharf fill have significant overlap. Whereas all others listed are adjacent and may easily avoid disturbing the sediment. Ground/sediment-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW) present in the soil.
Site K (Seawall Lot 333) (38750002) 1-59&1/2 Townsend Street	C, D, E, F & G- adj.	Site Type: State Response or NPL Status: Certified O&M – Land Use Restrictions Only Site K is located at 1 through 59 1/2 Townsend Street in San Francisco and is owned by the San Francisco Redevelopment Agency. The site was underwater during the 1800's but completely filled with soil and construction debris by 1913. Previous site occupants included a paint warehouse, ship service companies, and a forklift service company. Approved RA. The removal activities at the site consisted of excavation and bioremediation of soil containing petroleum cap. Approximately 246 cubic yards of petroleum hydrocarbon contaminated soil were biotreated on an asphalt paved lot and subsequently used as backfill. The cap covers all portions of the property and consists of a layer of 10 mils Visqueen plastic and a 4-inch thick concrete slab. A 3-story residential building and 1-story at-grade parking lot has been constructed on site. Approved PEA. Documented fuel leaks at the site impacted the soil and groundwater. DTSC approved a hazardous waste management plan on May 6, 1991. Recorded Deed Restriction. Certified Site. Site Screening noted 5 underground tanks removed. hydrocarbons above 1,000 mg/kg and the placement of a concrete slab.	Avoidance of this site should be feasible as Alternatives C, D, E, F and G do not directly overlap with this site and are adjacent only. If ground disturbing activities are planned at this site that will penetrate or damage the cap, recommend engagement with EPA to determine possible path forward.

Site ID	Alternative	Description	Evaluation
Mission Bay Redevelopment Area	G 2090 Final & Construction G 2040 Final & Construction F 2040 Embankment F 2040 LOD F 2090 Embankment F 2090 LOD E Sect. 4 -Levee/Berm w/ mod. & ext. EWN E Sect. 3- Bulkhead wall w/ fill E Sect. 2- Embarcadero Wharf fill D 2090 D2040 C	Site Type: Cleanup Program Site Status: Open – Site Assessment – Land Use Restrictions Diesel, Gasoline, Heating Oil / Fuel Oil, Lead, Asbestos A May 21, 1999, Risk Management Plan (RMP) was approved by the Regional Water Board for the 300-acre Mission Bay Redevelopment Area. The RMP describes risk management procedures prior to development, during development, and after development. The purpose of the procedures is to protect people from exposure to poor quality fill materials and lower-level, widespread environmental pollution that could not be feasibly cleaned up. On March 21, 2000, a covenant and environmental restriction ("deed restriction") on the property was executed. The deed restriction obligates future landowners to comply with the RMP. Prior to 1906, the Development Project Area was part of the San Francisco Bay. In 1906, the land was created by filling in the marshlands and shallow tidal flats at the San Francisco Bay margin with serpentine rock and soils from the nearby Potrero Hill. Serpentine is a type of ultramafic rock that commonly contains naturally occurring asbestos. An 8-acre area near the vicinity of former Pier 64 was remediated in 2005 to remove separate-phase petroleum pursuant to Board Site Cleanup Order No. R2-2005-0028.	Avoidance of this area is recommended. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW) present in the soil and groundwater. If ground-disturbing activities are planned, invasive site investigation will be required to determine the nature and extent of contamination in accordance with ER 1165-2-132, paragraphs 8.c.(1) and 9.a. Additionally, this area is under Land Use Restrictions that would require coordination with RWQCB. Further investigation is warranted and will be required.
Pier 70, Crane Cove Park, Upland And Sediment	G 2090 Final & Construction – adj only G 2040 Final & Construction F 2040 Embankment F 2040 LOD F 2090 Embankment & LOD – minor overlap E Sect. 3 – Bulkhead wall w/ fill E Sect. 4 – Levee/Berm w/ mod. EWN D 2090 LOD	Cleanup Program Area Open - Verification Monitoring Crane Cove Park is a portion of the Port of San Francisco's Pier 70 property. In 2002, there was a release of polychlorinated biphenyls (PCB) transformer oil, and the Port initiated an emergency clean up response. Remedial activities for the PCBs were overseen by US EPA in accordance with TSCA. Concentrations of PCBs in soil remain at approximately 10 feet below surface. Sediment data adjacent to Crane Cove Park identified concentrations of metals, petroleum hydrocarbons, polyaromatic hydrocarbons (PAHs), PCBs, and dioxins and furans. The sediments were capped in 2020, and the Port is currently conducting bathymetric annual cap inspections to verify its presence.	Avoidance of this area is recommended. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW) present in the soil/sediment. This site is being investigated by the NFS and more information about projected/completed cleanup of site should be acquired.

Site ID	Alternative	Description	Evaluation
	D 2040 Berms		
Pier 70	G 2090 Final & Construction – minor overlap G 2040 Final & Construction F 2040 Embankment & LOD F 2090 Embankment – minor overlap F 2090 LOD E Sect. 4 – Levee/Berm w/ mod. EWN D 2090 Berm D 2040 Berm C – adj only	Site Type: Cleanup Program Site Status: Open – Remediation - Land Use Restrictions Pier 70 historical use includes shipyards dating to mid-1800s, including the manufacturing, maintenance, and repair of marine vessels. The Port of San Francisco owns the 64-acre property and is in the process of redevelopment with private parties who will take on long-term leases. Generally, soil and/or groundwater has been impacted to some degree with petroleum, metals, asbestos, and polyaromatic hydrocarbons (PAHs). A Risk Management Plan was developed in 2013, approved by the Water Board, and requires a "Durable Cover" be maintained over the property. The final Durable Cover will be built with the redevelopment of the property. The Site is divided into three primary areas: Crane Cove Park (Port), Historic Core (Orton Development) and the Special Use District (Forest City/Brookfield Properties).	Avoidance of this area is recommended. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW) present in the soil/sediment. This site is being investigated by the NFS and more information about projected cleanup of site should be acquired. Risk Management Plans, Land Use Restrictions, Deed restrictions and other controls have already been instituted for varying parts of this property. Recommend further investigation to determine a path forward.
Potrero Power Plant	G 2090 Final & Construction -adj. only G 2040 Final & Construction – Minor overlap F 2040 Alt. LOD, Embankment, T wall and LOD F 2090 LOD	Cleanup Program Site Open – Long Term Management This was the site of the Former Potrero Power Plant. The subject property has been used for various commercial and industrial activities since 1872, including sugar refining, barrel manufacturing, electric power generation, and a manufactured gas plant (MGP). The last of these activities, electric power generation, was concluded in 2011. The project area includes 34-acres of the former power plant facility and approximately 22-acres of the adjacent off-shore sediments. For purposes of remedial investigation and planning, the Site was divided into seven operational areas, with six on-shore areas (Switch Yard/General Construction Yard, Hoe Down Yard, Station A, Northeast, Tank Farm, and Unit 3) and one off-shore area (Offshore).	Avoidance of this area is recommended. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW) present in the soil/sediment. This site is being investigated by the NFS and more information about projected cleanup of site should be acquired. Risk Management Plans, Land Use Restrictions, Deed restrictions and other controls have already been instituted for the varying parts of this property. Recommend further investigation to determine if there is a path forward.

Site ID	Alternative	Description	Evaluation
MME Expansion (Frmr Sfer) Project/ Former Western Pacific	G 2040 Final & Construction F 2040 Embankment & LOD E Sect. 4 – Levee/Berm w/ extensive EWN D 2040 EWN and Berms D 2090 EWN and Berms	Open - Site Assessment As Of 11/3/2021 ACTIVITIES PROHIBITED WHICH DISTURB THE REMEDY AND MONITORING SYSTEMS WITHOUT APPROVAL ASPHALT COVER NOT TO BE DISTURBED WITHOUT APPROVAL DAY CARE CENTER PROHIBITED ELDER CARE CENTER PROHIBITED HOSPITAL USE PROHIBITED LAND USE COVENANT NO EXCAVATION OF CONTAMINATED SOILS WITHOUT AGENCY REVIEW AND APPROVAL NO GROUNDWATER EXTRACTION AT ANY DEPTH WITHOUT APPROVAL NOTIFY PRIOR TO SUBSURFACE WORK PUBLIC OR PRIVATE SCHOOL FOR PERSONS UNDER 21 PROHIBITED RAISING OF FOOD PROHIBITED REQUIRES SURFACE COVERS RESIDENCE USE PROHIBITED The Site is owned by the City and County of San Francisco and lies in an area reclaimed from the San Francisco Bay in the Islais Creek Estuary. A former owner, Western Pacific Railroad, used the area as a switchyard for rail cars. The soil and groundwater of the site are contaminated with inorganic and organic chemicals, including lead, arsenic, chromium, cobalt, polynuclear aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs). The contamination may have been caused by previous operations or by the nature of artificial fill material, composed of crushed bedrock building debris, sand, and other typical fill material. The City had proposed constructing a power plant to handle demand during peak hours (a "peaker plant") but the proposal was withdrawn in 2008. A deed restriction was recorded against the property in 2002.	Avoidance of this area is recommended. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW) present in the soil and groundwater. If ground-disturbing activities are planned, invasive site investigation will be required to determine the nature and extent of contamination in accordance with ER 1165-2-132, paragraphs 8.c.(1) and 9.a. Additionally, this area is under Land Use Restrictions that would require coordination with RWQCB. Further investigation is warranted.

Site ID	Alternative	Description	Evaluation
		The current development plan for the Site is to construct a temporary bus facility for SFMUNI. Lead oversight for the case was transferred from the RWQCB to the SFDPH on 11/3/2021.	
Islais Creek	G 2040 Final & Construction E Sect. 6 – Bulkhead Wall and Wharf @maritime terminal, E Sect. 4 – Levee/Berm w/ mod. EWN D 2040 PS Wall, LOD, Fill and Wharf, EWN, Berms D 2090 LOD, EWN C	The western portion of Islais Creek (west of the 3rd Street Bridge) was designated as “toxic hot spot” by RWQCB in 1999 due to elevated concentrations of metals, PAHs, PCBs, and pesticides in sediment and observed toxicity to aquatic organisms in toxicity tests. Sediment samples from the eastern portion of Islais Creek, from 3rd Street Bridge to the Bay, contained lesser concentrations of COCs, so the site was not designated a toxic hot spot. Discharges from four combined sewer overflows and a wastewater outfall to the creek are the primary sources of contaminants to Islais Creek (RWQCB 1999). This site is under water today.	Avoidance of this area is recommended. Sediment and/or Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW). If ground-disturbing activities are planned, invasive site investigation (Phase II) will be required to determine the nature and extent of contamination in accordance with ER 1165-2-132, paragraphs 8.c.(1) and 9.a. Further site investigation is needed.
Pier 90	G 2040 Final & Construction G 2090 Final & Construction F 2040 Embankment & LOD F 2090 Embankment & LOD E Sect. 6 – Bulkhead wall and wharf @maritime terminal. D 2040 LOD, EWN, Berms, Extension Wall & Fill and Wharf D 2090 LOD & Wall Wharf and Fill C	Site Type Cleanup Program Site Status Open – Remediation as of 3/1/2022 The project property is on Pier 90 located along the south side of Islais Creek Channel, at the northeast intersection of Amador and Illinois streets and Cargo Way. The site is a former Exxon Mobil bulk oil facility with prior operations by Texaco and General Petroleum Corporation. The area was used for oil storage and transport from at least 1924 to sometime between 1975 and 1989. Multiple large above ground storage tanks and the associated piping were located on the property. The tanks had been removed by 1989. Review additional site characterization letter describes the Installation of six monitoring wells. The utility corridors may act as preferential pathways for contaminant migration. Contaminants: Arsenic, copper, diesel, gasoline, lead, nickel, total petroleum hydrocarbons, Waste oil / motor / hydraulic / lubricating, zinc	Avoidance of this area is recommended. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW). If ground-disturbing activities are planned, invasive site investigation (Phase II) will be required to determine the nature and extent of contamination in accordance with ER 1165-2-132, paragraphs 8.c.(1) and 9.a. Further site investigation is needed.

Site ID	Alternative	Description	Evaluation
San Francisco Energy Company Cogeneration Project, Seawall Lot 344	G 2090 Final & Construction G 2040 Final & Construction F 2040 Embankment, LOD F 2090 Embankment, LOD E Sect. A – Extensive EWN D 2040 Sheetpile, LOD, Fill and Wharf, EWN, Berms D 2090 LOD, EWN C	SITE_TYPEVoluntary Cleanup No updates or documents other than the voluntary cleanup agreement available. The Site Action Plan (aka Removal Action Workplan) was approved. The site was part of the San Francisco Bay until Bay filling activities established a land mass in this area. Proponent has represented that while this area was filled in, it was never developed. Analytical results of soil samples contain lead up to 2,000 TPH and low levels of pesticides, PNAs, and PCBs in the fill material. A Voluntary Cleanup Agreement was signed on 8/21/95 to provide oversight for the characterization and cleanup of the project as part of the California Energy Commission siting process for a cogeneration plant. A Site Action Plan (aka: Removal Action Workplan) as approved on March 14, 1996, which required that the Site be capped with a combination of asphalt, concrete, and clean fill material. The removal action was not implemented because implementation was dependent upon certification of the project by the California Energy Commission.	Avoidance of this area is recommended. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW). If ground-disturbing activities are planned, invasive site investigation (Phase II) will be required to determine the nature and extent of contamination in accordance with ER 1165-2-132, paragraphs 8.c.(1) and 9.a. Further site investigation is needed.
Pier 94 & 96 Fill Site	G 2090 Final & Construction- adj. G 2040 Final & Construction F 2040 Embankment, LOD, No strategy- adj. F 2090 Embankments – adj F 2090 LOD E Sect. A – Ext. EWN E Sect. 6- Bulkhead wall &wharf @maritime terminal E Sect. 5- Bulkhead wall @ maritime terminal D 2040 Sheetpile, LOD, Extension Wall, EWN D 2040 Berms – adj. only D 2090 LOD, EWN	In 1961, the Port initiated construction of a marine terminal in the area now designated as Piers 94 and 96 by placing fill material, primarily clean soil, rock, dredged material, and construction debris behind a perimeter debris dike. Future development at the site would require a site mitigation plan to outline proper soil and groundwater handling procedures and appropriate site capping requirements to mitigate human and ecological exposure to the hazardous materials identified during the site investigation. In 1961, the landfill was created by constructing a perimeter debris dike from the existing shore extending east out into the bay from Pier 92 in the north to Pier 96 in the south. The debris dike was comprised of wood, brick, metal, and concrete with sandy gravel, silty sand, and clay (Geo/Resources, 1990). In 1964, about 2.5 million cubic yards of dredge spoils from Pier 80 were placed within the dike. From 1965 to 1975, an unknown quantity of construction debris and municipal waste were placed over the bay mud dredge spoils. The thickness of the waste unit ranges from about 9 feet to 29 feet. According to Geo/Resources, the waste unit is comprised of a heterogeneous mixture of wood, brick, concrete, roots, terra cotta, metal, plastic, and household debris, mixed with silty sandy clay and silty clayey sand. Between 1975 and 1977, a 2- to 5-foot layer of rocky soil with minor amounts of debris was placed over the waste unit (Geo/Resources, 1990). The landfill never operated as a municipal solid waste landfill; however, because of the nature of some of the fill that comprises the	Avoidance of this area is recommended. Ground-disturbing activities in this area have the possibility of encountering known hazardous constituents (HTRW) present in the soil and groundwater. If ground-disturbing activities are planned, invasive site investigation will be required to determine the nature and extent of contamination (if any remains) in accordance with ER 1165-2-132, paragraphs 8.c.(1) and 9.a. More information about the specific contaminants and their location will likely present a path forward.

Site ID	Alternative	Description	Evaluation
	C	upland portions of Pier 94, an approximately 14-acre area ("Site") is regulated as a Class III landfill (non-hazardous solid waste) by the RWQCB. The Port's filling activity was initially authorized by the RWQCB under WDRs issued in March of 1972 (Order No. 72-9). The WDRs were revised and updated in 1975, 1987, and 2003.	
Pier 98 Fill Site	D 2040 Sheetpile	Heron's Head Park (the Site) is an approximately 26 acre park built on a peninsula of land jutting into India Basin in southeast San Francisco. Owned by the Port of San Francisco, this park began its life as "Pier 98", land comprised of fill placed in San Francisco Bay to construct a container terminal in the early 1970s. The Port's original fill placement in the 1970s was permitted by Waste Discharge Requirements (WDR) issued by the California EPA, Regional Water Quality Control Board (Water Board). In compliance with those requirements, after filling ceased the Port investigated soil conditions and monitored chemical constituents in groundwater for over ten years. The Water Board review found that the data indicated no significant potential for the site to impact water quality. The Water Board approved construction of the park, including placement of a Geosynthetic Clay Liner (GCL) over portions of the landfill to minimize potential for leachate generation in a portion of the Site where organic material had been placed along with inert fill material.	Only D 2040 Sheetpile footprint is in the vicinity of this site, therefore, recommendation is to adjust the footprint to avoid the area where the GCL and landfill site exist by removing a ½ a mile from design.
Pier 70 Fill Site	Unable to determine	The California State Water Resources Control Board (SWRCB) indicated no specific COCs at this municipal solid waste landfill. No additional site history was provided by SWRCB (Port 2021a).	No project impact anticipated with information provided. Unable to determine extent of landfill site.
PG&E Hunters Point	G 2090 Final & Construction G 2040 Final & Construction F 2040 Embankment, LOD F 2090 Embankment, LOD E Sect. 4 Levee/Berm w/ ext. EWN D 2040 LOD, EWN, Berms D 2090 LOD, EWN, Berms C	The site is approximately 38 acres bounded by San Francisco Bay to the east. In the early 1900s, the Site area was used for ship and barge building. The original power generation plant was constructed on the Site in the 1920s and utilized fuel oil. In 1948/1949, two additional steam units and three additional aboveground fuel storage tanks were added to the plant and fill material was placed in the southeastern portion of the Site for development of this area. In 1958, an additional steam unit and three above ground fuel storage tanks were added. In 1969, the breakwater around the cooling water lagoon outlet was constructed. By 1975, the dike between the breakwater and Pier 96 was completed, creating the cooling water lagoon. Another aboveground fuel storage tank 8 had been added by this time. In 1976, a gas fueled turbine unit was constructed. By 1977, another above ground fuel storage tank had been added.	Avoidance of this area is recommended. Ground-disturbing activities in this area are likely to encounter known hazardous constituents (HTRW) present in the soil and groundwater. If ground-disturbing activities are planned, invasive site investigation will be required to determine the nature and extent of contamination in accordance with ER 1165-2-132, paragraphs 8.c.(1) and 9.a.. Additionally, this area is under Land Use Restrictions that would require coordination with RWQCB. Further investigation is warranted.

Site ID	Alternative	Description	Evaluation
		In 2002, PG&E removed 8 of the nine aboveground fuel storage tanks which were primarily used to store heavy fuel oils. One aboveground fuel storage tank (no. 9) was retained to store the distillate (low sulfur) fuel used by the Unit Number 1 peaking turbines as necessary for electric system reliability. The Plant was shut down on May 15, 2006. The aboveground plant structures have been removed and the below ground structures are being dismantled. Reports, containing the results of environmental media sampling conducted at the Site, indicate that the soil and/or groundwater are contaminated with hazardous substances, including total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), metals and polychlorinated biphenyls (PCBs). Much of the Site contains fill material derived from local serpentine rock which contains naturally Construction -occurring asbestos (NOA) and the metals, nickel, chromium and cobalt.	
Federated Fry Metals	G 2090 Final & Construction – adj G 2040 Final & - adj	1450 Marin Street LLC Project / Federated Fry Metals is a State Response site that is under Certified O&M and Land Use Restrictions status. COCs include lead and mercury. Federated Metals Corporation owned and operated a secondary metals plant in a heavily industrialized section of San Francisco. Operations at the site included the production of lead and brass ingot. Oxides were formed during smelting and removed in the form of slag. It is also believed that approximately 1,500 yd3of crushed and washed pre-1950s-style battery boxes were deposited onsite. Currently, the site is capped with asphalt. In an email exchange between DTSC and ACE Drilling & Excavation (DTSC 2020), DTSC noted that in a site inspection (conducted in November 2020) minor cracks were observed. DTSC recommends the continued monitoring of the cracks and scheduled repairs if the cracks worsen or if impacted soil beneath the cap is exposed. The site is in compliance with the restrictions and requirements of the Land Use Covenant, and the cap surface continues to be an effective barrier over the impacted soil.	No project impact anticipated. This site is adjacent to Alternatives G 2090 and G 2040 only, therefore, avoidance should be possible.

2.2 Views of the Non-Federal Sponsor (Port of San Francisco)

Given the industrial history of the Port of San Francisco (Port), the Port has extensive experience with environmental site investigation and remedial activities conducted either by the Port or by other responsible parties.

The Port believes that the level of potential future investment under the proposed Total Maximum Net Benefits Plan also provides an opportunity to address past harms associated with environmental contamination. Under earlier sections of this Appendix, the preliminary analysis of contaminated sites suggests “avoidance” as a strategy for implementation of the Total Benefits Plan, consistent with ER 1165-2-132.

The Port believes that the avoidance approach may miss the opportunity to leverage local and Federal investment in the Total Maximum Net Benefits Plan to address past harms associated with existing contamination, particularly when:

- Regulatory agencies with oversight authority have approved risk management plans authorizing future construction activities: and/or
- Proposed measures such as ground improvement or structural shoreline stabilization would have the benefit of providing either *in situ* treatment of existing contamination or would prevent migration of such contamination to the Bay.

The Port acknowledges that USACE operates under strict regulations designed to protect Federal taxpayers from paying for remediation of local contamination. The Port of San Francisco/Non-Federal Sponsor will work with federal and state regulatory agencies and the USACE to address environmental contamination.

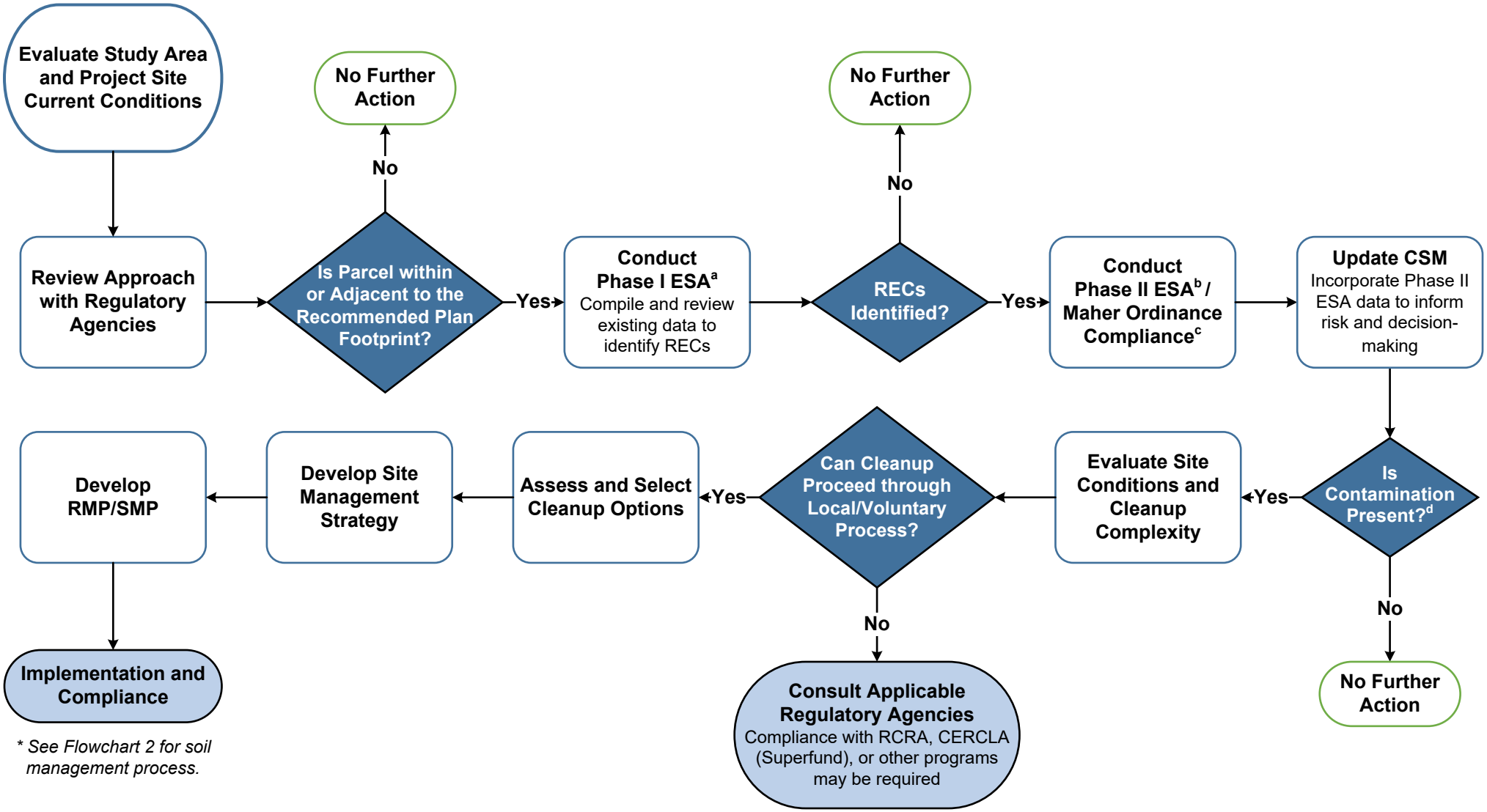
3.0 References

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ATTACHMENT 1: FLOWCHARTS

Flowchart 1: Environmental Site Assessment and Risk Management Process



** See Flowchart 2 for soil management process.*

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Flowchart 1: Environmental Site Assessment and Risk Management Process

Notes:

[a] A Phase I ESA is conducted in accordance with ASTM E1527-21, Standard Practice for ESAs: Phase I ESA Process (ASTM International 2021). The purpose of the Phase I ESA is to identify RECs, defined as the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property due to a release, under conditions indicative of a release, or under conditions that pose a material threat of a future release. This process involves a review of historical and regulatory records, a site inspection, and interviews, and does not include sampling or testing.

[b] A Phase II ESA is conducted in accordance with ASTM E1903-11, Standard Practice for ESAs: Phase II ESA Process (ASTM International 2020). The purpose of the Phase II ESA is to develop information regarding the presence, likely presence, or absence of hazardous substances or petroleum products on a property. It is typically initiated to further evaluate RECs identified during a Phase I ESA. Activities may include the collection and analysis of environmental media (e.g., soil, groundwater, soil gas, or surface water) to characterize site conditions. A Phase II ESA supports site decision-making but is not intended to satisfy the requirements of a full site characterization under CERCLA, RCRA, or state cleanup programs.

[c] The Maher Ordinance (San Francisco Health Code Article 22A) requires environmental investigation, and if necessary, mitigation or remediation, for development projects on properties where contamination is known or reasonably suspected. The ordinance applies to areas of historical fill or prior industrial activity and is administered by the SFDPH. Site development within Maher-designated areas requires submittal and approval of a site mitigation plan prior to construction. Additional information is available from SFDPH (SFDPH n.d.).

[d] Standards appropriate for current and future exposure scenarios will be evaluated, including residential and commercial/industrial standards.

Acronyms and Abbreviations:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

CSM = conceptual site model

ESA = environmental site assessment

n.d. = no date

PRPs = potentially responsible parties

RCRA = Resource Conservation and Recovery Act

RECs = recognized environmental conditions

RMP = risk management plan

SFDPH = San Francisco Department of Public Health

SMP = site management plan

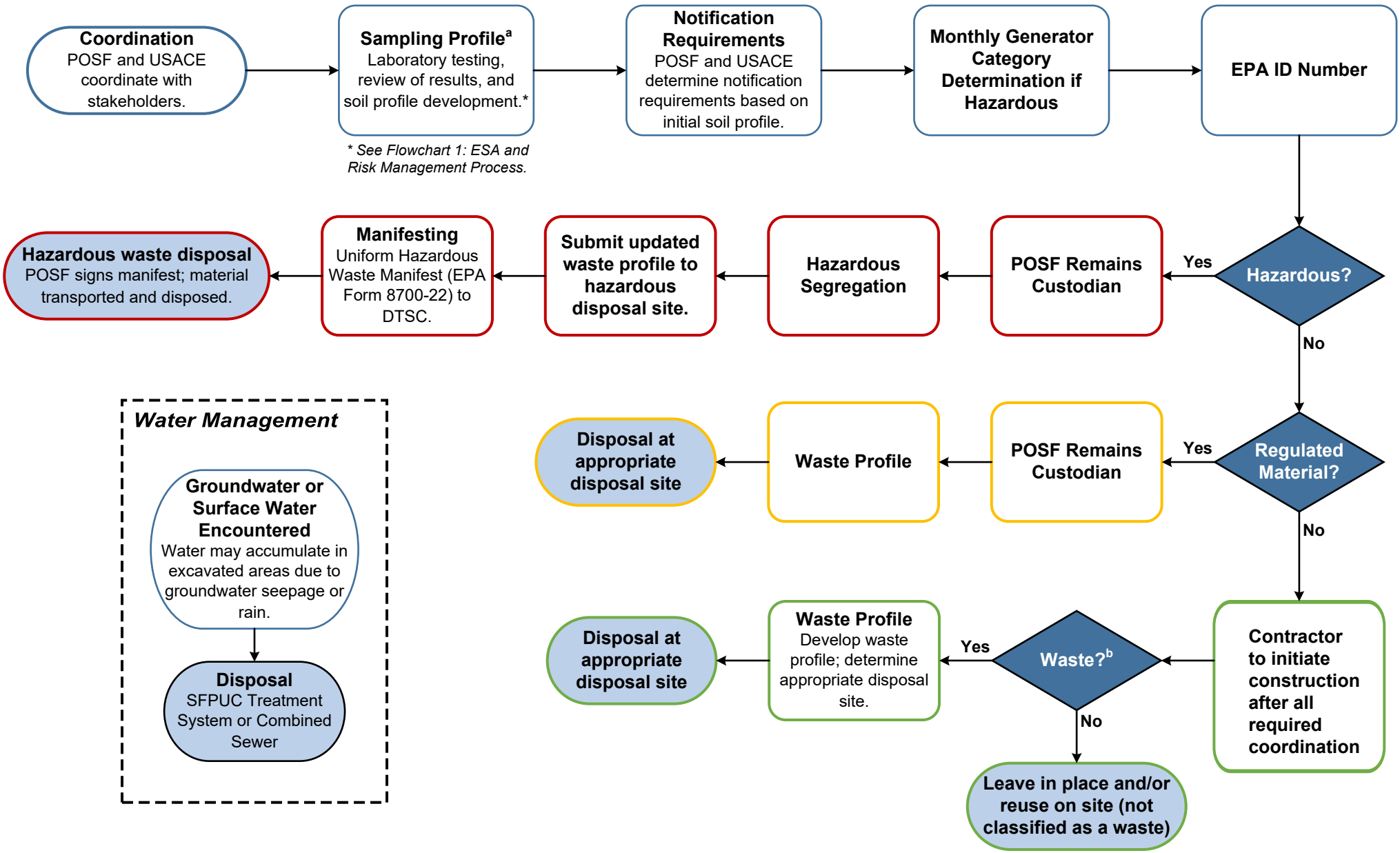
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Flowchart 2: Soil Management Process



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PORT OF SAN FRANCISCO

Flowchart 2: Soil Management Process

General Notes:

1. This flowchart addresses waste management actions following initial soil characterization. See separate flowchart for risk evaluation and pre-characterization planning.
2. This flowchart does not apply to sites with an existing soil management plan.
3. This flowchart does not incorporate requirements for radioactive waste because the fill and use history of the POSF does not suggest the presence of any radioactive waste on POSF property (USACE & POSF 2025).
4. This flowchart provides a high-level, conceptual framework for managing soil that is excavated during remedy implementation or construction at sites where contamination is known to be present and where site conditions may meet criteria to pursue an exception under applicable HTRW policy. The flowchart is not a site-specific soil management plan, and the sequence, decision points, and responsibilities shown are illustrative. The process will be refined on a site-by-site and disposal facility-specific basis through coordination with regulatory agencies and to ensure compliance with USACE requirements.

Footnotes:

[a] Specific tests required will be determined by the Phase II ESA. Testing is not limited to waste characterization and will include evaluation of impacts to human health and the environment.

[b] Any remedial action or disposal will be regulated by the site management plan. For the purposes of this process, “waste” refers to excavated soil or other materials generated during project construction activities that are not classified as California or federal hazardous waste, are not otherwise regulated materials under federal or California law, and do not meet onsite reuse criteria or consist of excess material not needed for onsite reuse. Such materials require offsite disposal at an appropriate facility. Final waste determination procedures will follow the site management plan.

Acronyms and Abbreviations:

DTSC = California Department of Toxic Substances Control

EPA = United States Environmental Protection Agency

ESA = environmental site assessment

HTRW = hazardous, toxic, and radioactive waste

ID = identification

POSF = Port of San Francisco

SFPUC = San Francisco Public Utilities Commission

USACE = United States Army Corps of Engineers

Reference:

USACE and POSF. 2025. Appendix D: Environmental and Cultural Resources, Draft Integrated Feasibility Report and Environmental Impact Statement, San Francisco Waterfront Coastal Flood Study.

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.1.7
LAND USE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Land Use Attacment 1: Land Use Zoning and Neighborhood Figures for Alternatives

1.0 Affected Environment

1.1 Regulatory Framework

1.1.1 Federal Regulatory Setting

- No federal regulations related to land use are applicable to the Project.

1.1.2 State Regulatory Setting

- The Public Trust Doctrine

The City and County of San Francisco, through the San Francisco Port Commission, was granted sovereign tide and submerged lands in trust through legislation referred to as the 1968 Burton Act. Since that enactment, the California Legislature has amended the Port's statutory trust grant through over 20 statutes. Many of these amendments were enacted to facilitate the improvement of the infrastructure and historic structures on trust lands along the San Francisco waterfront (California State Lands Commission [SLC] 2023).

The Public Trust provides that tide and submerged lands and the beds of lakes, streams and other navigable waterways are to be held in trust by the State for the benefit of the people of California. San Francisco Bay tidal and submerged lands fall into this Public Trust Doctrine. The Common Law doctrine of the Public Trust protects the public's right to use California's waterways for navigation, fishing, boating, natural habitat protection and other water-oriented activities.

Under this doctrine, the Port of San Francisco through the Burton Act has a duty to protect and sustain its coastal tidelands and submerged lands for public purposes ranging from navigation and commerce to recreation and conservation, as well as the authority to defend the public's interests when they are at risk. Historically, the Public Trust has referred to the basic right of the public to use its waterways to engage in "commerce, navigation, and fisheries"; the doctrine has been broadened by various landmark court decisions to include the right to swim, boat, and engage in other forms of water recreation, and the right to preserve lands in their natural state to protect scenic and wildlife habitat values. The Public Trust, as a common law doctrine, is not static but is continuously evolving to protect the public's use and needs in California's waterways (SLC, 2023; Center for Ocean Solutions 2017).

- San Francisco Bay Conservation and Development Commission Plans

In 1965, the McAteer-Petris Act established the San Francisco Bay Conservation and Development Commission (BCDC). As a state agency, BCDC is charged with protecting and enhancing the Bay and has regulatory responsibility over development within the Bay and along the Bay's shoreline. BCDC accomplishes its mission by minimizing fill in wetlands and mudflats, and encouraging the use, restoration, and protection of marshes, salt ponds, and wildlife refuges. Additionally, BCDC supports maritime activities and requires public shoreline access for new waterfront projects. BCDC permits are required for projects within the Bay or within 100 feet of the shoreline.

The waterfront is located within the area of jurisdiction of the BCDC, which includes the Bay itself to the highest tide line (mean high-tide line) as well as the first 100 feet shoreward from that line (the shoreline band) around San Francisco Bay. This jurisdiction requires consideration of several BCDC plans, such as The Bay Plan and the San Francisco Waterfront Special Area Plan. BCDC's Adapting to Rising Tides Program is also relevant.

The Bay Plan defines BCDC's role in protecting the Bay through control of filling and dredging within the Bay, and shoreline development adjacent to the Bay. The San Francisco Waterfront Special Area Plan is an amendment to the Bay Plan prepared in partnership with the Port to apply policies of the Bay Plan specifically to the plan area. Port projects must comply with the San Francisco Waterfront Special Area Plan, McAteer-Petris Act, and the Bay Plan.

The Adapting to Rising Tides Program is a collaborative effort across the region to help Bay Area communities adapt to sea level rise (SLR) and storm flooding by providing an adaptation planning approach that integrates sustainability and transparent decision making (Port of San Francisco 2020a).

- Ocean Protection Council Sea Level Rise Guidance

Rising Seas in California: An Update on Sea-Level Rise Science (2018 Update), developed by the Ocean Protection Council's Science Advisory Team, summarizes the current state of SLR science. This information was used to update the state's SLR guidance, which provides a methodology for state and local governments to analyze risks and incorporate SLR considerations into planning efforts. The City of San Francisco is revising its SLR planning guidance for capital planning projects within its Sea Level Rise Vulnerability Zone (SLRVZ) in accordance with the new state guidance (Port of San Francisco 2020a).

1.1.3 Local Regulatory Setting

All Port projects must comply with the City and County of San Francisco's (City's) Planning Code, General Plan, and associated Area Plans including existing height limits. A 40-foot height limit applies to projects on all piers except the Ferry Building. The majority of seawall lots also have a 40-foot height limit, except for a few parcels with higher limits. A June 2014 San Francisco ballot measure, Proposition B: Waterfront Building Heights, requires voter approval for new projects to exceed established height limits (Port of San Francisco 2020a).

- San Francisco General Plan and Special Area Plans

The San Francisco General Plan (General Plan) sets forth San Francisco's comprehensive, long-term land use policy. The General Plan provides general policies and objectives to guide land-use decisions and contains policies that relate to physical environmental issues. The General Plan consists of 10 issue-oriented plan elements: Air Quality, Arts, Commerce and Industry, Community Facilities, Community Safety, Environmental Protection, Housing, Recreation and Open Space, Transportation, and Urban Design. In addition to the guidance in the General Plan, the City has adopted a series of Special Area Plans within the project area, including the Northeastern

Waterfront Plan (Reach 1); Downtown, Transit Center District, and Rincon Hill plans (Reach 2); East Soma and Central Waterfront plans (Reach 3) and the Central Waterfront and Bayview-Hunters Point plans (Reach 4) (Figure 1-1).

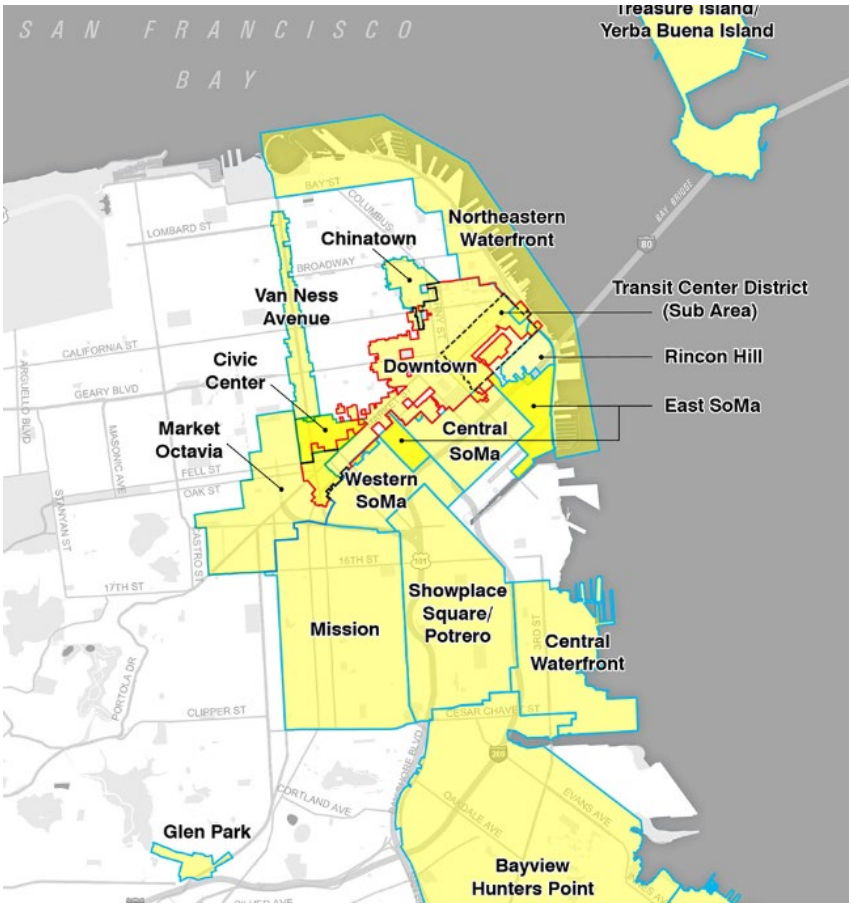


Figure D.1.7-1: San Francisco Special Plan Areas

- San Francisco Planning Code

The San Francisco Planning Code (Planning Code), which incorporates the City's zoning maps by reference, implements the General Plan and governs permitted uses, densities, and configuration of buildings in San Francisco. Permits to construct new buildings (or to alter or demolish existing ones) may not be issued unless (1) the proposed project conforms to the Planning Code, (2) allowable exceptions are granted pursuant to provisions of the Planning Code, or (3) amendments to the Planning Code are approved as part of the project. The Planning Code provides location-specific development and use regulations that govern density and configuration of buildings. Because the Construction area is located on Port land, relevant sections of the Planning Code are included in this land use discussion as a reference for the surrounding land uses and zoning. Zoning maps are available online for the City (City and County of San Francisco 2023a and 2023b).

- The Waterfront Plan

The Port's Waterfront Plan (previously the Waterfront Land Use Plan) is the Port's official planning document and governs the use, design and improvement of Port property, and was adopted by the Port Commission on April 11, 2023. The Final Waterfront Plan is the result of a 3-year public planning process by the Waterfront Working Group (Port of San Francisco, 2023).

As Port projects must comply with the Planning Code and General Plan, BCDC San Francisco Bay Plan (Bay Plan), and San Francisco Waterfront Special Area Plan, the Waterfront Plan compiles these requirements (Port of San Francisco 2020a and 2023).

1.1.4 Other Relevant Plans

- Plan Bay Area 2050

The Association of Bay Area Governments and the Metropolitan Transportation Commission adopted Plan Bay Area 2050 as the Bay Area's long-term regional transportation and land use blueprint in October 2021. The plan connects housing, the economy, transportation, and environmental elements to provide a more equitable and resilient Bay Area. The plan identifies an action plan for 80 specific measures across 35 different strategies.

- Public Realm Plans and Studies

Various City agencies have prepared public realm related plans and studies, including the Fisherman's Wharf Public Realm Plan (2010) and Central Waterfront-Dogpatch Public Realm Plan (Adopted 2018), as well as various transportation plans and projects through San Francisco Public Works, the San Francisco Planning Department, and the San Francisco Municipal Transportation Agency. These include Better Streets projects, transportation projects (such as the Embarcadero Enhancement Project) and the San Francisco Bicycle Plan (2009) amongst others. These transportation plans and projects along or adjacent to the waterfront are of important consideration to the Port. The City also has several plans focused on sustainability, environmental protection, and open space preservation, such as the Green Connections project to link people to parks, open space and the waterfront; an Urban Forest Plan; Groundplay, an effort to transform underused public spaces into enjoyable public spaces; and standards for bird-safe buildings (Port of San Francisco 2020a).

1.2 Existing Conditions

This section describes the land uses in the Construction area and in the immediate vicinity.

1.2.1 Existing Land Uses

In 1968, the Burton Act mandated the transfer of Port lands from State management to the City and created the Port Commission to develop, lease, administer, manage, and maintain Port lands. Today, Port lands provide a myriad of maritime, commercial,

cultural, and public services. Port land use has shifted from primarily maritime to mixed maritime, commercial, recreational, open space, and other uses over time. Breakbulk cargo flourished along the Embarcadero through World War II when the U.S. military displaced the Port's traditional maritime tenants. Starting in the 1970s, cargo shipping replaced breakbulk shipping and these activities relocated to modern terminals in Oakland and the Port's Southern Waterfront. The historic finger piers have been adapted to accommodate public-oriented maritime commerce alongside long-standing industrial maritime operations resulting in one of the most diverse maritime portfolios in the nation. Recreational boating marinas at Pier 39 and South Beach Harbor and small craft docks in several other locations accommodate a growing interest in water recreation. The Port also provides berths for historic ships and its deep-water pier berths accommodate visiting military and research vessels along this shoreline.

The 1989 Loma Prieta earthquake led to the demolition of a double-decker freeway over the Embarcadero that had been a barrier between San Francisco and the waterfront and spurred the Port to prepare a Waterfront Land Use Plan (Waterfront Plan) for its properties. The 1997 Waterfront Plan, revised several times, guided the reconnection of the city with its waterfront and provided new revenues aligned with local values and legal responsibilities. The Waterfront Plan shaped many land use and development decisions that, along with major public works and Redevelopment Agency projects, resulted in today's waterfront (Port of San Francisco 2020a). Highlights include the Embarcadero Promenade, a revitalized Ferry Building with commercial shops and restaurants, and historic building rehabilitation at Pier 1; Piers 1.5-3-5 bulkhead buildings; Pier 15 (the Exploratorium), and the Ferry Arch. New building construction included Oracle Park and the James R. Herman Cruise Terminal at Pier 27. In addition, many dilapidated piers were removed to create open water areas and major open space parks and plazas at Brannan Street Wharf, Rincon Park, Cruise Terminal Park, and Pier 43 Promenade and Plaza. Numerous other public improvements are documented, including major plans and improvements outside of the Project area at Mission Rock and Pier 70 Union Iron Works Historic District in the central waterfront area (Port of San Francisco 2020a).

In 2019, the Waterfront Plan Working Group of citizen and waterfront stakeholders produced comprehensive recommendations to update the Plan. In April 2023, the Port Commission approved the Final Waterfront Plan. The Final Waterfront Plan has nine goals and supporting policies. The Waterfront Plan describes the Port's long-term goals and policies to guide the use and improvement of Port piers and properties along its 7½ mile waterfront, from Fisherman's Wharf to India Basin/Bayview.

1.2.2 Land Use Designations

This section describes the land use categories that broadly characterize the predominant uses for city blocks and Port facilities in the Construction Area, as shown in the Land Use Attachment 1. A general description of land uses is provided in the Embarcadero, Mission Creek and Islais Creek reaches (see descriptions below).

Two land use categories, Maritime land use and Port Open Space & Public Access are discussed qualitatively as this is not within the City of San Francisco zoning map

designations. For detailed discussions of land uses on Port property within the Construction Area, see the Embarcadero Seawall Program Land Use Risk Assessment (Port of San Francisco 2020a). These land use types are described below:

- **Port Open Space & Public Access** describes all open space and public access on Port managed property, which includes a network of public access areas and open spaces oriented toward the Bay visually or physically. The waterfront includes several areas of mixed maritime and open space land use such as Ferry Plaza, which houses a public farmer's market and ferry terminals, as well as several small piers that provide recreation and fishing access. Many piers also provide public access along their aprons, or their perimeters, where the public can walk and enjoy views of the Bay. Additionally, the Embarcadero Promenade provides a pedestrian and bicycle path for transportation along the waterfront, and is this area's section of the regional San Francisco Bay Trail, a 500-mile long regional pedestrian and bicycle path around the Bay.
- **Maritime land** is an important land use category, discussed qualitatively and not shown as a separate land use on the figures. This land use depends on a waterfront location to operate and includes uses that support maritime activities such as industrial, storage, office and other uses. Several maritime functions are active within the Construction Area, including cruise, excursion, water recreation, commercial fishing, harbor services, passenger ferry and water taxi, and temporary and ceremonial berthing. Cargo shipping and ship repair functions occur in the southern waterfront, along with additional water recreation, harbor service, passenger ferry and temporary berthing operations. The Port continues to reserve piers and land for maritime activities consistent with its public trust responsibilities. Maritime berthing functions adjacent to piers and wharves are also not reflected on the land use map. Additional information regarding maritime land use and activity north of Mission Creek is available in the Embarcadero Seawall Program Maritime Commerce Risk Assessment (Port of San Francisco 2020b).

These six land use categories include three mainland uses for the Port's lands – Commercial, Industrial, and Open Space.

The remaining categories pertain to city land uses and are grouped as Open Space, Commercial (also found in Port's lands), Residential, Mixed Use, Industrial, and Public Land Use. These land use categories are on the City of San Francisco zoning map designations and are shown in Figures D-1-7-1 through D-1-7-11 in the Land Use Attachment 1. They represent the following land uses:

- **Open Space** depicts any open space and public access on City-managed property available for public enjoyment such as parks, plazas, and recreational areas, and areas that provide public access for recreation or scenic vistas.
- **Commercial land** use includes for-profit businesses and the trading of goods or services. Commercial land uses within the Preliminary Construction Zone and

within the subareas include retail stores, hotels (including inns and motels), restaurants, fitness studios, entertainment, and visitor services such as parking. This category also includes some mixed uses (without residential) and office land use (management, information, professional services).

- **Residential land** use represents properties with housing including condominiums, apartments, single-family homes, and affordable housing. Residential use on Port lands occurs only where the properties were determined to be surplus to the public trust.
- **Mixed Use** land use signifies mixed uses (with residential). The study area contains several residential complexes as well as mixed office and residential buildings. This category also includes any medical facilities.
- **Industrial land** use generally includes industrial activities such as manufacturing; production, distribution and repair (PDR); or storage. A significant amount of industrial activity occurs in the southern waterfront, and much of the industrial land use consists of warehousing. On Port piers, industrial uses are generally part of mixed maritime and industrial areas and can also include other mixed uses such as office space and cultural, institutional and educational uses, such as museums (e.g. the Exploratorium Science Museum on Pier 15) and art galleries.
- **Public land use** includes publicly managed properties and infrastructure services, such as wastewater treatment plants (e.g. the Southeast Waste Water Treatment Plant in the Islais Creek Reach) and public transportation lots, as well as vacant land, but generally no Open Space and Public Access, which is depicted under the open space categories.

These six land uses are determined by their Zoning Districts, a key component of the Planning Code (SF Planning Department 2023).

1.2.3 General Overview of Land Uses along San Francisco's Waterfront

The Project area is highly developed and characterized by multiple land uses. It encompasses portions of several San Francisco neighborhoods, including Russian Hill and North Beach (Fisherman's Wharf), the Financial District, South of Market (SoMa)/Mission Bay, Potrero Hill/Central Waterfront, and Bayview North/Islais Creek (see Attachment 1). These are described in four reaches below, starting with the northernmost portion of the project area and proceeding to the southernmost portion.

This section describes the land uses that currently exist in these neighborhoods along the waterfront, referencing the reaches used throughout the assessment; Embarcadero, which includes Reaches 1 and 2, Mission Creek (Reach 3) and Islais Creek (Reach 4), named after respective major geographical features in each reach.

1.2.3.1 Land Use Profile – Embarcadero Reaches (Reaches 1 and 2)

The Embarcadero Reaches (see Land Use Attachment 1, Figures D-1-7-1 through D-1-7-11) stretch from Fort Mason and Aquatic Park along the northeastern waterfront to the span of the Bay Bridge, covering 5 subareas: Aquatic Park, Fisherman's Wharf, Piers 31-35, Northeast Waterfront and Ferry Building. San Francisco's urban waterfront here is vibrant and diverse, a place for maritime use and public enjoyment. Architecturally, the waterfront is distinguished by piers and bulkhead buildings built for maritime commerce before World War II, many of which are part of a national register historic district and cultural resources for the city. Piers continue to perform maritime functions that operate alongside, or as part of, many of the city's leading visitor destinations, including the Ferry Building, the Exploratorium, Alcatraz Landing, Pier 39, Fisherman's Wharf, and Hyde Street Pier. An open space system provides recreation along the Bay shoreline and these facilities make the San Francisco waterfront a destination, attracting more than 24 million people annually.

Land use in the Aquatic Park Subarea is predominantly Open Space along the waterfront. Most of the waterfront in this subarea belongs to the San Francisco Maritime National Historic Park, including Hyde Street Pier and its several historic vessels, the Maritime Museum in the historic bathhouse, and Aquatic Park Pier (also known as Municipal Pier), which extends into the water from the end of Van Ness Avenue. The subarea includes Aquatic Park Cove and a portion of Fort Mason Golden Gate National Recreation Area (GGNRA). Both Aquatic Park Pier and Aquatic Park Cove, the subarea's main waterfront elements, also belong to Aquatic Park Historic District. Dock uses are temporary and ceremonial, allowing fishing access through four public points. Other land uses include water recreation, and ceremonial berths for historic ships and interpretive exhibits. The Aquatic Park Subarea covers many historic and recreational attractions.

Most of the Fisherman's Wharf Subarea is identified as a Commercial District - reflecting the many restaurants and retail enterprises catering largely to tourists. This includes a number of hotels and visitor services. Piers 39 through 47 are home to historic buildings and assets, restaurants, hotels, fishing, water recreation, and terminals for San Francisco Bay Ferry, Blue & Gold Fleet, and Red & White Fleet. Some piers provide additional shoreline access, and there are several small landscaped open space areas throughout Fisherman's Wharf. In addition to recreational uses, Fisherman's Wharf also has an active fishing industry. The adjacent North Beach neighborhood includes Residential land uses. As shown on Figures D-1-7-1A through D-1-7-10A, a Muni bus storage and maintenance facility (Kirkland Division) and the San Francisco Public Utilities Commission's North Point Wet-Weather Facility are both visible as Public land use, covering more than a block each.

Along Piers 31 through 35, the piers are all zoned as Industrial, while a portion of the waterfront and the water treatment plant as well as Telegraph Hill/Pioneer Park are identified as Public. Across from the piers, on the west side of the Embarcadero, blocks on land are identified Commercial, including mostly offices, and in one case a parking garage. There is also some Mixed Use, including Residential use, skirting the Project area. Piers 31, 33, and 35 provide berths for excursion terminals, fish processing and

potential future berths, and a secondary two-berth cruise terminal. These piers, as well as the subarea's seawall sections, bulkhead wharves, and most of the buildings, are part of the Port of San Francisco's Embarcadero Historic District.

Along the Northeast Waterfront, a multitude of land uses are present. The piers in this subarea are zoned Industrial, with some being used as storage sheds. Inland across the Embarcadero, the area is zoned as Commercial and Mixed Use. There is also a wide variety of Maritime uses at piers in this subarea: with piers for cruise ships, harbor services including bar pilots, temporary and ceremonial berths, and inactive/reserve berths. Port property in this subarea includes a series of historic buildings and finger piers, a cruise terminal, bulkhead wharves, and seawall lots. The seawall, bulkhead wharves, and most of the piers of this subarea are part of the Embarcadero Historic District. Significant waterfront and tourist attractions of this subarea include the Exploratorium, historic piers, iconic views of the bulkhead buildings, the James R. Herman Cruise Terminal, and multiple restaurants, including the Pier 23 Café Restaurant and Bar and the Waterfront Restaurant. The subarea also includes areas zoned as Open Space for recreation, such as the Embarcadero Promenade, which runs along the entire length of the subarea's waterfront, supporting recreational use and foot traffic between tourist attractions.

The Ferry Building Subarea includes the Ferry Building, the Port's headquarters at Pier 1, the city's downtown ferry terminals, and portions of San Francisco's Financial District. The Financial District is the Bay Area's largest and densest job center, comprising large areas of high-density housing, commercial, and mixed-use space near the Embarcadero and Market Street. The piers and Ferry Building are identified as Commercial, with Port Open Space & Public Access uses. The gateway area between the Ferry Building and Downtown Office Commercial District is Open Space. The area also includes some Residential land use. The piers in this subarea are for fishing, ferry and water taxi, excursion, harbor services, water recreation, and temporary or ceremonial berthing. There are four public access locations. In addition to the ferry terminals, this area also contains significant city and regional transportation infrastructure and connection points, including underground Embarcadero BART/Muni stations, multiple Muni bus lines, historic streetcars, and cable cars. The Bay Trail also runs along the Embarcadero and the Financial District shoreline. Commercial and Maritime uses on Port property (piers and inland lots) generate revenues for capital repair and maintenance of Port marine infrastructure, buildings and public realm assets that support maritime use, visitor attractions and public enjoyment of the shoreline.

Public Open Space includes Sue Bierman Park, 4.4 acres of land that previously served as on- and off-ramps for the elevated Embarcadero Freeway that was demolished and converted into open space after being damaged by the 1989 Loma Prieta earthquake. Located to the north of the Ferry Building, Pier 1.5 includes a water taxi landing and public boat dock. Pier 7, located on the northernmost end of this subarea's shoreline, is a long, thin pier, lined with benches and panoramic views of both the Bay and the city. It is also popular for crab fishing, mainly at night, and for shark and perch fishing. At the southern end of this subarea, between the Ferry Building and Bay Bridge, Pier 14 serves as a breakwater that extends over 600 feet into the Bay, protecting the Downtown Ferry Terminal from wave and tidal forces. Pier 14 also includes several

educational markers to help the public imagine future SLR protections. Adjacent to Pier 14, the Downtown San Francisco Ferry Terminal Expansion Project is expanding and enhancing the ferry landing area. The project includes the construction of new ferry gates that will be able to accommodate roughly three to four feet of anticipated SLR above a 100-year extreme tide event.

1.2.3.2 Land Use Profile - Mission Creek Reach (Reach 3)

The Mission Creek reach (see Land Use Attachment 1, Figures D-1-7-1 through D-1-7-11) covers the waterfront from the span of the Bay Bridge to Pier 80 and includes the area around the Mission Creek inlet. The SoMa and Mission Bay neighborhoods comprise developing mixed-use neighborhoods as well as large commercial buildings on both sides of Mission Creek. The subareas in this reach include South Beach, Mission Creek, Mission Rock, Mission Bay, and Pier 70.

The South Beach Subarea includes several different types of land uses. The piers, waterfront and the San Francisco Giants' baseball park are all zoned Industrial. Across the Embarcadero, the area is zoned mainly Residential and Mixed Use. At 4th Street, the area includes a portion of the Central SoMa Mixed Use District, which includes residential and office use. Between Mission Creek and Townsend Street, the area is Mixed Use and part of the Mission Bay Redevelopment Area. South Beach is home to historic buildings, piers, South Beach Harbor, parks, affordable housing developments, and city and regional assets key to disaster response. Along the shoreline, the South Beach waterfront has piers with a variety of berths to allow for temporary and longer-term docking and harbor services, water recreation visitor berths and the South Beach Marina, Bay excursions, a water-taxi landing, and inactive/reserve berths as well as four public access locations with water access. Oracle Park, the San Francisco Giants' baseball park, is a key community resource and economic generator. The China Basin Ferry Terminal in this location provides water-transit service on game days throughout the Bay Area.

The Mission Creek Subarea also has a diverse set of land uses dominated by Mixed Use and Industrial land uses around the Mission Creek inlet, especially between the Interstate-80 and 280 freeways. The areas surrounding Mission Creek are identified as the Mission Bay Redevelopment Area with some mixed-use residential and public spaces, including the areas along the freeway corridors.

This subarea includes the Mission Creek inlet, including its Maritime uses, encompassing houseboats, a kayak boat launch, ferry and water taxi piers, berths and harbor services. Old and new residential housing, grocery stores, and additional community services are also in this area. Interstate 80 freeway off-ramps (shown as Mixed Use land use) and the Caltrain King Street Station and Transit Hub (shown as Commercial land use) are all important regional transportation assets and are located within the area north of Mission Creek Channel.

The Mission Rock Subarea is primarily identified as Mixed Use and Open Space, with Mixed Use inland. It covers the area south of the Mission Creek inlet and includes China Basin Park (Industrial), Piers 48 and 50 (Mission Rock Mixed Use and Industrial, respectively), and Seawall Lot 337 (Mixed Use). Much of this area is planned for

redevelopment under the Port's Mission Rock and Pier 48 project, which will provide new affordable housing, open space for public use, new living-wage jobs, and renovation of Pier 48. Currently, the historic Pier 48 is leased by several companies and serves a variety of maritime, commercial, environmental, and emergency response uses.

Originally an industrial district, the Mission Bay Subarea underwent a transformation in the last decade. The land uses of the Mission Bay Subarea are now predominantly Mixed Use including residential units, offices, and medical facilities including the central UCSF Mission Bay Campus. Open Space use is present along the waterfront. The subarea includes several landmarks, including the newly opened Chase Center, Bayfront Park, the Corinne Woods Pier 52 Boat Launch, and UCSF and Kaiser medical centers.

The Pier 70 Subarea is primarily Industrial (the seawall lots and piers) and Mixed Use, with a portion of Pier 70 having its own mixed-use designation. The subarea also includes the newly opened Crane Cove Park and other Open Space areas along and connecting to the waterfront. This subarea contains the Union Iron Works Historic District, encompassing Pier 68 and many buildings and structures near Pier 70. Pier 68 also provides Maritime uses, consisting of large ship dry docks, cranes, and industrial buildings. However, existing structures at the site have deteriorated over time and the pier itself is largely unused (numerous improvements would be needed to maintain shipyard services at this location). A Port-led effort referred to as the Pier 70 project is underway to create a new, mixed-use development in the area. The project will revitalize the area east of Illinois Street extending from Mariposa to 22nd Street. Plans include rehabilitation of historic resources, support for ongoing ship repair, new waterfront parks and shoreline access, and space for new residential, office, retail, and industrial land uses. While industrial uses will continue to be an important aspect of the Central Waterfront, including on this site, the City's Central Waterfront Area Plan has identified this area as a location for additional growth and a wider range of land uses, including residential, commercial, and waterfront parks. The Pier 70 project will include approximately 2,400 residential units, 1.2 to 1.9 million square feet for commercial use, and six acres of open space. Development will raise grades to accommodate SLR and include waterfront riprap and loose stone used to form a foundation for a breakwater to relieve the force of breaking waves.

1.2.3.3 Land Use Profile - Islais Creek Reach (Reach 4)

The Islais Creek reach stretches from Pier 80 to Heron's Head Park (see Land Use Attachment 1, Figures D-1-7-1E through D-1-7-11E). Located along the southeast edge of the city, it covers portions of the Bayview North/Islais Creek neighborhoods and includes the industrial areas surrounding Islais Creek, as well as residential areas and developments. Much of the city's Industrial land use is located within this reach. A portion is part of the former Industrial Protection Zone Special Use District, which was established to protect and preserve industrial land uses and activities from competing with higher priced land uses. Current uses include various industrial and automobile related businesses such as iron, metal, and chemical processing companies, gas stations, rental car facilities, automotive repair shops, and the home of the Yellow Cab

Co-Op. There are also areas identified as Public, which are City and State facilities including a highway patrol office, a Public Works Yard, and the Southeast Wastewater Treatment Plant. The five subareas in this reach include Pier 80, Islais Creek, Cargo Way, Piers 94-96, and Heron's Head.

Most of the Pier 80 Subarea is zoned as Heavy Industrial, a land use designation that is the least restricted and usually separated from residential and commercial areas. Most of this land is controlled by the Port and includes Maritime functions; Pier 80 is a 60-acre working cargo pier handling automobile exports with two warehouses, four deepwater berths, and two cranes used to offload materials from ships. It is also the city's only pier that can unload materials from ships directly to railroad cars. Seawall Lot 356 and portions of the Potrero Hill neighborhood's southern industrial area, including a Muni Metro East Maintenance Facility (zoned as Public) and Warm Water Cove Park and the Blue Greenway (Port Open Space and Public Access), are also part of the subarea. This subarea is also part of the Port of San Francisco Piers 80–96 Maritime Eco-Industrial Center (Maritime Eco-Industrial Strategy), which is generally bounded by 25th Street on the north, Illinois Street on the west, and Cargo Way on the south. It co-locates Maritime and Industrial uses to enable product exchange, optimize use of resources, incorporate green design and green technologies on-site, foster resource recovery and reuse, provide economic opportunities that employ local residents, minimize environmental impacts, and incorporate public open space for enjoyment and wildlife habitat.

Most of the project area in the Islais Creek Subarea is Light and Heavy Industrial with PDR and some Commercial land uses (along Third Street with some neighborhood commercial use). The project area includes the industrial area surrounding the western portion of Islais Creek, the Islais Creek Channel, and the northern section of the Bayview Hunters Point neighborhood north of Quesada Avenue. The area contains several key infrastructure assets, including the Southeast Wastewater Treatment Plant (shown as Public use) as well as multiple transportation storage, maintenance, and operation facilities that serve the entire city. Islais Creek is also part of the Port of San Francisco Piers 80–96 Maritime Eco-Industrial Strategy (Maritime Eco-Industrial Center).

The Cargo Way Subarea, which includes Pier 90-92 backlands (Seawall Lots 344 East and West) at the southern entrance of the Islais Creek, Third Street, and Illinois Street Bridges, is also Heavy Industrial. It is controlled by the Port. In addition to the Port's Maritime maintenance facility, Industrial land uses include construction material storage and processing facilities as well as an Intermodal Cargo Transfer facility operated by the San Francisco Bay Railroad, maritime services through dry bulk cargo ship loading, and two concrete batch plants that are the city's sole providers of concrete. It also includes a small wetland and adjacent upland area, known as Pier 94 wetlands (Port Open Space).

The Piers 94-96 Subarea is an Industrial area located on Bay fill with buildings and aggregate, and construction material operations. Both piers have been identified by the Federal Emergency Management Agency as staging areas for goods as well as debris removal in the event of a disaster. Industrial and Maritime land uses include a dry-bulk cargo terminal, San Francisco Bay Railroad, the Recology Recycling Center (including

sustainable crushing and concrete recycling facilities), and long term lay berths used for maritime, industrial, and emergency response services.

The Heron's Head Subarea is identified by the City as Industrial due to its past as a rock-fill breakwater to protect the south side of Pier 96. However, it is now home to the 22-acre Heron's Head Park and considered as Port Open Space and Public Access land use. Heron's Head Park provides public access to the waterfront in the otherwise industrial neighborhood and the park and its wetlands offer ecological value through salt marsh habitat. Infrastructure in this subarea relevant to the public include the EcoCenter, an educational community center, and one of PG&E's nine San Francisco substations, the 110 – 161 kilovolt Hunters Point substation.

2.0 Environmental Consequences

2.1 Assessment Method

The context for land use utilizes the existing land use and anticipated developments in the Project Area as of late 2023. The existing land use refers to the City of San Francisco zoning maps (Planning San Francisco, 2023) to determine the different land uses along the waterfront. Anticipated developments will be included that appear to be reasonably foreseeable by 2040.

Planned developments have been identified within the Project area that will occur without the Project. These developments are described in **Table D.1.7-1** and any land use changes that occur from these developments will not be included in this analysis or considered land use changes as a result of this Project.

Table D.1.7-1: Planned Developments

Name	Land Use	Reach	Acreage
Mission Bay Park P3	Mixed Use	3	2
Mission Rock	Mixed Use	3	43
P22 Bayfront Park	Mixed Use	3	9
Mission Bay Ferry Landing	Open Space	3	0
Agua Vista Park Improvements	Open Space	3	1
Mission Bay Water Taxi Landing*	Open Space	3	0
Crane Cove Park	Industrial Land Use	3	11
Pier 70	Mixed Use	4	58
Potrero Power Station	Mixed Use	4	47

Pier 94 Backlands Improvements	Industrial Land Use	4	81
Pier 70 Shipyard	Industrial Land Use	4	4

Note: *Mission Bay Water Taxi Landing is in the Open Water and does not change an existing land use.

2.2 Basis of Significance

The context for evaluating land use will include the adopted and publicly released draft land use plans for the San Francisco waterfront area.

The alternative could pose a significant impact to land use if implementation of an alternative would result in any of the following conditions:

- The degree to which the Project would alter planned land uses, patterns, types and densities and whether the project would physically divide an established community. Areas within the project footprint are considered highly likely to be modified and potentially change land use designations to accommodate the Project.
- The degree to which changes from the Project would occur to land uses due to construction or operations of the measures. This includes the area within a 200-foot buffer for construction of measures. Construction is expected to be temporary but could continue at a given construction site for up to 10 years. All areas within the construction area are not expected to change land use during construction, however in areas of more intense construction, land uses may change with retreat and disruption of use. Operation conditions are not detailed sufficiently to evaluate at this time and operation impacts to land use will be considered with project-level environmental documents.
- Conflict with local or regional land use plans or policies addressing environmental effects. Existing land use plans were reviewed to determine if the current alternatives differ or conflict with established guidelines and policies. Modification of some plans will be required to accommodate the changing waterfront due to inundation, retreat, and construction disruptions.

2.3 Effects

Existing land use and anticipated changes are evaluated in this section for each of the alternatives.

2.3.1 Construction Impact Summary

Impacts to land uses during construction can result from residents and users experiencing the noise, dust, and increases in construction traffic, as well as changes to

traffic and transit patterns and detours for cars, transit, and pedestrians and bicycles to keep people safe in construction zones. In any given area that disruption could last from days or weeks to years depending on the specific activity and construction and detour plans. These disruptions can cause only temporary changes to existing uses, or when for a longer duration can cause a longer term land use change that can affect a neighborhood or community. In some cases, new land uses will be introduced such as parks and trails that enhance a neighborhood and can make it more attractive to users. Retreat from areas that become more frequently flooded within an alternative can put additional pressure on adjacent areas that are protected, including commercial, residential, and industrial uses, as these are pushed out of retreat areas and replaced elsewhere.

Direct construction impacts to land use would result from demolishing existing buildings to construct flood-protection and retreat measures. The measures that would have the greatest impact are floodproofing and demolishing buildings, construction related to bay fill, soil improvements and seawall improvements which can cause disruption in the vicinity of construction from road closures, noise, and traffic impacts, deployable flood gates which can temporarily decrease movement into certain areas, and roadway impacts which can discourage movement into the area and diminish use of existing land uses in the area. These measures could alter the community and lead to land use changes. Areas that are proposed for retreat would be flooded with rising sea levels and the land use and structures would be abandoned at these locations. No plans currently exist to identify areas where uses would move or intensify to accommodate displaced uses from the retreat areas. These may cause land uses changes in other areas than the construction zones identified here, however at this point there is not enough known of the planning steps that would be taken to accommodate retreat, and is too speculative at this point for meaningful analysis.

Impacts to land use could result in the division of communities from construction or rebuilding of important transportation corridors. The measures such as roadway impact and bridge elevations would be most disruptive to established transportation connections. Although construction impacts would be temporary, less than 10 years for each construction phase, the impacts may have long-term effects to land uses that are more dependent on transportation connections, such as, industrial or commercial facilities requiring access to the waterfront for transport of good or tourism.

Another potential impact to land use could be as key facilities are relocated to another area or demolished, the surrounding existing land uses may shift to other land uses. For example in Alternative G, the Chase Center will be demolished and the nearby tourist facilities and retail business may no longer be in as great demand and convert to residential or other commercial uses. Where elements of the Kaiser or UCSF Medical Center at Mission Bay may be demolished or relocated, the nearby medical facilities would be less convenient to patients and health operators and may follow where the medical center would reestablish.

Land use plans and policies will need to be modified to acknowledge changes in certain areas for each of the alternatives, as land uses and transportation will be modified for retreat, modification of transit and transportation plans, intensification of some land uses, and new land uses are introduced.

2.3.2 Operations and Maintenance Impact Summary

Impacts from operations and maintenance would be minimal for most construction measures, except use of deployables and tide gates. Deployable flood gates would limit access to transportation corridors for hours to days during storm surges or high tide events. With this unpredictability for access, communities that rely on the bridges and connected roadways (proposed for flood gates) may become less valuable and shift land uses. The tide gates could impact the residents, such as houseboats, and industrial and commercial facilities that rely on reliable water access at the Embarcadero in Reach 1, part of Terry Francois Boulevard in Reach 3, and Mission and Islais Creeks.

2.3.3 Recommended Plan

Impacts to land use from the Recommended Plan are scored in **Table D.1.7-2**. Since the Draft EIS, Independent Measures 2A, 2B and Living Seawalls have been included as part of the Recommended Plan and are included as part of the impacts analysis for the Recommended Plan.

Table D.1.7-2: Summary of Land Use Impacts Associated with the Recommended Plan

Recommended Plan Land Use Impact Rating by Measure	Bay Fill	Levee	Bulkhead wall/Seawall	Deployable Flood Gate	Roadway Impact	Sheetpile Wall	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint (1st Action)	2	2	4	3	4	1	4	1	4	1	1	1	1	1
Construction/Footprint (2nd Action)	1	2	4	1	4	1	1	1	4	1	1	1	1	1
O&M Assumptions	1	1	1	3	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	1	2	3	3	3	1	3	1	3	1	1	1	1	1

In Reach 1, the initial actions under the Recommended Plan include floodproofing around 50 buildings, installation of short floodwalls along the outer edges of piers, and installing a closure structure at Pier 27. In Reach 2, the initial actions include performing ground improvements for seismic performance along the Embarcadero, raising or

elevating buildings on the piers, raising the shoreline with a new higher seawall and rebuilding wharves including bay fill (a living seawall or other engineering with nature measure would be included between Pier 14 and Pier 22 ½), pile-driving of replacement or new piles, and installation of small flood walls along the edges of the piers.

In the Subsequent Actions for Reach 1, changes similar to the initial actions in Reach 2 will be implemented, including ground improvements along the Embarcadero, constructing a higher seawall, and raising wharves under the high RSLC scenario. Under intermediate RSLC, additional floodproofing would occur. Construction along the Embarcadero will occur at different times in reaches 1 and 2, so that the entire corridor length is not in construction at once. Construction along the waterfront including the seismic ground improvements will cause land use disruption during construction. Though construction of the entire work may take 6 years, the construction will move along the waterfront and will be temporary in any given location.

For Reach 3, in Mission Creek/Mission Bay, key First Actions involve raising the shorelines to 13.5 feet through levees, curbs, and floodwalls, performing ground improvement, installing deployable closure structures at Third and Fourth Street bridges across Mission Creek and at Terry Francois Boulevard near Pier 50, and enhancing wildlife habitat. Subsequent Actions include further elevation of first action structures, maintenance of roadway capacity, and incorporation of engineering with nature features. Improvements are located near the shoreline, along Terry Francois Boulevard, and the margins of Mission Creek. Bridges would be protected with use of deployable barriers when extreme events are predicted; this could result in closing of these corridors for hours to days. In Subsequent Actions the bridges would be raised.

Lastly, in Islais Creek/Bayview (Reach 4), initial actions involve elevating the shorelines, installing concrete curbs, performing ground improvement, and incorporating engineering with nature features. Deployable barriers would be used at Illinois Street Bridge for the initial period. Piers 90 and 92 would be rebuilt. Subsequent Actions include additional shoreline elevation, construction of levees, and building adaptations, and would include raising the Illinois Street Bridge in later actions.

The Recommended Plan construction measures would require alterations to residences and commercial and industrial businesses, including the demolition of 122,360 square-feet of building footprints. By providing a bayward line of defense (LOD) and retaining much of the existing shoreline, this alternative requires minimal displacement of existing uses, and preserves more of the existing uses than other alternatives. The new LOD would not generate construction effects that would divide the community and these features would ensure that future flood events do not physically divide the waterfront neighborhoods. Implementation of project construction- and displacement-related measures under AMM LU-1 and LU-2 would be required to reduce land use and policy effects related to the Recommended Plan. The Recommended Plan compared to the No Action FWOP has less impact on planned land use, land use patterns, types, and densities. It also has fewer impacts long-term than Alternative F and G. The Recommended Plan would result in a ***less than significant impact with mitigation*** to land use along the waterfront with implementation of AMM LU-1 and LU-2.

Recommended Plan construction would impact less land area and have fewer demolitions than other alternatives, as the footprint is primarily along the waterfront and minimizes loss of usable land. Construction duration is expected to be 10 years. These direct impacts have the potential to convert land use patterns, but less than under the No Action alternative, or the other action alternatives. The Recommended Plan would have a ***less than significant impact with mitigation*** from land use changes due to construction with implementation of AMM LU-1 and 2.

This alternative would be consistent with existing land use plans and accommodate anticipated sea-level rise up to 7 feet in 2090. This alternative adapts to anticipated sea-level rise with less demolition and smaller construction area than other alternatives. The Recommended Plan would have ***less than significant impact with mitigation*** on local or regional land use plans with implementation of AMM LU-2.

Table D.1.7-3: Alternative Recommended Plan – Potential Land Use Changes

Action	**1st Action**				**2nd Action**			
Land Use Designation	**Project Footprint**		**Construction Area**		**Project Footprint**		**Construction Area**	
	Acres	Parcels	Acres	Parcels	Acres	Parcels	Acres	Parcels
Open Space	3.69	20	24.65	55	0.01	1	0.95	3
Commercial Land	62.03	562	152.76	1,848	7.99	34	50.55	101
Residential Land	1.21	1	17.71	1,120	-	-	7.08	23
Mixed Use	13.58	233	79.15	1,848	22.27	34	120.61	128
Industrial Land	95.40	96	329.79	192	45.86	35	98.74	43
Public Land Use	3.34	7	16.20	27	4.07	6	19.35	10
Total*	**179.27**	**164**	**620.26**	**443**	**80.20**	**110**	**297.29**	**308**

*Open Water does not include a land use designation and is not included in the total acres.

2.3.4 Alternative B: Nonstructural

Alternative B is a non-structural alternative and includes floodproofing, modifying, and planned abandonment and demolition of buildings and infrastructure once land uses are displaced to reduce flood risks. No flood protection structures such as levees of walls would be built. As sea levels rise, areas with higher flood risks could be managed for responsible retreat, while areas with lower risks could be floodproofed or modified. Policy changes may need to be implemented to allow for increased housing density and

business relocations in inland areas. Essential utilities and major transportation and transit corridors would be relocated or modified to continue providing service.

Substantial displacement of residences, commercial and industrial businesses, and community and public facilities as inundation increases over time and areas flood frequently would lead to building acquisition and demolition. Alternative B would involve building demolition of 1.1 million square feet of buildings and pier/wharf removal. Implementation of project construction- and displacement-related measures under AMM-LU-1 and LU-2 would be required to reduce the effects on existing and planned land use. Similar to the FWOP, 237 publicly owned facilities would experience flooding under Alternative B by 2090 and many of these structures would be demolished. The Alternative B would have a ***significant and unavoidable impact*** on land use compared to the other action alternatives.

Implementation of Alternative B would provide the benefit of more reliable and predictable flood protection and retreat than No Action, reducing the risk of emergency events and flood damage and response. The planned protection of some and displacement of other land uses provided under this alternative would reduce the substantial adverse effect of increased flooding frequency and intensity over that anticipated under the No Action alternative which would have no concerted planning efforts to assist in managing inundation effects.

This is a high number of abandonments and will have significant effects on the existing land use types and patterns. This could lead to neighborhoods and major businesses along the San Francisco Waterfront being displaced and physically divide established communities. These effects would occur more slowly than would occur in the event of no action by the USACE and Port - the baseline for the analysis is the No Action FWOP. Compared to those no action effects which would allow flooding of areas with no planned protection, land uses under this scenario may remain in place longer than with no action, but would eventually become too expensive and likely unsustainable in place as sea level rises, changing land uses and causing potentially increased development pressures or land use changes in other parts of the City. Alternative B could delay these major changes compared to no action but would ultimately have similar results.

Alternative B would require floodproofing or retreat of buildings and critical infrastructure (Table D.1.7-4 and Table D.1.7-5). Construction would involve floodproofing buildings, relocating critical systems, and demolition of abandoned buildings and infrastructure. A retreat from the flooding waters could be phased from repeated storm surges and high tides encroaching onto existing dry land. However, retreat or abandonment could occur after a single significant flooding event especially if a storm surge occurred during high tide and buildings were heavily damaged beyond repair. For building floodproofing, construction would be at a smaller scale and are anticipated to be a city block at the largest. This impact is considered ***too speculative for meaningful consideration*** to determine at this time and will be reevaluated during project-level analysis.

Alternative B has no major flood infrastructure that requires ongoing operations, and therefore ***no impacts*** due to Operations.

The existing land use plans and policies would not directly be affected by the Project. Floodproofing or retreating buildings that are vulnerable to flooding, which would meet

the goals of the Waterfront Plan by allowing adaptation. This would also meet the policies in the General Plan to examining flooding and adapt to future climate flood hazards. Other land use plans would likely need to be modified to reflect the expected reality of increased flooding frequency and retreat of land uses that are currently anticipated in the existing land use plans. Without any information as to where new facilities, residences, or commercial and industrial uses will be relocated, additional modifications to land use plans outside the area to allow the relocation of these uses would be needed. Some existing plans will require modification to acknowledge the changed uses. The Project would have ***less than significant impact*** to existing land use plans or policies compared to taking no action and allowing unplanned retreat and ad-hoc floodproofing from flooding without accommodation in new or modified land use plans.

Table D.1.7-4: Alternative B – Potential Land Use Changes (2040 and 2065)

Implementation Year	**2040**				**2065**			
Land Use Designation	**Project Footprint**		**Construction Area**		**Project Footprint**		**Construction Area**	
	Acres	Parcels	Acres	Parcels	Acres	Parcels	Acres	Parcels
Open Space	2.81	2	2.09	13	3.64	9	1.67	10
Commercial Land	108.15	174	97.27	216	38.52	92	64.01	169
Residential Land	0	0	1.26	3	5.34	11	5.13	16
Mixed Use	250.72	310	113.67	190	89.63	226	159.21	342
Industrial Land	168.15	41	127.91	57	100.13	162	212.85	217
Public Land Use	11.10	25	31.46	16	10.01	15	29.50	27
Total*	**541.28**	**552**	**373.65**	**495**	**247.26**	**515**	**472.37**	**781**

*Open Water does not include a land use designation and is not included in the total acres.

Table D.1.7-5: Alternative B – Potential Land Use Changes (2090 and 2115)

Implementation Year	**2090**				**2115**			
Land Use Designation	**Project Footprint**		**Construction Area**		**Project Footprint**		**Construction Area**	
	Acres	Parcels	Acres	Parcels	Acres	Parcels	Acres	Parcels
Open Space	0.16	1	1.32	4	0	0	0.47	3

Commercial Land	53.04	96	59.32	192	20.25	50	60.78	226
Residential Land	12.71	26	18.18	74	5.20	21	27.13	104
Mixed Use	92.10	204	211.08	411	73.35	157	226.79	564
Industrial Land	120.96	146	247.56	306	66.85	114	289.82	316
Public Land Use	5.83	12	39.19	27	2.67	11	40.69	40
Total*	**284.8**	**485**	**576.65**	**1014**	**168.33**	**353**	**645.68**	**1253**

*Open Water does not include a land use designation and is not included in the total acres.

2.3.5 Alternative F: Manage the Water, Scaled for Higher Risk

Table D.1.7-6 shows a summary of the land use impacts associated with Alternative F.

Table D.1.7-6: Summary of Land Use Impacts Associated with Alternative F

Alternative F Land Use by Measure	**Bay fill**	**Levee**	**Bulkhead wall/Seawall**	**Roadway Impact**	**Tide Gate**	**T-wall**	**Vertical Wall/Curb Extension**	**Wharf**	**Ecological Armoring***	**Ecotone Levee***	**Marsh Enhancement***
Construction Footprint	4	3	3	4	1	1	1	4	1	1	1
O&M Assumptions	1	1	1	1	3	1	1	1	1	1	1
Mitigated Rating	3	2	3	3	3	1	1	3	1	1	1

Alternative F proposes a coastal flood defense infrastructure that would rely on the construction of tide gates, shoreline extensions into the Bay with associated bay fill, levees, raised roads, and floodwalls along the current Bay shoreline, following the "manage the water" strategy. The shoreline would be extended into the Bay along the Embarcadero Waterfront in Reaches 1 to 3 to make space for underground stormwater storage capacity and to minimize disruption to transportation facilities along the Embarcadero. Floodproofing for maritime and industrial facilities would also be included. Residual coastal and inland flood risks could be addressed through floodproofing. More

than 1,000,000 cubic yards of fill would be used during construction in 2040, with more than 113,000 cubic yards in 2090. Flood-protection measures under Alternative F include tide gates in Mission Creek and Islais Creek to manage sea-level rise and cantilever pile walls along the northern waterfront, levees, and walls. Measures would be adaptable to additional sea-level rise in 2090. Tide gates would be installed at Mission Creek and Islais Creek to reduce inundation in those areas, and would be permanently closed in the Subsequent Actions, with added pumps.

This alternative would accommodate retreat from frequently flooded areas including 1.5 million square feet of demolition and 15,790 linear feet of wharf replacement. Implementation of project construction- and displacement-related measures under AMM-LU-1 and LU-2 would be required to reduce effects related to Alternative F. These AMMs would be required for all future construction activity.

Alternative F does support more protection and preservation of existing structures and infrastructure relative to Alternative A, No Action and long-term supports a more aggressive timeline for sea-level-rise defense. By 2090 under Alternative F, 92 public facilities would experience flooding and would likely require demolition, however, this would be less impactful than the FWOP. Alternative F would preserve substantially more existing land uses relative to the FWOP. While Alternative F includes alterations to the existing community to support some managed retreat inland along the southern waterfront, the new LOD would not generate construction effects that would divide the community and these features would ensure that future flood events do not physically divide the waterfront neighborhoods. Long term, these protection measures would avoid the worse effects of the FWOP on land use and land use policy.

Alternative F would use an active system by relying heavily on machinery to manage flooding. This alternative would install flood-protection measures including tide gates in Mission Creek and Islais Creek, extend seawalls bayward along the northern waterfront, and levees and walls for the Project to manage flooding. Port operations and working lands in the coastal adaption zone would be raised and adapted to 3.5 feet in 2040 and 7 feet in 2090 for sea-level rise. Alternative F would be adaptable for 2090 conditions for sea-level rise.

Alternative F would protect inland flooding by installing a tide gates and cantilever pile walls in 2040 and add additional flood defense in 2090. The area outside the flood-protection measures would be raised or adapted to sea-level rise. Since most of the land would be protected or adapted to sea-level rise, there is a more limited direct impact to land use as shown in Table D.1.7-7. The potential land use changes are lower than the established threshold for a significant impact for both 2040 and 2090. Alternative F would have a ***less than significant impact*** on land use.

Alternative F would construct flood-protection measures throughout the waterfront. A 200-foot buffer around the project footprint was established as the area were potential construction impacts could occur and lead to land use changes. Alternative F construction is expected to be 10 years long. Operations from tide gates were not included in this analysis and will be further developed during project-specific analysis. According to Table D.1.7-7, the thresholds for land use for the Construction area are

below the threshold for significant impact. Alternative F would have a ***less than significant impact*** for land use changes.

This alternative would be consistent with existing land use plans and accommodate anticipated sea-level rise up to 7 feet in 2090. This alternative would adapt to sea-level rise by actively pumping floodwaters away from inland areas. Alternative F would extend the waterfront into the Bay in more northern reaches. This alternative would have ***less than significant impact*** on local or regional land use plans.

Table D.1.7-7: Alternative F – Potential Land Use Changes

Implementation Year	**2040**				**2090**			
Land Use Designation	**Project Footprint**		**Construction Area**		**Project Footprint**		**Construction Area**	
	Acres	Parcels	Acres	Parcels	Acres	Parcels	Acres	Parcels
Open Space	5.03	17	19.41	37	5.38	16	15.56	30
Commercial Land	18.81	32	69.99	118	13.80	37	85.09	132
Residential Land	0	0	10.56	21	0	0	10.38	21
Mixed Use	3.20	27	42.66	106	9.68	37	54.01	156
Industrial Land	81.56	62	163.56	91	65.41	73	173.25	98
Public Land Use	0	0	1.60	8	4.02	6	10.94	15
Total*	**108.60**	**138**	**307.78**	**381**	**98.30**	**169**	**349.23**	**452**

*Open Water does not include a land use designation and is not included in the total acres.

2.3.6 Alternative G: Partial Retreat, Scaled for Higher Risk

Table D.1.7-8 shows a summary of the land use impacts associated with Alternative G.

Table D.1.7-8: Summary of Land Use Impacts Associated with Alternative G

Alternative G Land Use Impact Rating by Measure	Levee	Bridge raise	Bulkhead wall/Seawall	Roadway Impact	T-wall	Vertical Wall/Curb Extension	Wharf	Ecological Armoring*	Ecotone Levee*	Embankment Shoreline*	Naturalized Shoreline*	Marsh Enhancement*
Construction/Footprint	5	5	3	5	3	1	4	1	1	1	1	1
O&M Assumptions	1	1	1	1	1	1	1	1	1	1	1	1
Mitigated Rating	4	4	3	4	1	1	3	1	1	1	1	1

Alternative G proposes to build levees and walls in some areas, while initially floodproofing and then as water levels rise, retreat from inundation, eventual result in demolition in the second action of residences, businesses and community and public facilities particularly in Mission Bay and Islais Creek areas. By 2090 under this alternative, 111 public facilities would experience inundation and likely require demolition which is an improvement compared to the FWOP impacts. This alternative would also require alterations to commercial and industrial businesses along wharf structures. Bridges over Islais Creek would be raised, which would require demolition of existing bridges and building of truss bridges at a higher elevation to adapt to sea level change.

Retreat and required demolition under this alternative would remove approximately 8.4 million square feet of structure footprints, including the area of Mission Bay from Sixteenth Street on the south side of Mission Bay to King Street on the north side, a substantial land use change.

Compared to the No Action Alternative, Alternative G supports the preservation of many existing structures and infrastructure that would otherwise be lost but does have more effects on land uses and results in more retreat and building demolition than any of the retained alternatives to allow for more natural watersheds. Alternative G includes extensive alterations to the existing communities and land uses to support the managed retreat of the shoreline inland along the southern waterfront rather than defending at the existing shoreline. This preventive retreat would fundamentally alter the community connectivity and character in their respective neighborhoods but would also ensure that flood events do not physically divide the waterfront neighborhoods. With Alternative G, community isolation would occur as retreating from the waterfront intensifies, however, this retreat would result in less disruption and impacts from isolation than the FWOP since the retreat is planned and impacts can be minimized or mitigated. Alternative G

would be more severe than other build alternatives for disruptions to communities and access. Overall, this impact would have less effect on land use and policy when compared with the FWOP.

To accommodate retreat of the uses around Mission Bay, policy changes would be required to allow for redevelopment at higher densities in other areas of the city or region Implementation of project construction- and displacement-related measures AMM LU-1 and AMM LU-2 would be required to reduce the land sue and policy effects of Alternative G).

Alternative G would adapt to natural flooding by building levees in flood-prone areas and relocating buildings, transportation systems, and public assets. This alternative would accommodate sea-level rise at 3.5 feet in 2040 and 7 feet in 2090. The Port working lands would be adapted to flooding.

Alternative G would change Port working lands to flooding as sea-levels rise by 2090. This would result in a substantial change to the land use over the next century. For industrial lands this would be a significant change in land use for 2040 and 2090. As an overall total change in land use, this would result in a significant change as well. In addition to industrial lands in 2090, commercial and mixed use lands would have a significant impact. Alternative G would result a ***significant and unavoidable impact*** to direct land use along the waterfront.

Alternative G construction would impact a larger area of land since the shoreline would be raised further inland and bayside areas would be abandoned or adapted to flooding (Table D.1.7-9). Construction duration is expected to be 10 years. These impacts have the potential to convert land use patterns especially for industrial parcels. The significance threshold was exceeded for industrial lands in 2040, mixed use land in 2090, and total overall land use for both 2040 and 2090. This exceedance demonstrates the impact that this alternative would have on land use in San Francisco. Land use impacts due to operations will be evaluated in a project-specific level analysis. Alternative G would have a ***significant and unavoidable impact*** from land use changes due to construction.

This alternative would be consistent with existing land use plans and accommodate anticipated sea-level rise up to 7 feet in 2090. This alternative adapts to anticipated sea-level rise and accommodates flooding in low-lying areas. Alternative G would have ***a less than significant impact*** on local or regional land use plans.

Table D.1.7-9: Alternative G – Potential Land Use Changes

Alternative Year	2040				2090			
Land Use Designation	Project Footprint		Construction Area		Project Footprint		Construction Area	
	Acres	Parcels	Acres	Parcels	Acres	Parcels	Acres	Parcels
Open Space	8.84	27	30.76	67	1.57	5	28.74	61
Commercial Land	72.87	141	168.96	274	107.66	134	153.29	262
Residential Land	6.31	18	15.75	27	0	0	10.83	22
Mixed Use	14.42	75	123.87	258	136.61	328	209.97	510
Industrial Land	111.06	84	238.57	93	212.56	39	154.07	116
Public Land Use	2.40	13	11.42	21	14.41	8	9.36	23
Total*	**215.90**	**358**	**589.33**	**740**	**472.81**	**514**	**566.26**	**994**

*Open Water does not include a land use designation and is not included in the total acres.

3.0 Mitigation

The following avoidance, minimization, and mitigation measures would be required for all alternatives. AMMs in other sections including Noise, Air Quality, Socioeconomics and Communities, and Transportation will minimize effects on land uses during project construction.

AMM-LU-1: Planning Agency Coordination and Plan Revisions

The USACE and Port would coordinate with SF Planning and appropriate agencies such as BCDC to coordinate plan revisions and public outreach regarding any land uses that will be changed as a result of the project. This would include planning for parcels or portions of parcels that are planned for retreat and inundation by San Francisco Bay waters and may be removed from the City of San Francisco's plans or plans modified to acknowledge the foreseen changes in zoning areas or to modify current designations.

AMM-LU-2: Public Outreach and Communication

Outreach and communication with the public will be required throughout the life of the project, in particular as construction approaches and during construction. Preparation of a living Communication Plan to coordinate public outreach and communication of project activities including construction schedules and attendant road, lane, or sidewalk closures, and identification of community liaisons for contact during construction will be coordinated with USACE, Port and City.

4.0 Cumulative and Other Impacts

As described in previous sections, all alternatives are anticipated to change or convert land uses. One area that could have a cumulative impact would be industrial land uses, especially in the alternatives with a significant and unavoidable impact to industrial lands.

Reduction of industrial lands could lead to an overall decline of industrial businesses and specifically maritime industrial businesses on or near the San Francisco Waterfront. These would be businesses such as boat repair and rebuilding, shipping, and fisheries on Port working lands. But this could also include industrial companies located more inland that are impacted by the Project and its construction.

Industrial facilities can be difficult neighbors for residential buildings, commercial areas, schools and parks due to typically generating higher levels of noise and air pollution compared to residential or commercial facilities. Industrial operations generally need larger lot sizes to move, transport, and process materials. It is anticipated that a limited number of new industrial lands could be created from the conversion of existing land uses to industrial land since finding large lots or assembling several smaller lots away from residences is difficult in an urban environment.

San Francisco Planning did have an Industrial Protection Zone Special Use District that limited development of industrial lands into non-industrial uses. This special use district was within Reach 4 for the Project. However, the Planning Department has recommended to remove this special use district outside of Port lands. This resolution was adopted by San Francisco Planning Commission (SF Planning, 2022).

The decline of industrial land use through potential abandonment from flooding or demolition, and the decline in pool of trained industrial workers could overall result in a cumulative decline of industry in San Francisco that will not be recoverable.

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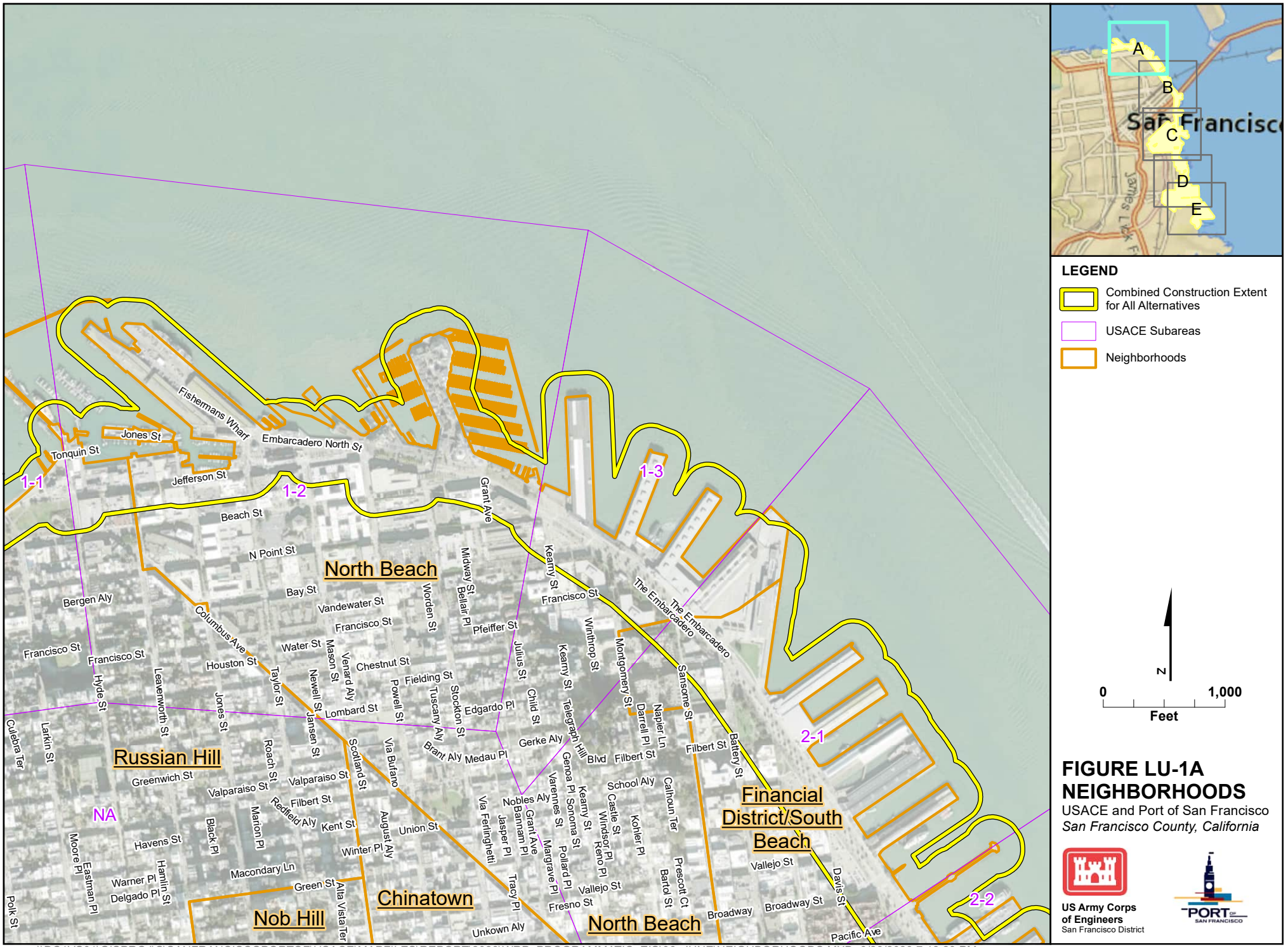
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LAND USE ATTACHMENT 1

LAND USE ZONING AND NEIGHBORHOOD FIGURES FOR ALTERNATIVES

Neighborhoods



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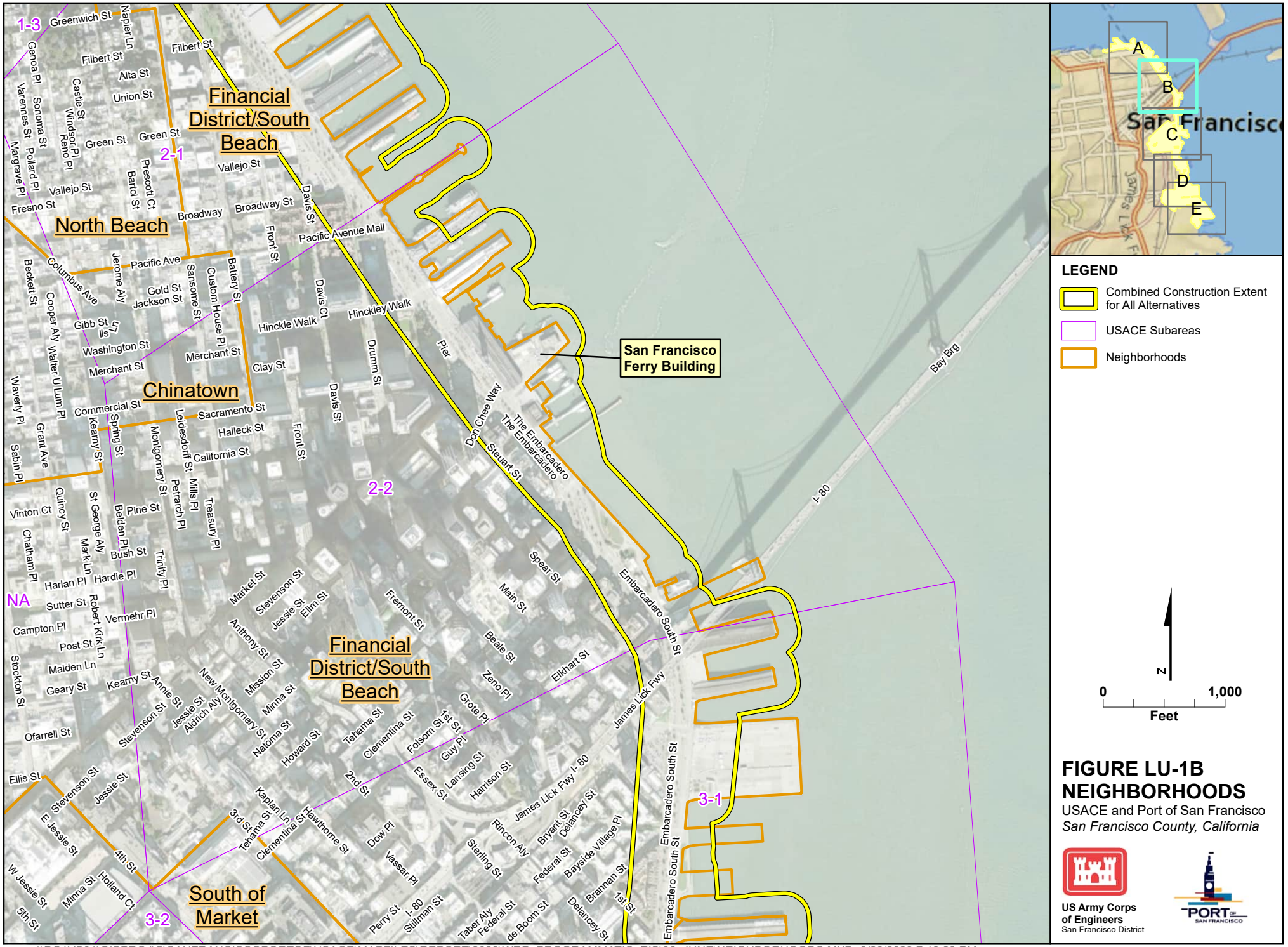
FIGURE LU-1A NEIGHBORHOODS

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO



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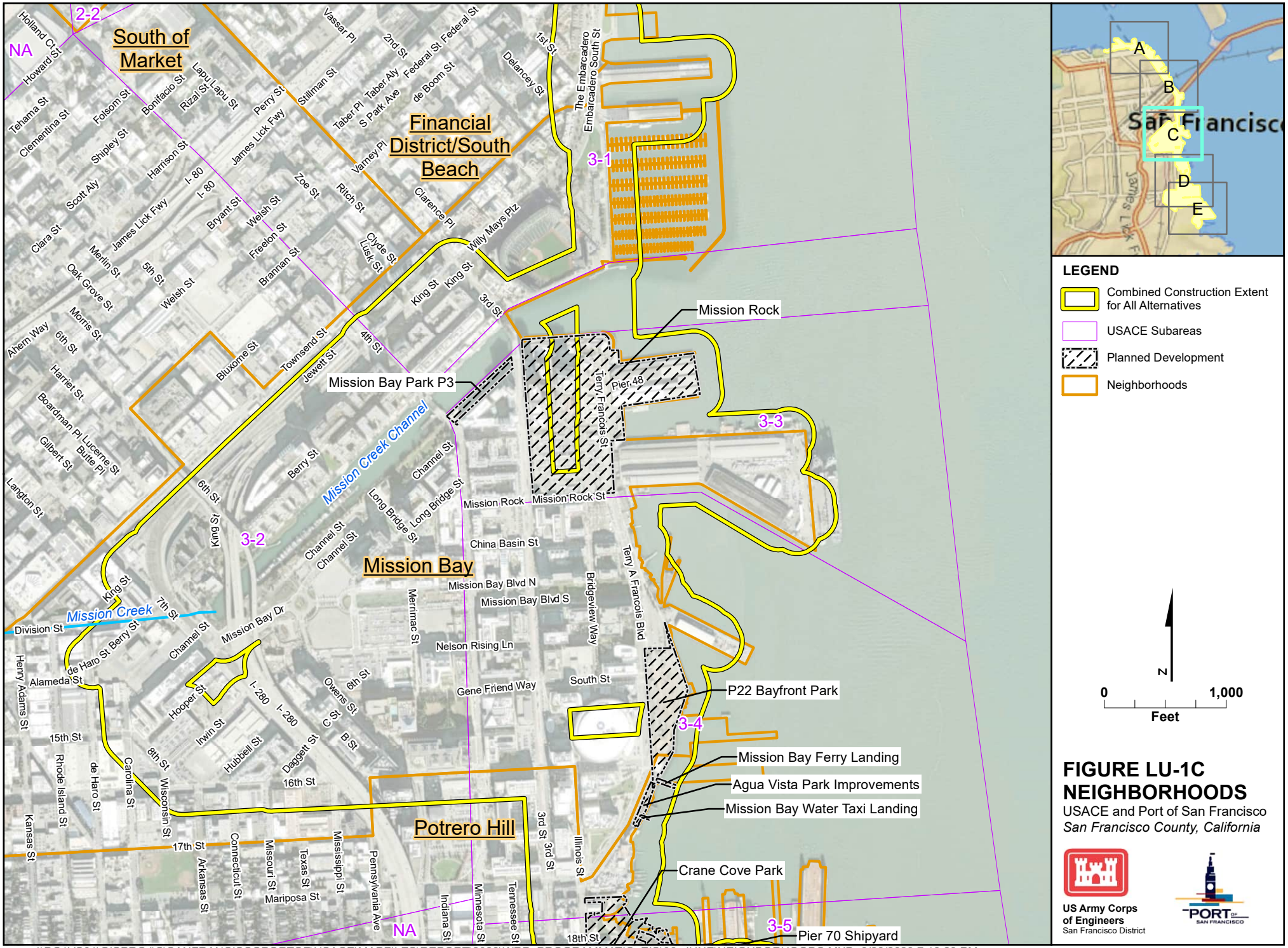


FIGURE LU-1C NEIGHBORHOODS

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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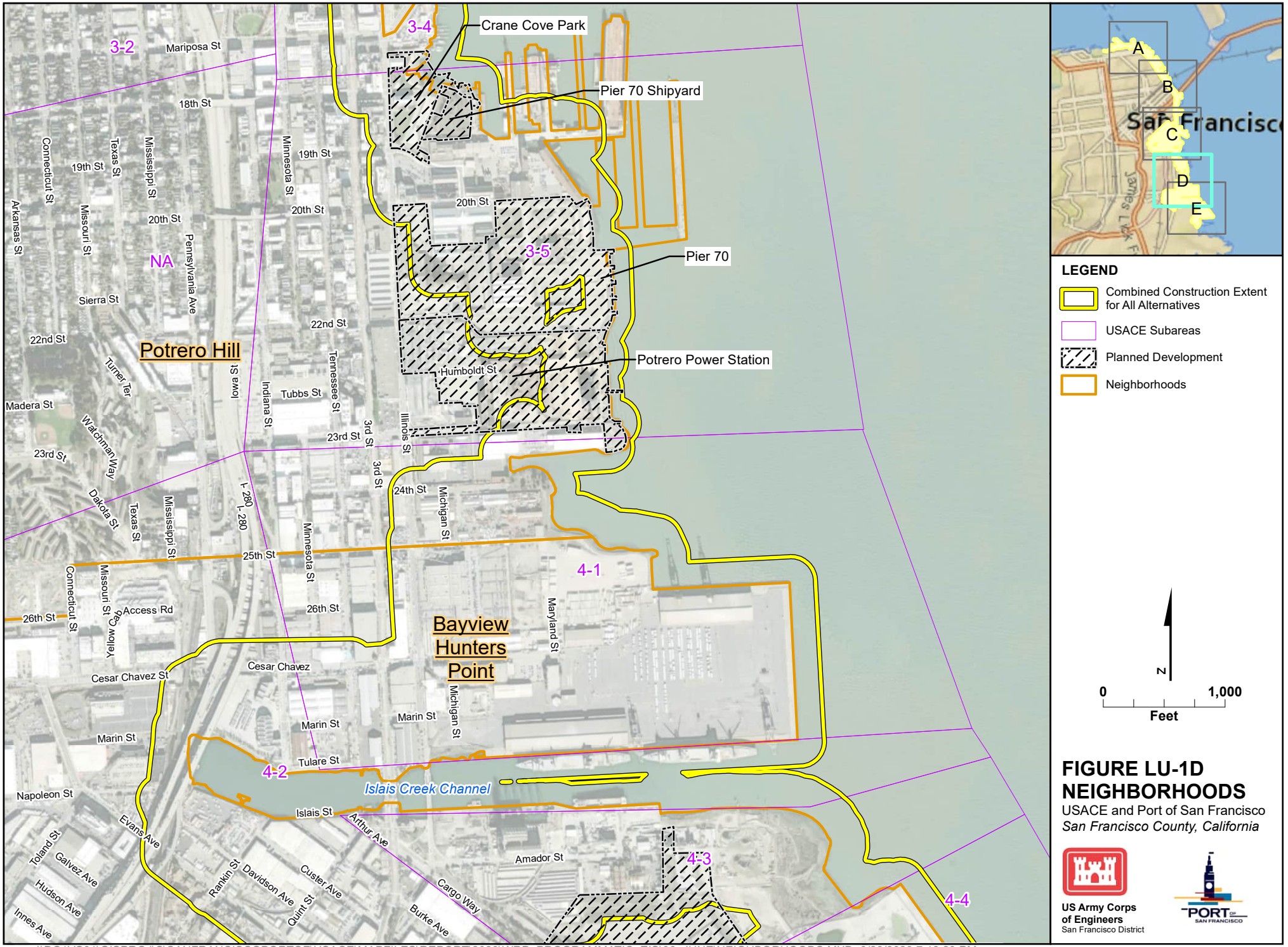


FIGURE LU-1D
NEIGHBORHOODS

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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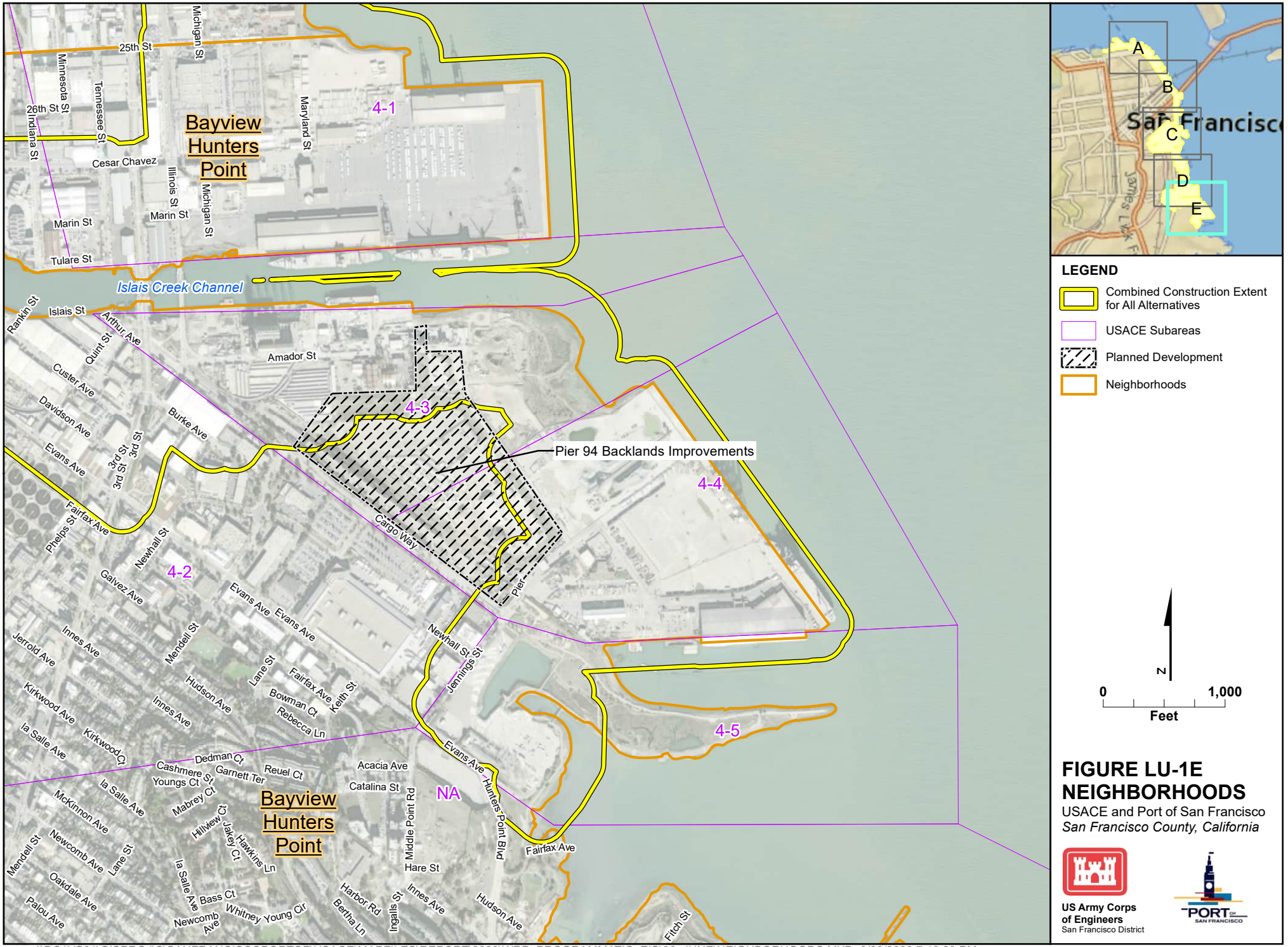


FIGURE LU-1E NEIGHBORHOODS

USACE and Port of San Francisco

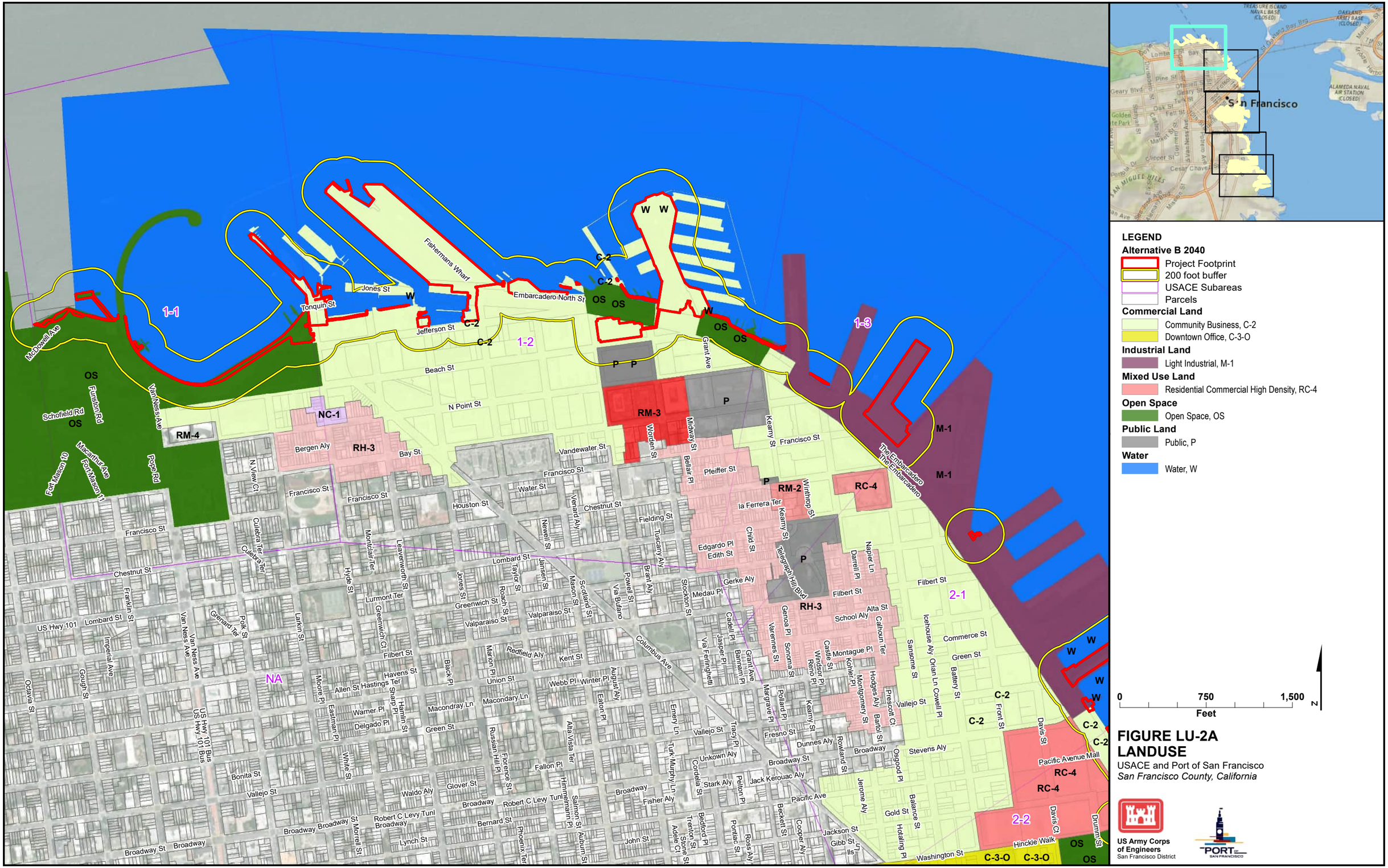
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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Alternative B 2040


1-1
1-2
1-3
2-1
2-2
NA
W
OS
P
C-2
C-3-O
RM-4
RM-3
RM-2
RH-3
NC-1
RC-4
M-1
Fisherman's Wharf
Jones St
Tonquin St
Jefferson St
Embarcadero North St
McDowell Ave
Beach St
N Point St
Grant Ave
Kearny St
Francisco St
Bay St
Chestnut St
Lombard St
Filbert St
Green St
Vallejo St
Broadway
Pacific Ave
Columbus Ave
Van Ness Ave
US Hwy 101
Fort Mason 10
Fort Mason 11
Pope Rd
Schofield Rd
Funston Rd
Macarthur Ave
Bergen Aly
Houston St
Water St
Telegraph Hill Blvd
Commerce St
Battery St
Front St
Davis St
Drumm St
Washington St
Hinckle Walk
Pacific Avenue Mall
The Embarcadero
Sansome St
Montgomery St
Leavenworth St
Hyde St
Larkin St
Polk St
Gough St
Octavia St
Imperial Ave
Franklin St
Taylor St
Jones St
Mason St
Scotland St
Stockton St
Powell St
Via Bufano
Brant Aly
Fielding St
Tuscany Aly
Newell St
Montclair Ter
Culebra Ter
Lurmont Ter
Greenwich St
Greenwich Ct
Grenard Ter
Havens St
Hastings Ter
Allen St
Kent St
Redfield Aly
Union St
Webb Pl
Winter Pl
Macondray Ln
Warner Pl
Delgado Pl
Eastman Pl
Moore Pl
Black Pl
Maron Pl
Sharp Pl
Hamlin St
August Aly
Eaton Pl
Emery Ln
Russian Hill Pl
Florence St
Alta Vista Ter
White St
Bonita St
Waldo Aly
Glover St
Fallon Pl
Tracy Pl
Tuck Murphy Ln
Unkown Aly
Cordelia St
Stark Aly
Jack Kerouac Aly
Fisher Aly
Himmelmann Pl
Salmon St
Auburn St
Morrell St
Robert C Levy Tunl
Bernard St
Phoenix Ter
Lynch St
John St
Adele Ct
Stone St
Trenton St
Bedford Pl
Pontiac St
Ross Aly
Becket St
Cooper Aly
Jackson St
Gibb St
Ills
Gold St
Balance St
Hdaling Pl
Jerome Aly
Osgood Pl
Pelton Pl
Rowland St
Dunnes Aly
Stevens Aly
Fresno St
Vallejo St
Prescott Ct
Bartol St
Hodges Aly
Kohler Pl
Castle St
Windsor Pl
Reno Pl
Sonoma St
Varennes St
Genoa Pl
Edgardo Pl
Edith St
Child St
Kearny St
Wrinthrop St
Ia Ferrera Ter
Darrell Pl
Napier Ln
Filbert St
School Aly
Alta St
Calhoun Ter
Cowell Pl
Orian Ln
Icehouse Aly
Gerke Aly
Medau Pl
Valparaiso St
Cadell Pl
Jasper Pl
Barnam Pl
Via Ferlinghetti
Margrave Pl
Pollard Pl
Montague Pl
Bellair Pl
Midway St
Worden St
Francisco St
Pfeiffer St
Vandewater St
Chestnut St
Water St
Houston St
Francisco St
Francisco St
Francisco St
Broadway
Broadway
Broadway St
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Green St
Union St
Filbert St
Lombard St
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Francisco St
Francisco St
Francisco

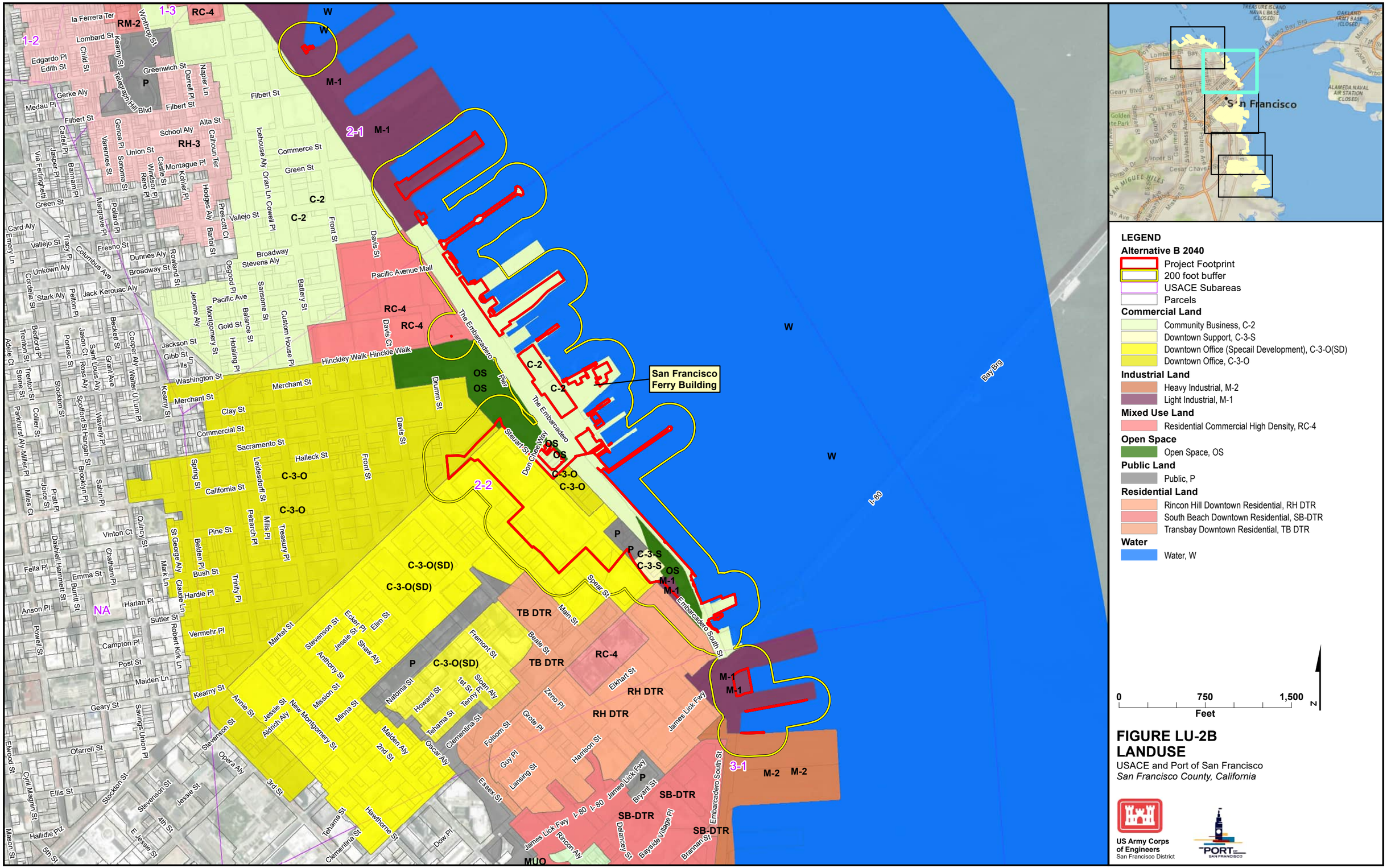


FIGURE LU-2B
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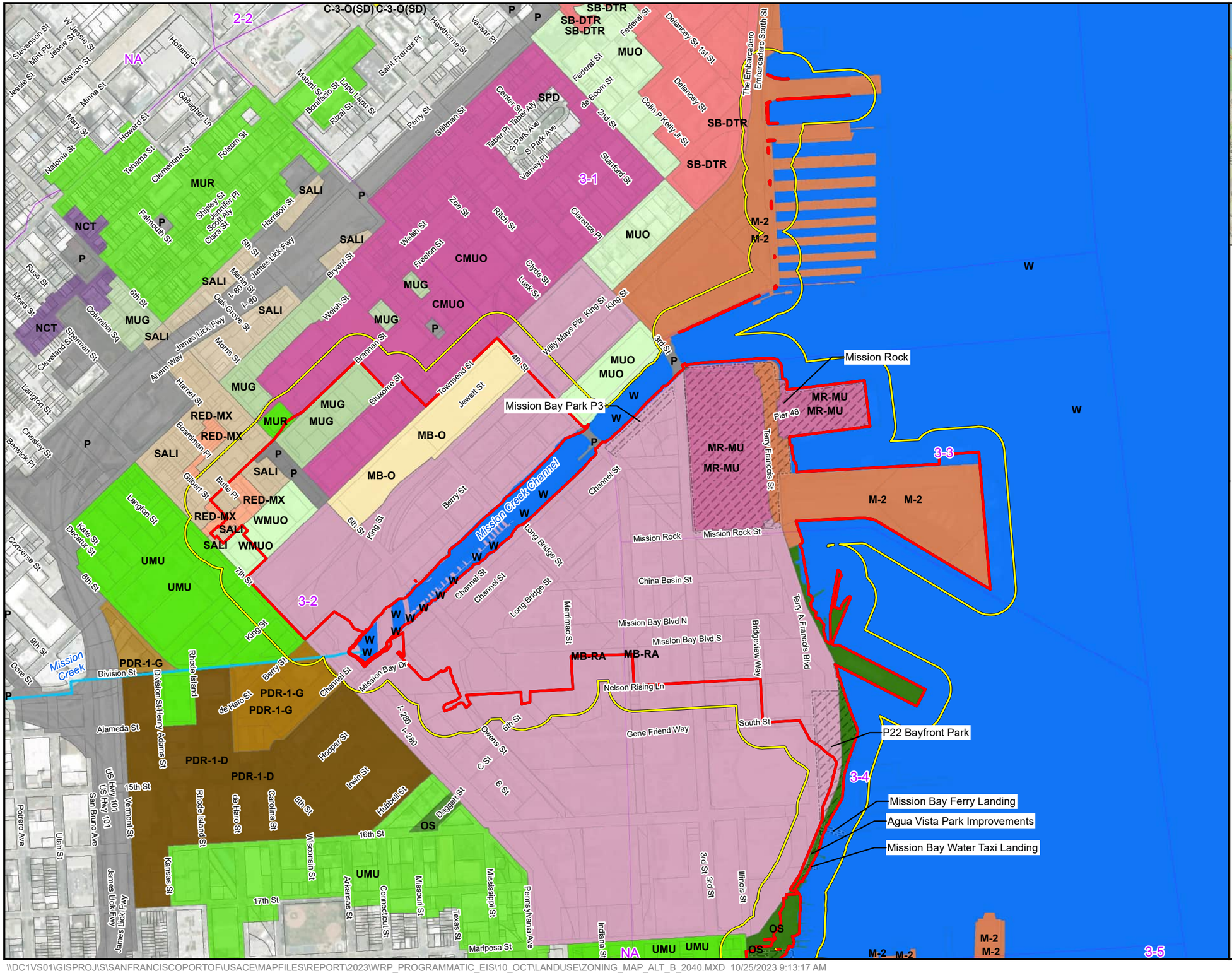
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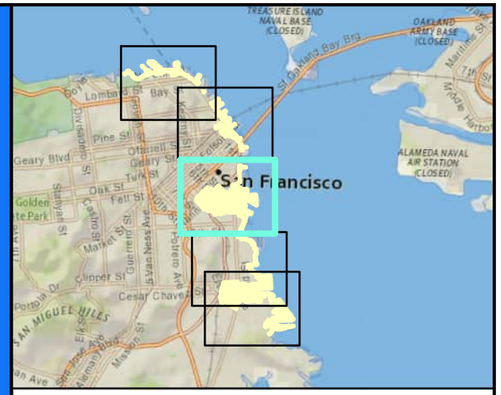
San Francisco County, California

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LEGEND

Alternative B 2040
- Project Footprint
- 200 foot buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Downtown Office (Specail Development), C-3-O(SD)
- Mission Bay Office Distrcit, MB-O
- Production Distribution and Repair - General, PDR-1-G
- Production Distribution and Repair - Design, PDR-1-D
- Service/Arts/Light Industrial, SALI

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Mission Bay Redevelopment, MB-RA
- Mission Rock Mixed Use, MR-MU
- Central Soma-Mixed Use Office, CMUO
- Residential Enclave-Mixed, RED-MX
- Mixed Use Office, MUO
- Mixed Use Residentail, MUR
- Mixed Use General, MUG
- Wsoma Mixed Use-Office, WMUO
- Urban Mixed Use, UMU

Open Space
- Open Space, OS

Public Land
- Public, P

Residential Land
- South Beach Downtown Residential, SB-DTR

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-2C LANDUSE

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

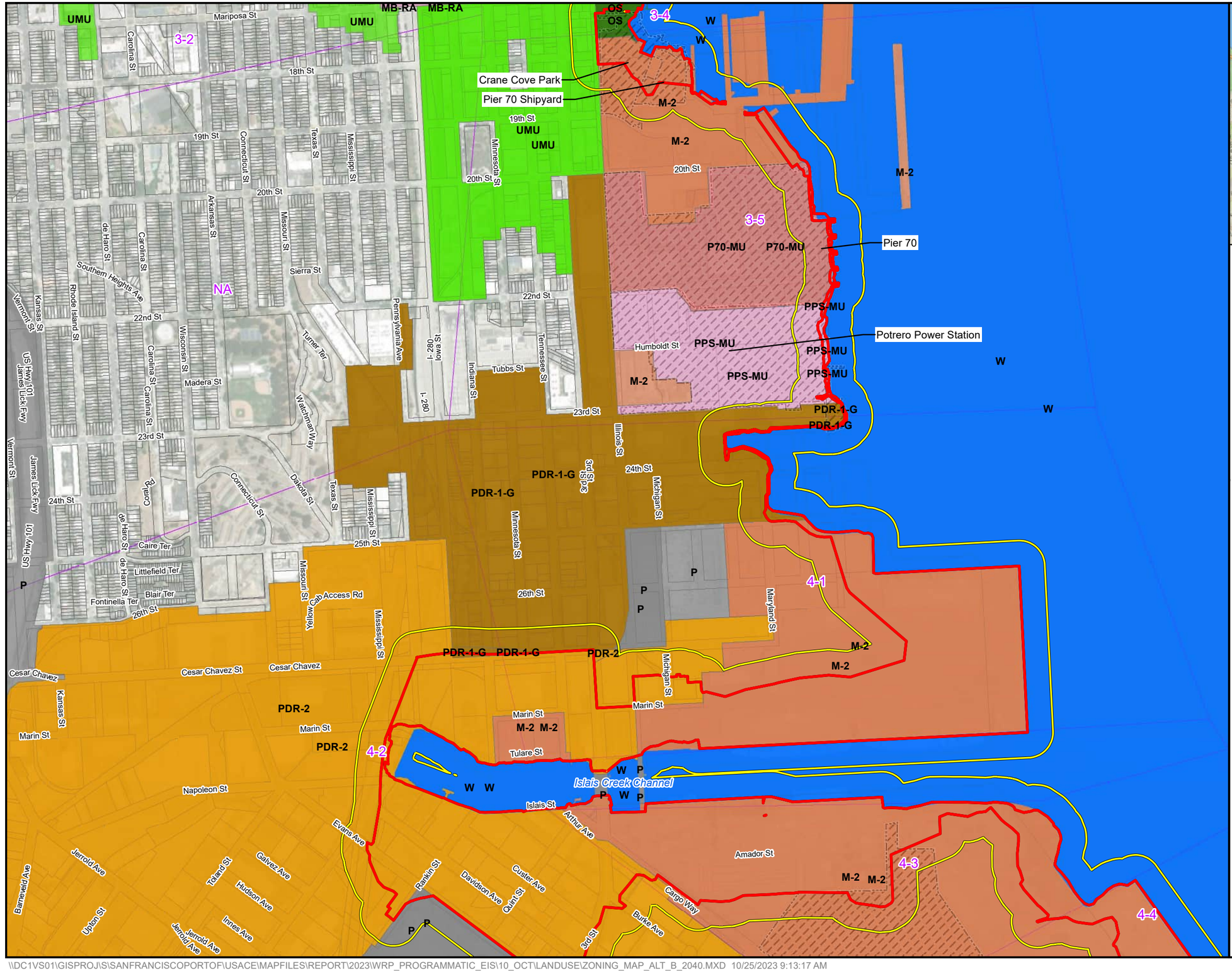


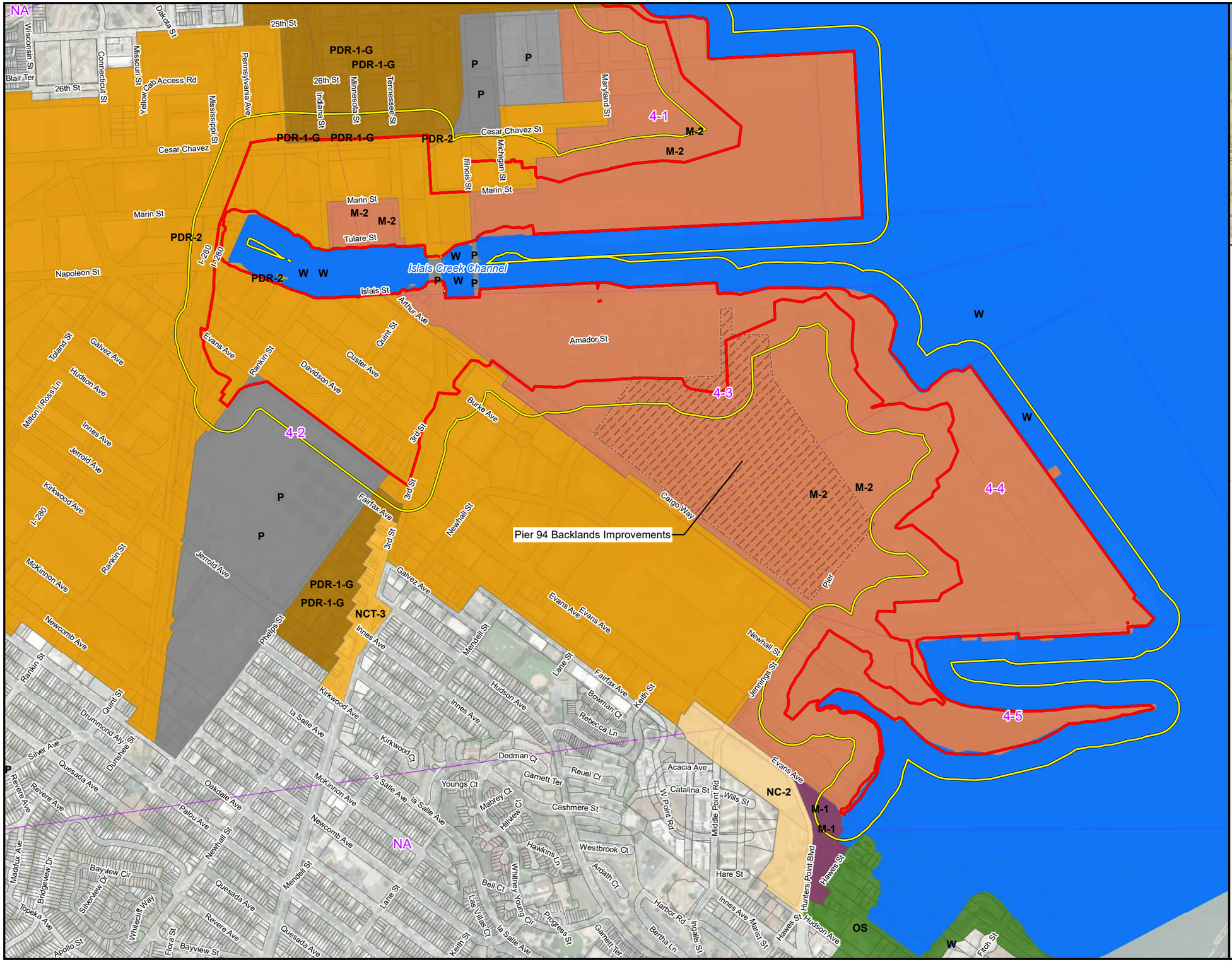
FIGURE LU-2D
LANDUSE

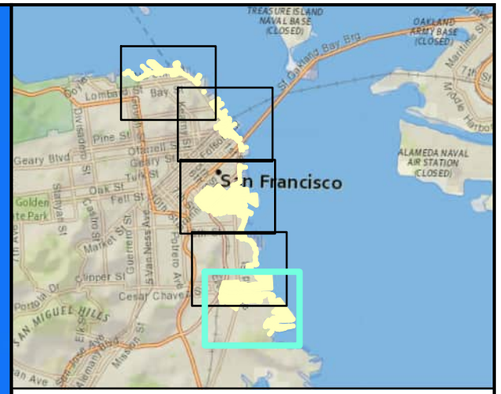
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San Francisco County, California

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LEGEND

Alternative B 2040
- Project Footprint
- 200 foot buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2
- Light Industrial, M-1

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-2E
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

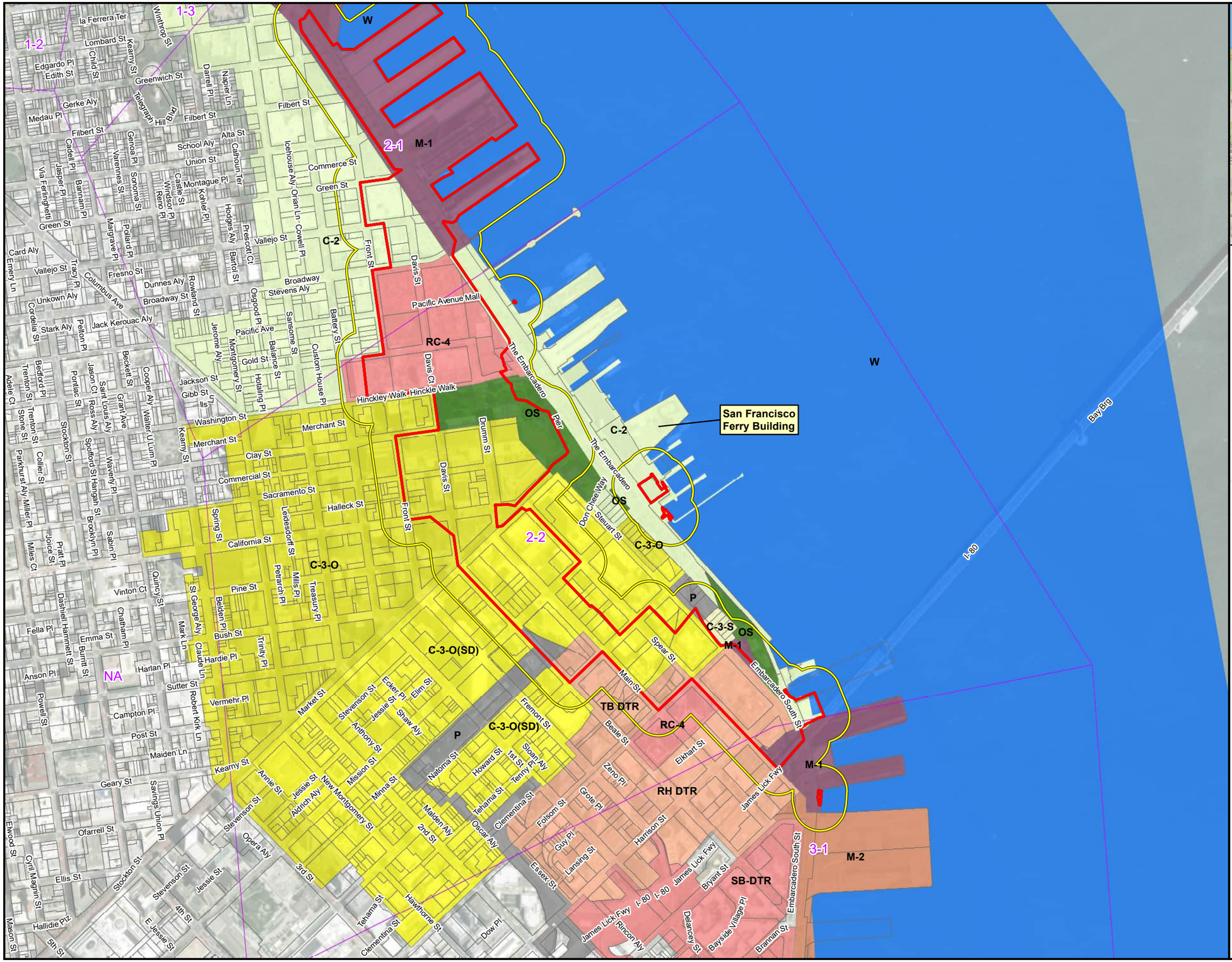
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San Francisco District

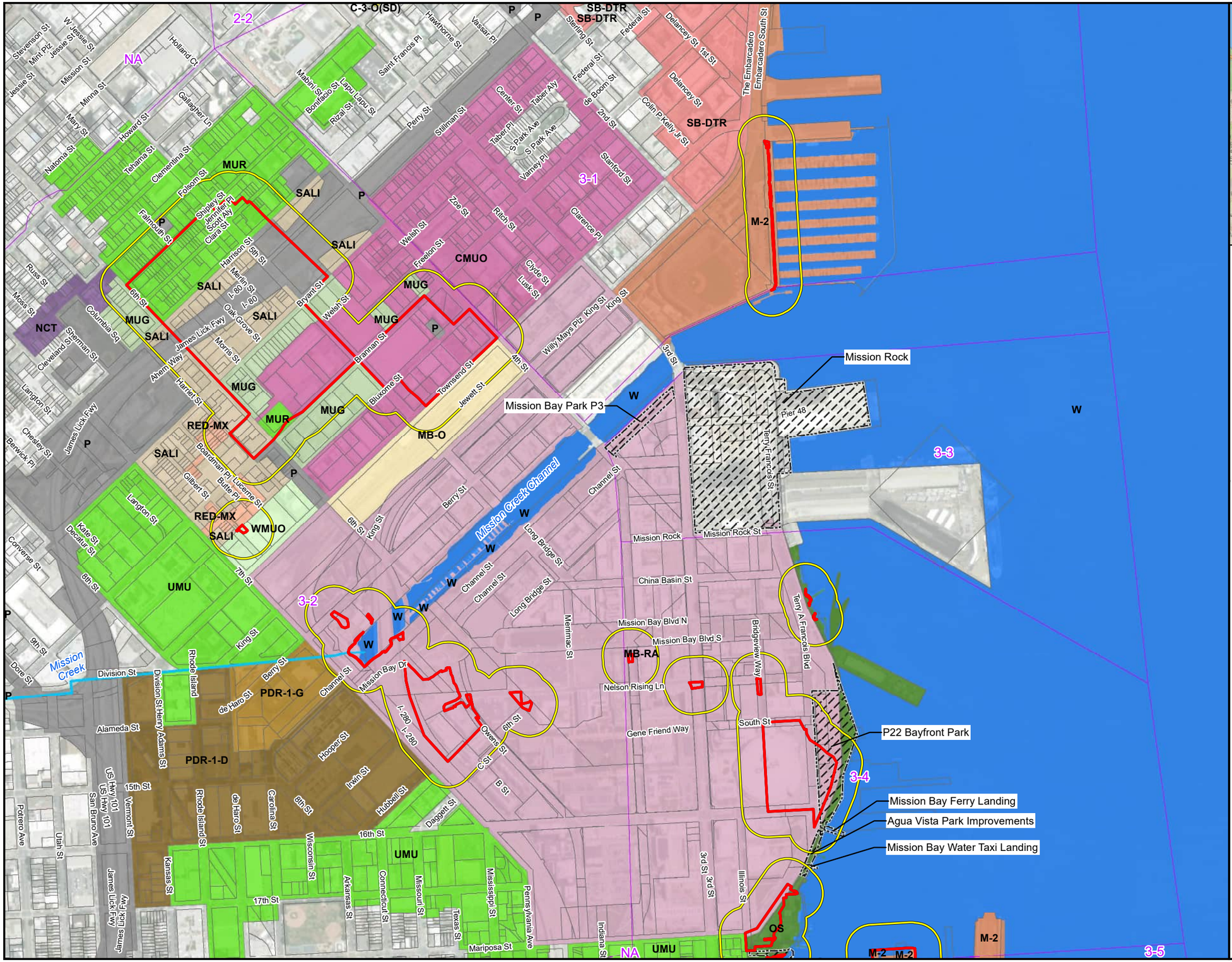
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Alternative B 2065


1-1
1-2
1-3
2-1
2-2
W
OS
C-2
C-3-O
RC-4
M-1
NA
Jones St
Tonquin St
Jefferson St
Embarcadero North St
Fishermans Wharf
Beach St
N Point St
Bay St
Francisco St
Chestnut St
Lombard St
Filbert St
Green St
Vallejo St
Broadway
Broadway St
Pacific Ave
Washington St
Hinckle Walk
Grant Ave
Kearny St
Columbus Ave
The Embarcadero
Van Ness Ave
US Hwy 101
McDowell Ave
Schofield Rd
Funston Rd
Fort Mason 10
Fort Mason 11
Macarthur Ave
Pope Rd
Bergen Aly
N View Ct
Culebra Ter
Montclair Ter
Leavenworth St
Hyde St
Lurmont Ter
Greenwich St
Larkin St
Polk St
Grenard Ter
Franklin St
Imperial Ave
Gough St
Octavia St
Jones St
Taylor St
Jansen St
Mason St
Scotland St
Powell St
Stockton St
Brant Aly
Via Bufano
Newell St
Venard Aly
Chestnut St
Fielding St
Tuscany Aly
Edgardo Pl
Edith St
Child St
Winthrop St
Ia Ferrera Ter
Telegraph Hill Blvd
Medau Pl
Gerke Aly
Napier Ln
Darrell Pl
Filbert St
School Aly
Alta St
Calhoun Ter
Commerce St
Battery St
Front St
Davis St
Pacific Avenue Mall
Drumm St
Davis Ct
Sansome St
Icehouse Aly
Orian Ln
Cowell Pl
Montague Pl
Kohler Pl
Castle St
Windsor Pl
Reno Pl
Montgomery St
Hodges Aly
Bartol St
Prescott Ct
Vallejo St
Fresno St
Dunnes Aly
Rowland St
Broadway
Osgood Pl
Stevens Aly
Jerome Aly
Balance St
Gold St
Hidalgo Pl
Custom House Pl
Genoa Pl
Sonoma St
Varennes St
Margrave Pl
Pollard Pl
Emery Ln
Tuck Murphy Ln
Cordelia St
Stark Aly
Pelton Pl
Jack Kerouac Aly
Fisher Aly
Beckett St
Cooper Aly
Jasper Pl
Cadell Pl
Via Ferlinghetti
Barnam Pl
Redfield Aly
Kent St
Union St
Macondray Ln
Webb Pl
Winter Pl
August Aly
Eaton Pl
Allen St
Hastings Ter
Havens St
Sharp Pl
Hamlin St
Warner Pl
Delgado Pl
Eastman Pl
Moore Pl
Black Pl
Marion Pl
Roach St
Greenwich Ct
Valparaiso St
Lombard St
Culebra Ter
Waldo Aly
Glover St
Bonita St
White St
Florence St
Russian Hill Pl
Alta Vista Ter
Fallon Pl
Himmelmann Pl
Salmon St
Auburn St
Bernard St
Morrell St
Phoenix Ter
Lynch St
John St
Trenton St
Adele Ct
Stone St
Bedford Pl
Pontiac St
Ross Aly
Jackson St
Gibb St
Ills
Robert C Levy Tunl
Broadway Broadway St
US Hwy 101 Bus
Water St
Houston St
Francisco St
Bay St
Pfeiffer St
Bellair Pl
Worden St
Midway St
Kearny St
Francisco St
The Embarcadero
The Embarcadero
Winthrop St
Napier Ln
Darrell Pl
Filbert St
Alta St
Calhoun Ter
Commerce St
Green


W
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C-3-O(SD)
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RH DTR
SB-DTR
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3-1
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San Francisco Ferry Building
Bay Brg
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Pacific Avenue Mall
Hinckley Walk
Front St
Davis St
The Embarcadero
Pier
Don Chee Way
Steuart St
Spear St
Main St
Beale St
Fremont St
Embarcadero South St
James Lick Fwy
Bryant St
Delancey St
Bayside Village Pl
Brannan St
Rincon Alley
Commercial St
Merchant St
Clay St
Washington St
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Scott St
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Baker St
Lyon St
Presidio Ave
Walnut St
Locust St
Spruce St
Maple Dr
Cherry Dr
Arguello Blvd
Parker Ave
Funston Ave
Wood St
Collins St
Beach St
Jefferson St
Fisherman's Wharf
Aquatic Park
Hyde St Pier
Alcatraz Island
Angel Island
Golden Gate Bridge
Golden Gate Park
Presidio
Lincoln Park
Fort Mason
Marina Green
Crissy Field
Baker Beach
Ocean Beach
Lands End
Sutro Baths
Cliff House
Seal Rocks
Farallon Islands
San Francisco
Oakland Bay Bridge
Treasure Island Naval Base (Closed)
Oakland Army Base (Closed)
Alameda Naval Air Station (Closed)
San Mateo-Hayward Bridge
San Mateo Bridge
Richmond-San Rafael Bridge
Golden Gate Bridge
Alcatraz Island
Angel Island
Sausalito
Tiburon
Belvedere
Mill Valley
Corte Madera
Larkspur
San Rafael
Novato
Petaluma
Sonoma
Napa
Vallejo
Benicia
Martinez
Pittsburg
Antioch
Oakley
Brentwood
Concord
Pleasant Hill
Walnut Creek
Lafayette
Orinda
Moraga
Berkeley
Albany
Richmond
El Cerrito
Hercules
Pinole
San Pablo
Alameda
Oakland
San Leandro
Hayward
Union City
Fremont
Newark
Milpitas
San Jose
Santa Clara
Sunnyvale
Mountain View
Los Altos
Palo Alto
Menlo Park
Redwood City
San Mateo
Burlingame
Millbrae
San Bruno
South San Francisco
Daly City
Pacifica
Half Moon Bay
Montara
Moss Beach
Princeton
Half Moon Bay
Pescadero
San Gregorio
Portola Valley
Woodside
Atherton
Los Gatos
Saratoga
Cupertino
Monte Sereno
Campbell
Morgan Hill
Gilroy
Hollister
San Juan Bautista
Watsonville
Aptos
Capitola
Santa Cruz
Scotts Valley
Boulder Creek
Ben Lomond
Felton
Davenport
Bonny Doon
Big Basin Redwoods State Park
Año Nuevo State Park
Año Nuevo Island
Point Reyes National Seashore
Point Reyes Station
Inverness
Olema
Bolinas
Stinson Beach
Muir Woods National Monument
Mount Tamalpais
Mount Tamalpais State Park
Point Reyes
Point Bonita
Point Diablo
Point Stuart
Point Blunt
Point San Pedro
Point Montara
Point Ano Nuevo
Point Pinos
Point Lobos
Point Sur
Point Piedras Blancas
Point Arguello
Point Conception
Point Dume
Point Mugu
Point Hueneme
Point Fermin
Point Vicente
Point Loma
Point Loma Lighthouse
Point Loma Nazarene University
Point Loma Peninsula
Point Loma Tidepools
Point Loma Kelp Beds
Point Loma Submarine Canyon
Point Loma Ecological Reserve
Point Loma Marine Reserve
Point Loma Marine Conservation Area
Point Loma Marine Protected Area
Point Loma Marine Management Area
Point Loma Marine Sanctuary
Point Loma Marine Monument
Point Loma Marine National Monument
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Point Loma Marine National Monument and Sanctuary
Point Loma Marine National Monument and Sanctuary Complex
Point Loma Marine National Monument and Sanctuary System
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RED-MX
WMUO
MB-O
UMU
PDR-1-G
PDR-1-D
3-2
3-3
3-4
3-5
W
OS
MB-RA
Mission Rock
Mission Bay Park P3
Pier 48
P22 Bayfront Park
Mission Bay Ferry Landing
Agua Vista Park Improvements
Mission Bay Water Taxi Landing
Mission Creek Channel
Mission Creek
Mission Rock St
China Basin St
Mission Bay Blvd N
Mission Bay Blvd S
Gene Friend Way
Nelson Rising Ln
South St
Terry A Francois Blvd
Bridgeview Way
Illinois St
Mariposa St
16th St
17th St
15th St
Alameda St
Division St
Berry St
3rd St
4th St
6th St
7th St
8th St
9th St
King St
Channel St
Long Bridge St
Mission Bay Dr
Owens St
C St
B St
I-280
I-80
Embarcadero South St
The Embarcadero
Delancey St
1st St
2nd St
Federal St
Stanford St
Clarence Pl
Freelon St
Welsh St
Brannan St
Townsend St
Jewett St
Bryant St
Harrison St
5th St
Folsom St
Howard St
Natoma St
Tehama St
Clementina St
Fremont St
Beale St
Main St
Spear St
Steuart St
Rincon Ln
Rincon Park
Pier 14
Pier 22 1/2
Pier 24
Pier 26
Pier 28
Pier 30-32
Pier 36
Pier 38
Pier 40
Pier 50
Pier 54
Pier 70
Pier 80
Pier 96
Pier 98
Pier 100
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Pier 134
Pier

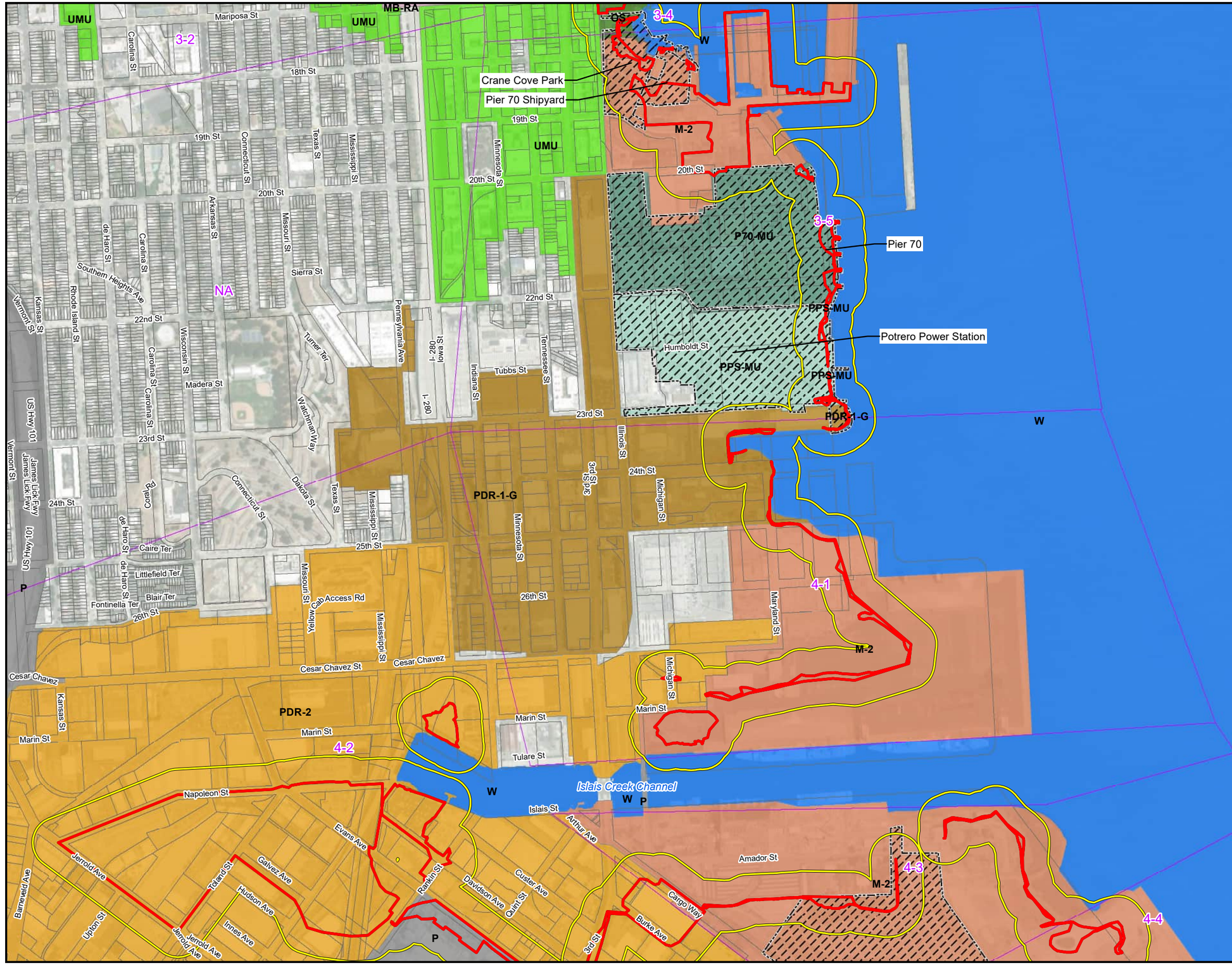


FIGURE LU-3D
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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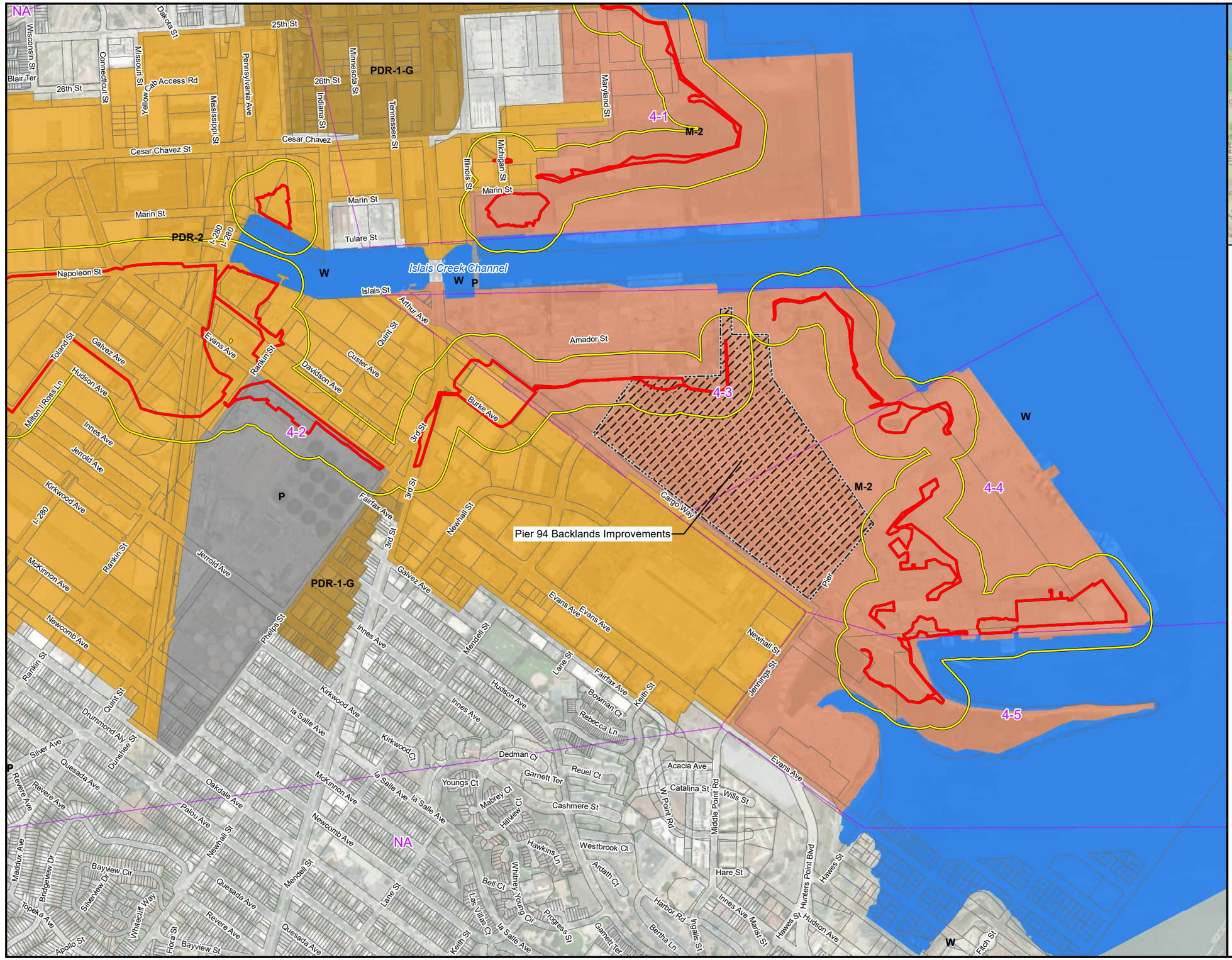


FIGURE LU-3E
LANDUSE

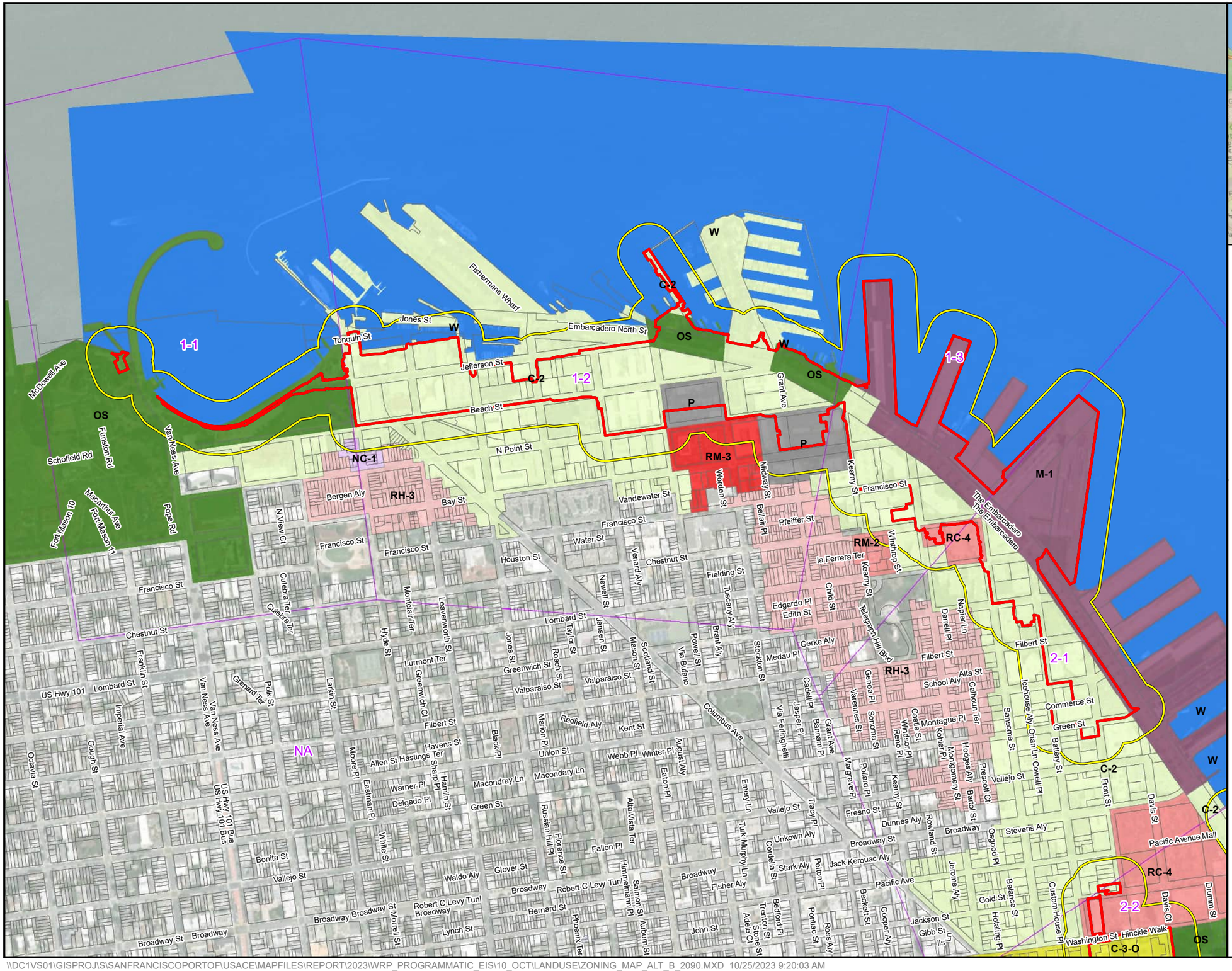
USACE and Port of San Francisco
San Francisco County, California

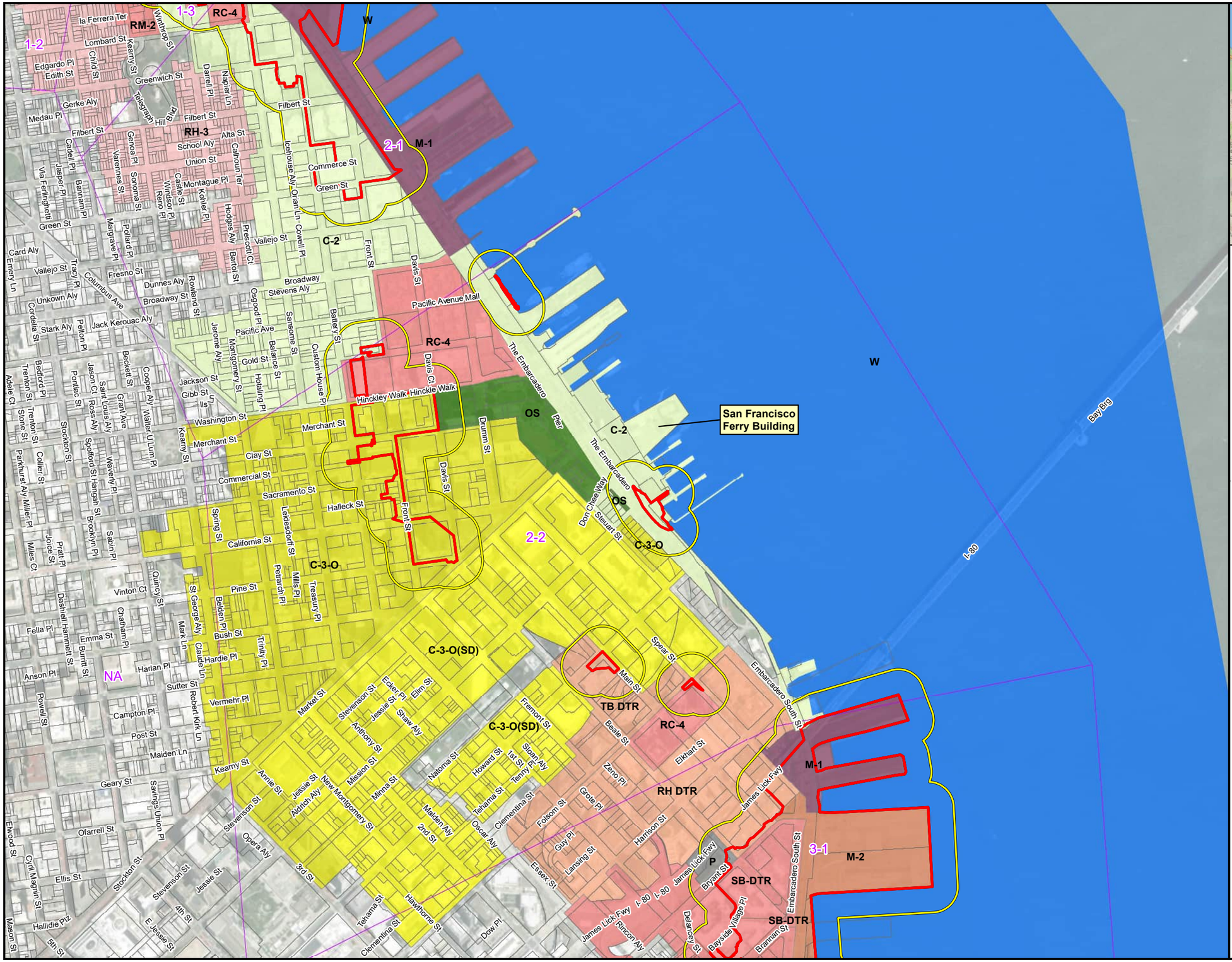
US Army Corps of Engineers
San Francisco District

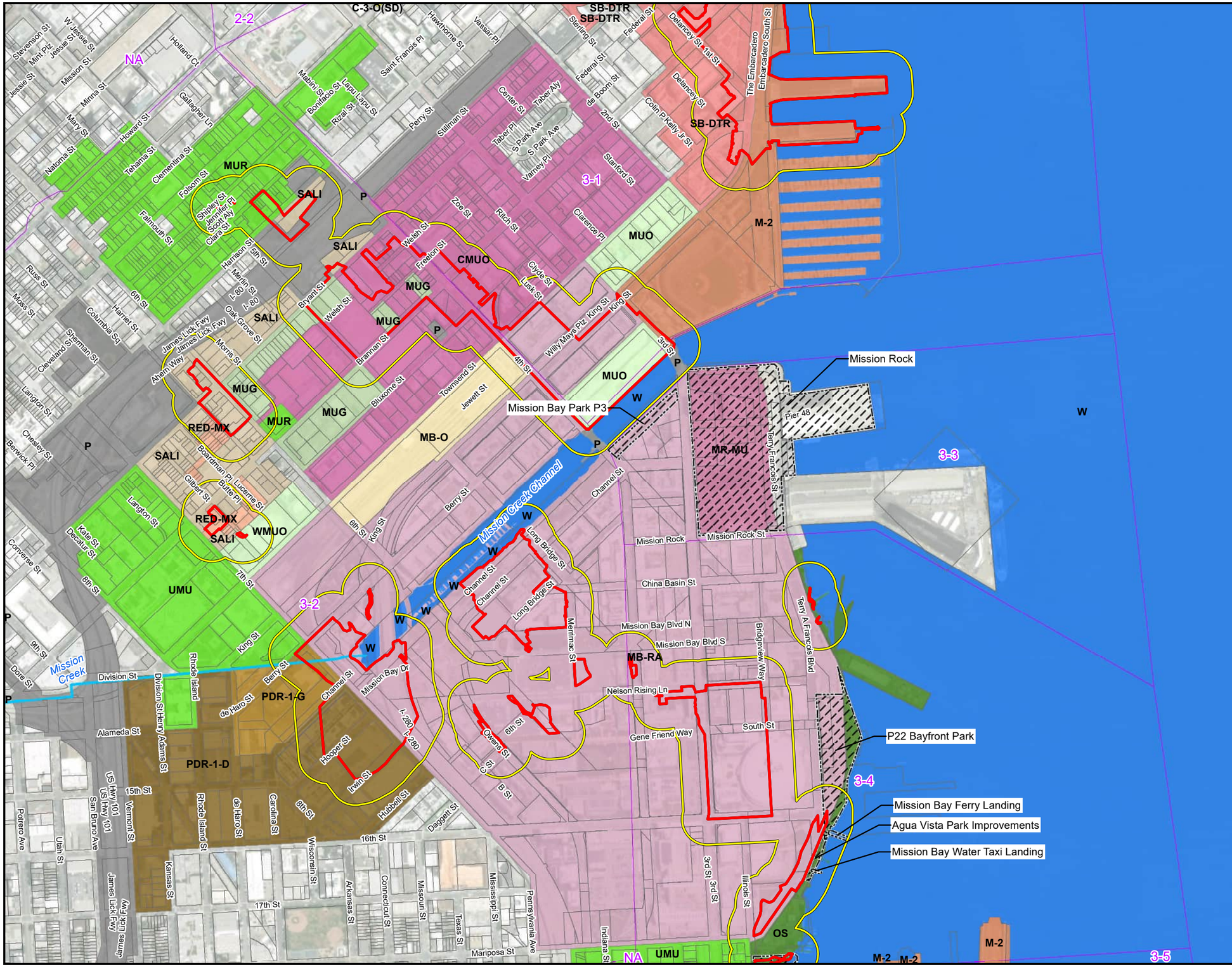
PORT SAN FRANCISCO

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Alternative B 2090


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C-3-O
NA
Fisherman's Wharf
Jones St
Tonquin St
Embarcadero North St
Jefferson St
Beach St
Grant Ave
Kearny St
Francisco St
The Embarcadero
N Point St
Bay St
Bergen Aly
Vandewater St
Water St
Houston St
Chestnut St
Fielding St
Pfeiffer St
Winthrop St
Ila Ferrera Ter
Edgardo Pl
Edith St
Child St
Telegraph Hill Blvd
Filbert St
Napier Ln
Darrell Pl
Gerke Aly
Medau Pl
Lombard St
Taylor St
Jansen St
Mason St
Scotland St
Stockton St
Powell St
Via Bufano
Brant Aly
Tuscany Aly
Newell St
Venard Aly
Leavenworth St
Hyde St
Lurmont Ter
Greenwich St
Valparaiso St
Roach St
Jones St
Montclair Ter
Culebra Ter
Francisco St
Chestnut St
Lombard St
US Hwy 101
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Grenard Ter
Polk St
Larkin St
Imperial Ave
Gough St
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Filbert St
Green St
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Broadway
Broadway St
Columbus Ave
Redfield Alley
Kent St
Union St
Webb Pl
Winter Pl
August Aly
Eaton Pl
Macondray Ln
Allen St
Hastings Ter
Havens St
Warner Pl
Sharp Pl
Hamlin St
Delgado Pl
Black Pl
Marion Pl
Moore Pl
Eastman Pl
White St
Bonita St
Waldo Aly
Glover St
Fallon Pl
Alta Vista Ter
Russian Hill Pl
Florence St
Emery Ln
Tracy Pl
Unkown Ln
Turk Murphy Ln
Cordelia St
Stark Aly
Jack Kerouac Aly
Pelton Pl
Fisher Aly
Pacific Ave
Beckett St
Cooper Aly
Jackson St
Gibb St
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Washington St
Hinckle Walk
Drumm St
Davis St
Davis Ct
Pacific Avenue Mall
Front St
Battery St
Commerce St
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Sansome St
Icehouse Aly
Orian Ln
Cowell Pl
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Prescott Ct
Bartol St
Montgomery St
Hodges Aly
Kohler Pl
Montague Pl
Castle St
Windsor Pl
Reno Pl
Sonoma St
Genoa Pl
Varennes St
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Cadell Pl
Jasper Pl
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Grant Ave
Via Ferlinghetti
Margrave Pl
Pollard Pl
Kearny St
Montgomery St
Osgood Pl
Rowland St
Jerome Aly
Broadway
Stevens Aly
Gold St
Balance St
Hidalgo Pl
Custom House Pl
Dunnes Aly
Fresno St
Midway St
Worden St
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Francisco St
Vandewater St
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Culebra Ter
Chestnut St
Francisco St
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Macarthur Ave
Pope Rd
McDowell Ave
Schofield Rd
Funston Rd
Van Ness Ave
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Salmon St
Auburn St
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Robert C Levy Tunl
Morrell St
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Bernard St
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Ross Aly
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RM-2
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Hinckley Walk
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Prescott Ct
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Osgood Pl
Stevens Alley
Rowland St
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Halleck St
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St George Alley
Mark Ln
Claude Ln
Hardie Pl
Trinity Pl
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Burritt St
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Campton Pl
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Hawthorne St
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Bayside Village Pl
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Emma St
Mason St
Cyril Magnin St
Ellis St
Ofarrell St
Elwood St
Parkhurst Alley
Miller Pl
Collier St
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Bedford Pl
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Cordelia St
Stark Alley
Jack Kerouac Alley
Unkown Alley
Emery Ln
Card Alley
Via Ferlinghetti
Jasper Pl
Cadell Pl
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Broadway St
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Montgomery St
Beckett St
Cooper Alley
Walter U Lum Pl
Jason Ct
Saint Louis Alley
Ross Alley
Pontiac St
Stockton St
Grant Ave
Kearny St
Merchant St
Clay St
Commercial St
Sacramento St
Halleck St
Front St
Davis St
Drumm


C-3-O(SD)
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MUO
CMUO
RED-MX
WMUO
MB-O
MB-RA
MR-MU
M-2
W
UMU
PDR-1-G
PDR-1-D
OS
Mission Rock
Mission Bay Park P3
P22 Bayfront Park
Mission Bay Ferry Landing
Agua Vista Park Improvements
Mission Bay Water Taxi Landing
Mission Creek Channel
Mission Creek
Pier 48
Mission Rock St
China Basin St
Mission Bay Blvd N
Mission Bay Blvd S
Nelson Rising Ln
Gene Friend Way
South St
Terry A Francois Blvd
Bridgeview Way
Merrimac St
Long Bridge St
Channel St
Berry St
King St
Division St
Mission Bay Dr
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Brannan St
Townsend St
Jewett St
Bluxome St
Freelon St
Welsh St
Bryant St
Harrison St
Folsom St
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Clementina St
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Stanford St
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Zoe St
Ritch St
Taber Pl
Taber Aly
Center St
Stillman St
Perry St
Rizal St
Bonifacio St
Lapu Lapu St
Mabini St
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Lusk St
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Hooper St
Irwin St
Hubbell St
Daggett St
Carolina St
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Connecticut St
Missouri St
Mississippi St
Pennsylvania Ave
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8th St
9th St
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B St
Harriet St
Columbia Sq
Sherman St
Cleveland St
Moss St
Russ St
Langton St
Chesley St
Benwick Pl
Converse St
Kate St
Decatur St
Gilbert St
Boardman Pl
Butte Pl
Luceme St
Morris St
Oak Grove St
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Merlin St
I-80
Shipley St
Jennifer Pl
Scott Aly
Clara St
Mary St
Minna St
Mission St
Jessie St
W Jessie St
Stevenson St
Mint Plz
Holland Ct
Gallagher Ln
Fairmount St
Potrero Ave
Utah St
San Bruno Ave
US Hwy 101
Vermont St
Kansas St
Rhode Island St
de Haro St
Carolina St
Wisconsin St
Arkansas St
Connecticut St
Missouri St
Mississippi St
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Indiana St
Illinois St
3rd St
Mariposa St
17th St
16th St
15th St
Alameda St
Division St
Mission Creek
Dore St
9th St
8th St
7th St
6th St
King St
Berry St
Channel St
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PDR-1-D
UMU
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Irwin St
Hubbell St
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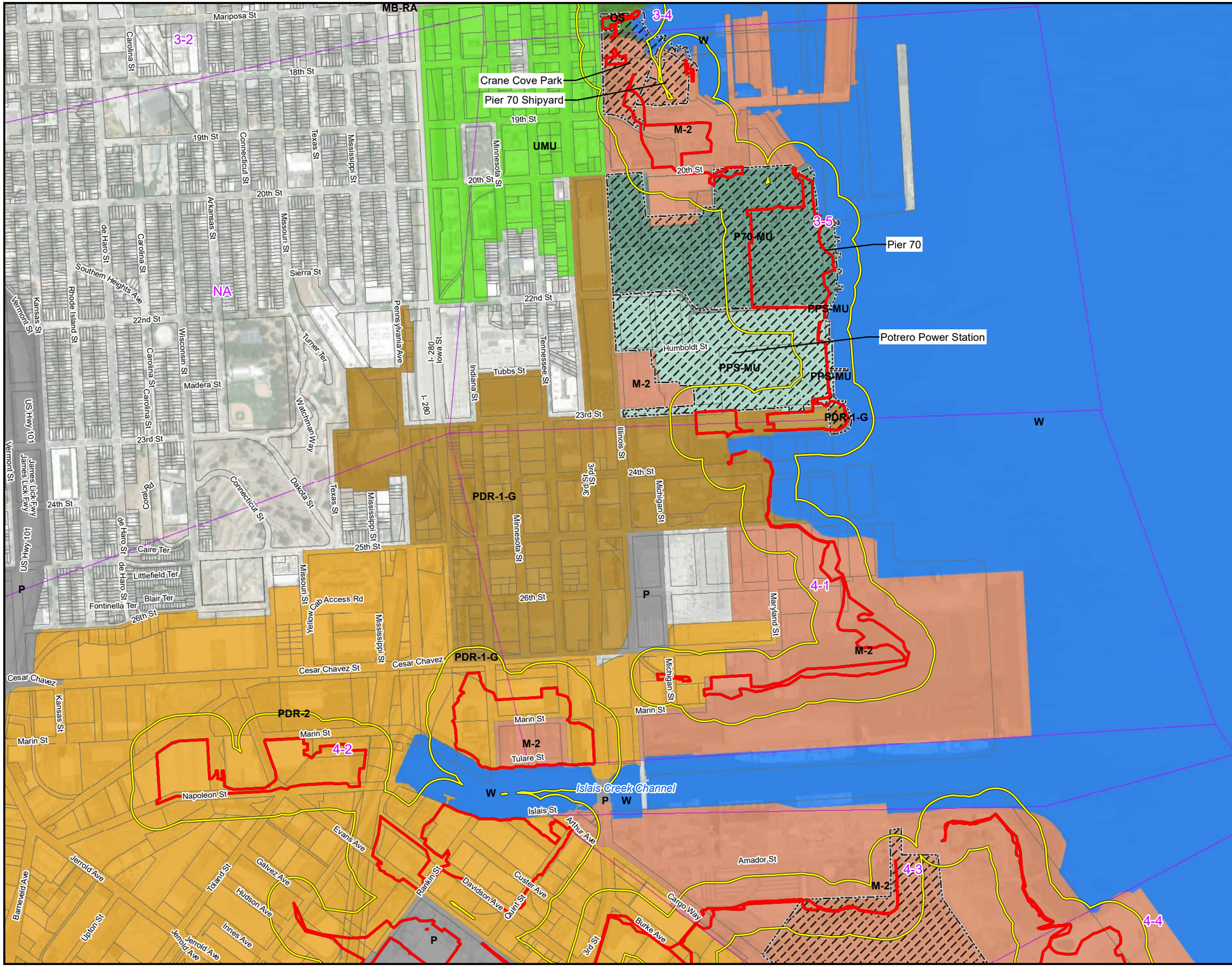


FIGURE LU-4D LANDUSE

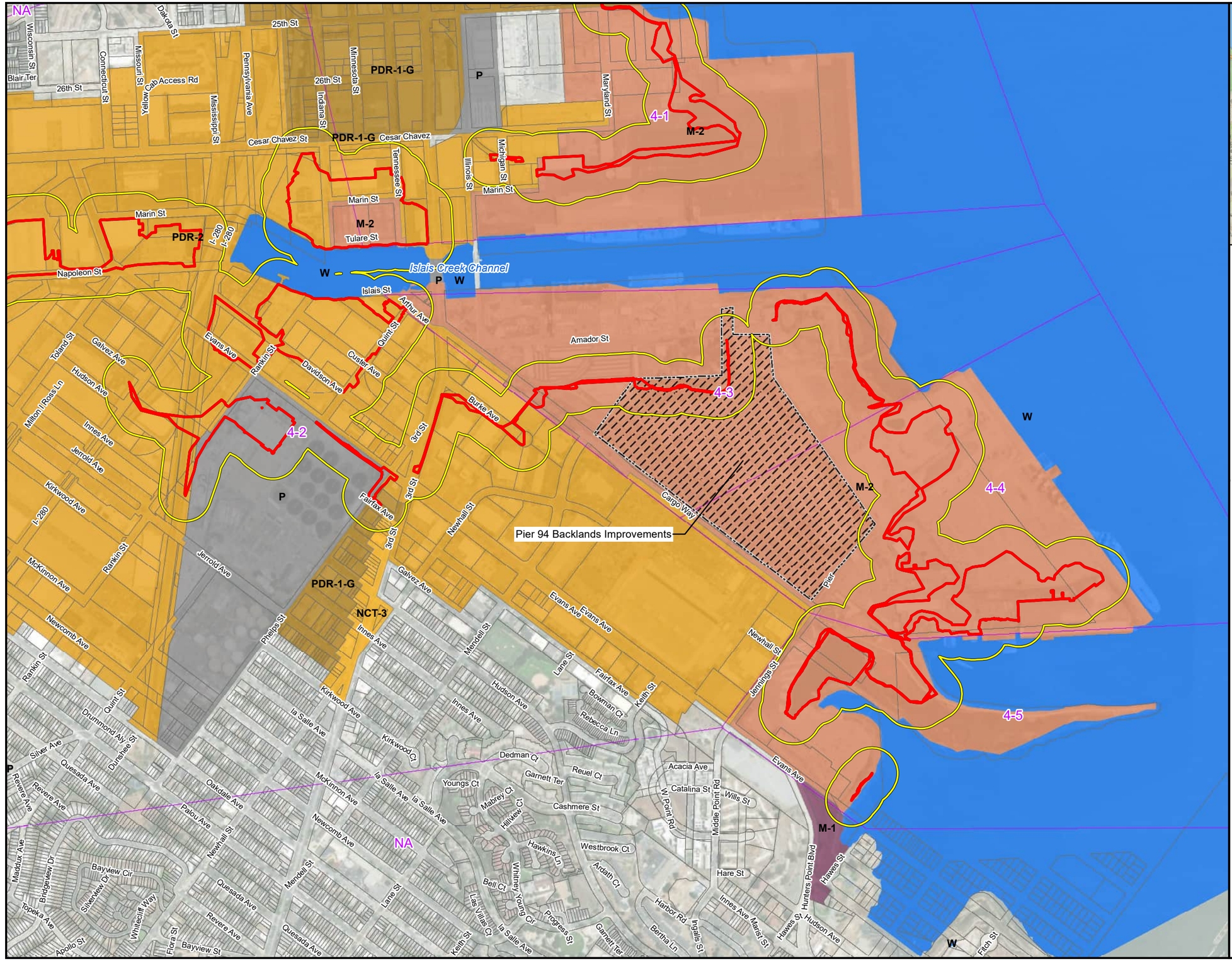
USACE and Port of San Francisco

San Francisco County, California

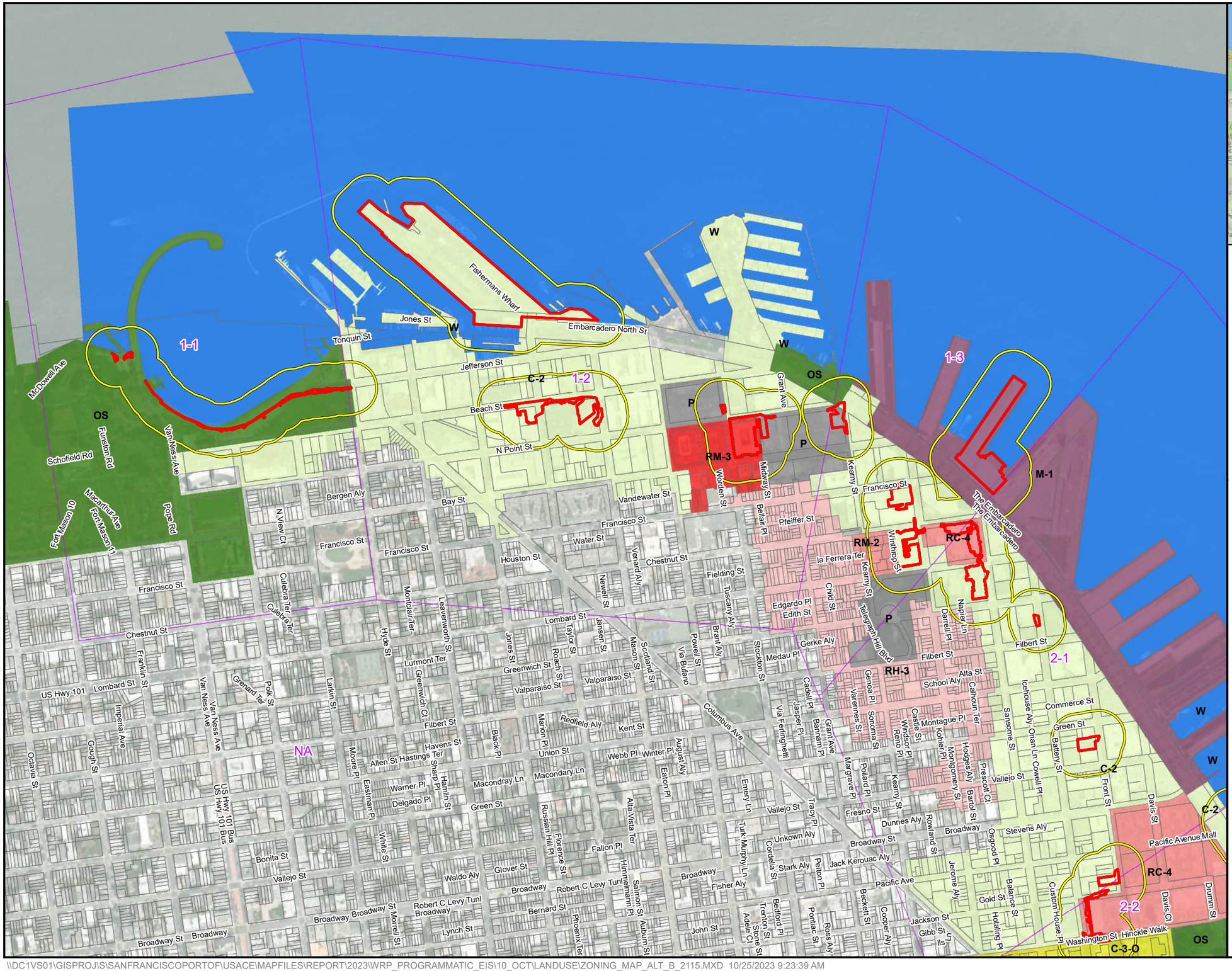
US Army Corps of Engineers
San Francisco District

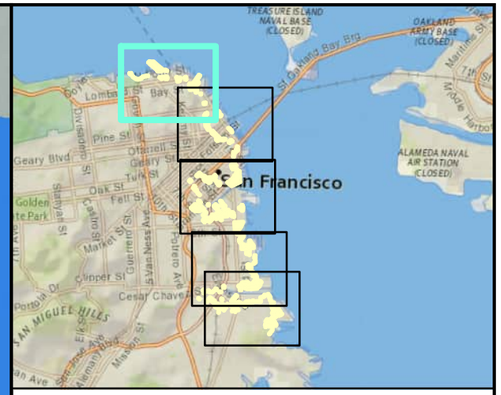
PORT SAN FRANCISCO

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NA
Wisconsin St
Dakota St
25th St
Blair Ter
26th St
Connecticut St
Missouri St
Cab Access Rd
Pennsylvania Ave
Mississippi St
Minnesota St
PDR-1-G
P
Maryland St
4-1
M-2
Indiana St
Cesar Chavez St
Cesar Chavez
Tennessee St
Illinois St
Michigan St
Marin St
PDR-2
I-280
Napoleon St
Islais Creek Channel
W
Islais St
Arthur Ave
Quint St
Amador St
Toland St
Galvez Ave
Evans Ave
Rankin St
Davidson Ave
Custer Ave
Burke Ave
3rd St
Hudson Ave
Milton I Ross Ln
Innes Ave
Jerrold Ave
4-2
4-3
Kirkwood Ave
Fairfax Ave
Newhall St
Pier 94 Backlands Improvements
Cargo Way
Pier
M-2
4-4
McKinnon Ave
PDR-1-G
NCT-3
Galvez Ave
Evans Ave
Phelps St
Innes Ave
Mendell St
Lane St
Fairfax Ave
Keith St
Jennings St
Newcomb Ave
Hudson Ave
Bowman Ct
Rebecca Ln
Kirkwood Ave
Ia Salle Ave
Kirkwood Ct
Drummond Alley St
Dunshee St
Silver Ave
Quesada Ave
Dedman Ct
Garnett Ter
Reuel Ct
Acacia Ave
Youngs Ct
Mabrey Ct
Hillview Ct
Cashmere St
Catalina St
W Point Rd
Middle Point Rd
Wills St
Evans Ave
4-5
Revere Ave
Oakdale Ave
Palou Ave
Newhall St
Ia Salle Ave
Newcomb Ave
NA
M-1
Madux Ave
Bridgeview Dr
Bayview Cir
Silverview Dr
Topeka Ave
Whitecliff Way
Quesada Ave
Revere Ave
Mendell St
Lane St
Hawkins Ln
Westbrook Ct
Whitney Young Cir
Bell Ct
Las Villas Ct
Progress St
Ardath Ct
Hare St
Harbor Rd
Ingalis St
Bertha Ln
Innes Ave
Marist St
Hawes St
Hunters Point Blvd
Hudson Ave
Fitch St
Flora St
Bayview St
Apollo St
Rankin St
Quint St
Drummond Aly St
Dunshee St
Silver Ave
Revere Ave
Quesada Ave
Oakdale Ave
Palou Ave
Newhall St
Newcomb Ave
Ia Salle Ave
Kirkwood Ave
Innes Ave
Hudson Ave
Fairfax Ave
Lane St
Mendell St
Phelps St
Evans Ave
Galvez Ave
Jerrold Ave
McKinnon Ave
Rankin St
Kirkwood Ave
I-280
3rd St
Fairfax Ave
Newhall St
Cargo Way
Pier
Evans Ave
Jennings St
Keith St
Fairfax Ave
Lane St
Mendell St
Phelps St
Innes Ave
Evans Ave
Evans Ave
Galvez Ave
Jerrold Ave
Rankin St
McKinnon Ave
Newcomb Ave
Kirkwood Ave
Ia Salle Ave
Kirkwood Ct
Drummond Aly St
Dunshee St
Silver Ave
Quesada Ave
Revere Ave
Oakdale Ave
Palou Ave
Newhall St
Ia Salle Ave
Newcomb Ave

Alternative B 2115





LEGEND

Alternative B 2115
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Parcels

Commercial Land
- Community Business, C-2
- Downtown Office, C-3-O

Industrial Land
- Light Industrial, M-1

Mixed Use Land
- Residential Commercial High Density, RC-4

Open Space
- Open Space, OS

Public Land
- Public, P

Residential Land
- Residential - House Three Family, RH-3
- Residential - Mixed Moderate Density, RM-2
- Residential - Mixed Moderate Density, RM-3

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-5A
LANDUSE

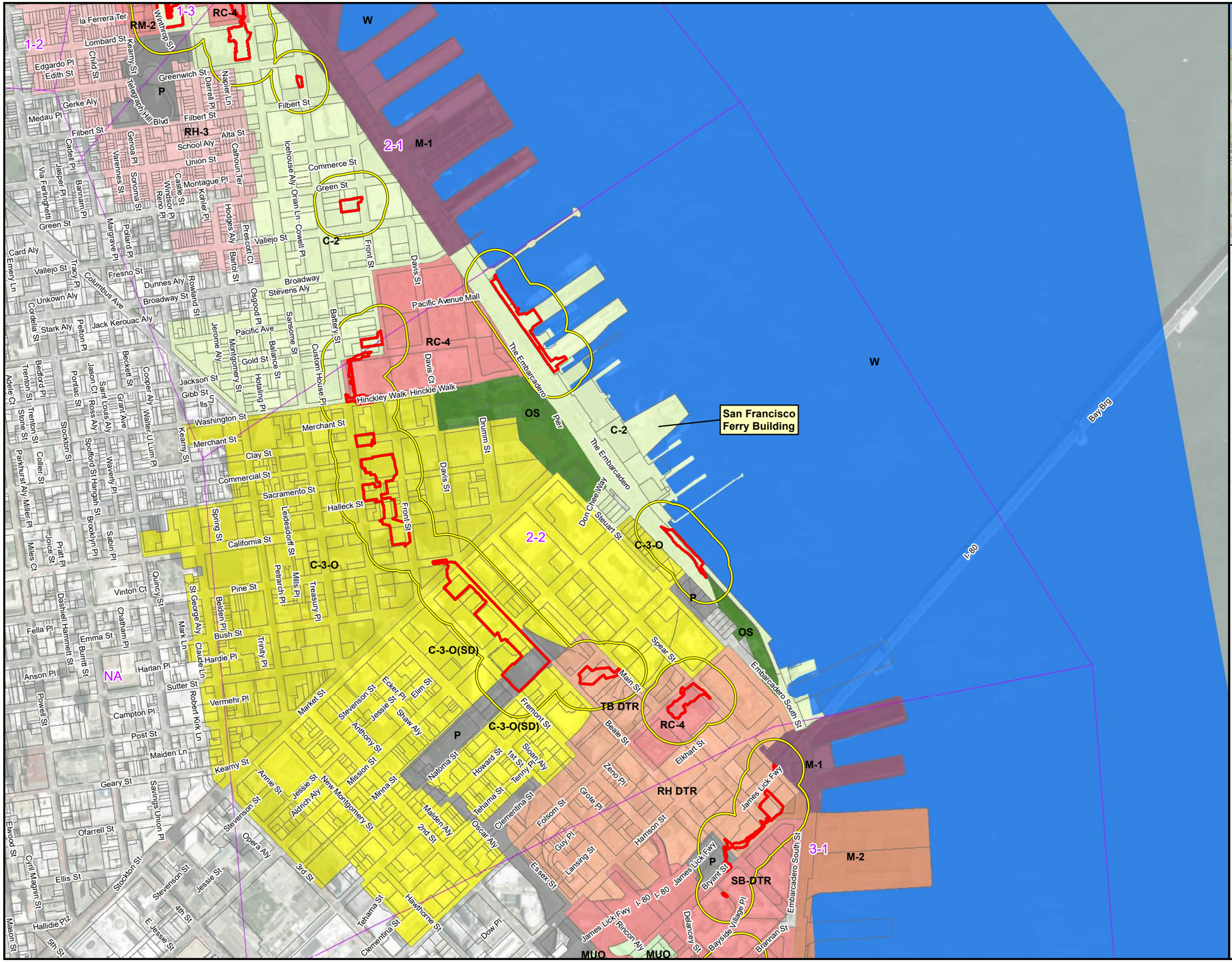
USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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LEGEND

Alternative B 2115
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Parcels

Commercial Land
- Community Business, C-2
- Downtown Office (Specail Development), C-3-O(SD)
- Downtown Office, C-3-O

Industrial Land
- Heavy Industrial, M-2
- Light Industrial, M-1

Mixed Use Land
- Residential Commercial High Density, RC-4
- Mixed Use Office, MUO

Open Space
- Open Space, OS

Public Land
- Public, P

Residential Land
- Residential - House Three Family, RH-3
- Rincon Hill Downtown Residential, RH DTR
- South Beach Downtown Residential, SB-DTR
- Transbay Downtown Residential, TB DTR
- Residential - Mixed Moderate Density, RM-2

Water
- Water, W

0 750 1,500 Feet

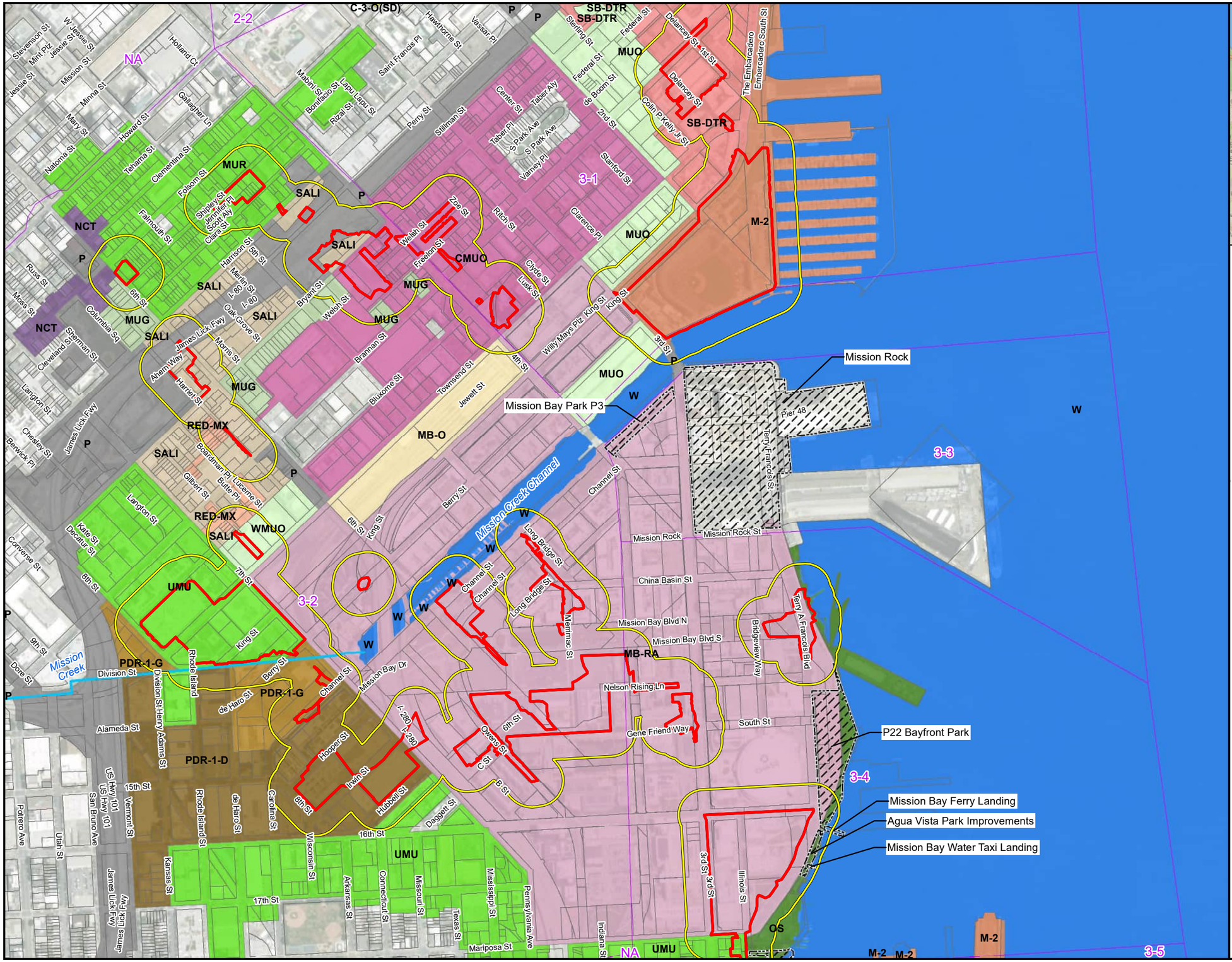
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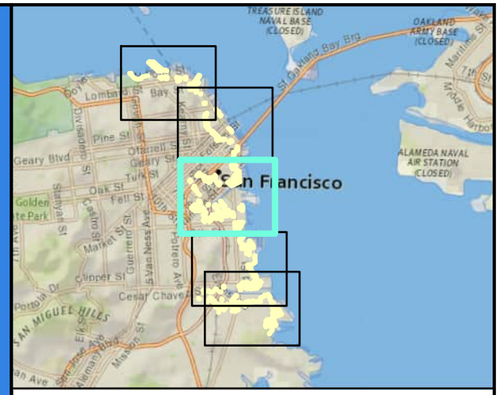
FIGURE LU-5B
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO





LEGEND

Alternative B 2115
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Downtown Office (Specail Development), C-3-O(SD)
- Mission Bay Office Distrcit, MB-O
- Production Distribution and Repair - General, PDR-1-G
- Production Distribution and Repair - Design, PDR-1-D
- Service/Arts/Light Industrial, SALI

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Soma Neighborhood Commercial Transit, NCT-SOMA
- Mission Bay Redevelopment, MB-RA
- Central Soma-Mixed Use Office, CMUO
- Residential Enclave-Mixed, RED-MX
- Mixed Use Office, MUO
- Mixed Use Residentail, MUR
- Mixed Use General, MUG
- Wsoma Mixed Use-Office, WMUO
- Urban Mixed Use, UMU

Open Space
- Open Space, OS

Public Land
- Public, P

Residential Land
- South Beach Downtown Residential, SB-DTR

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-5C
LANDUSE

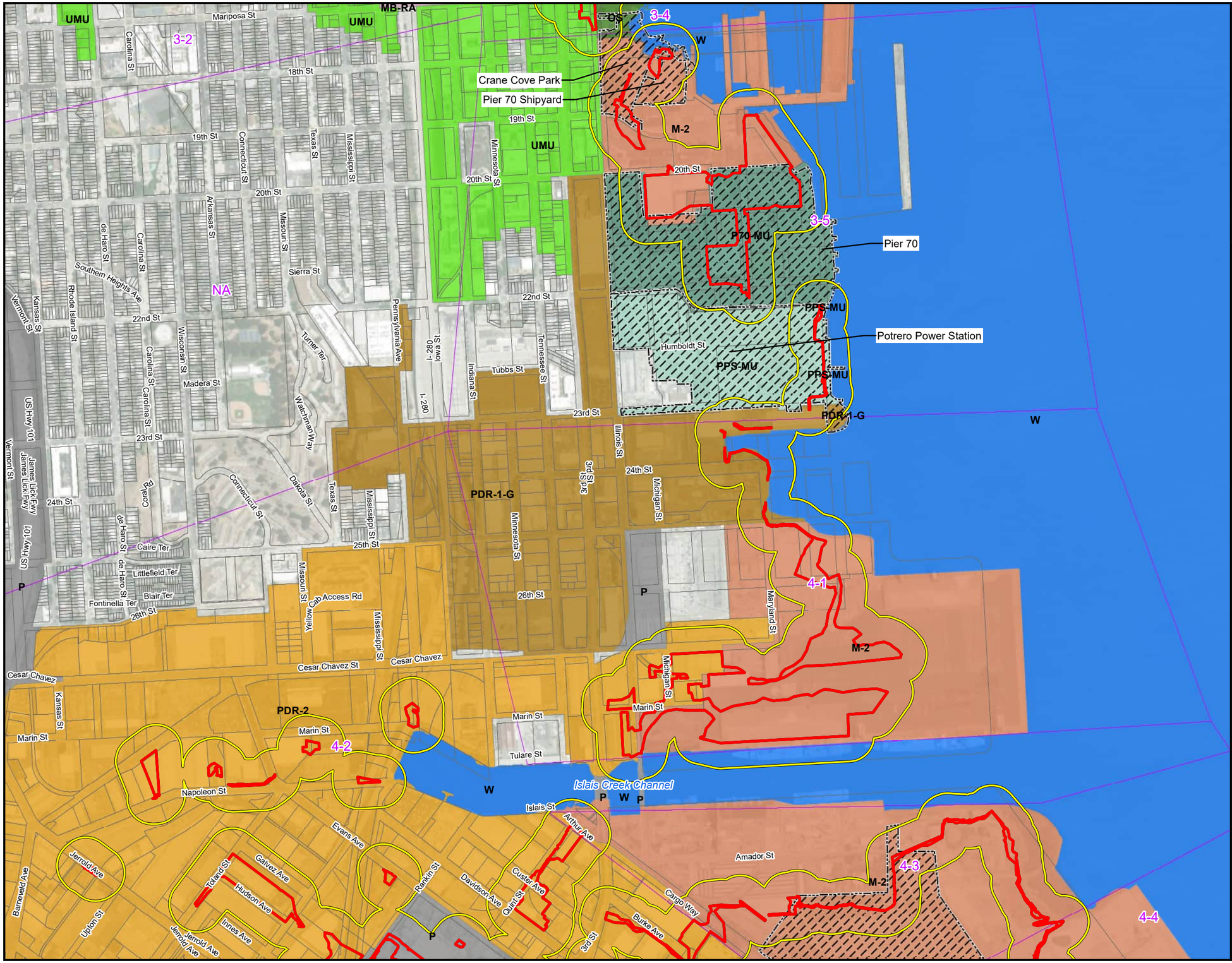
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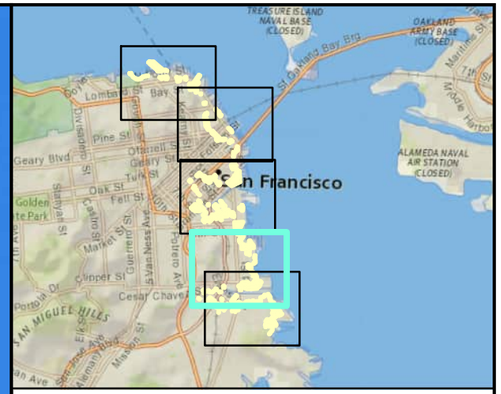
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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LEGEND

Alternative B 2115
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Mission Bay Redevelopment, MB-RA
- Urban Mixed Use, UMU
- Potrero Power Station Mixed Use, PPS-MU
- Pier70 Mixed Use, P70-MU

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-5D LANDUSE

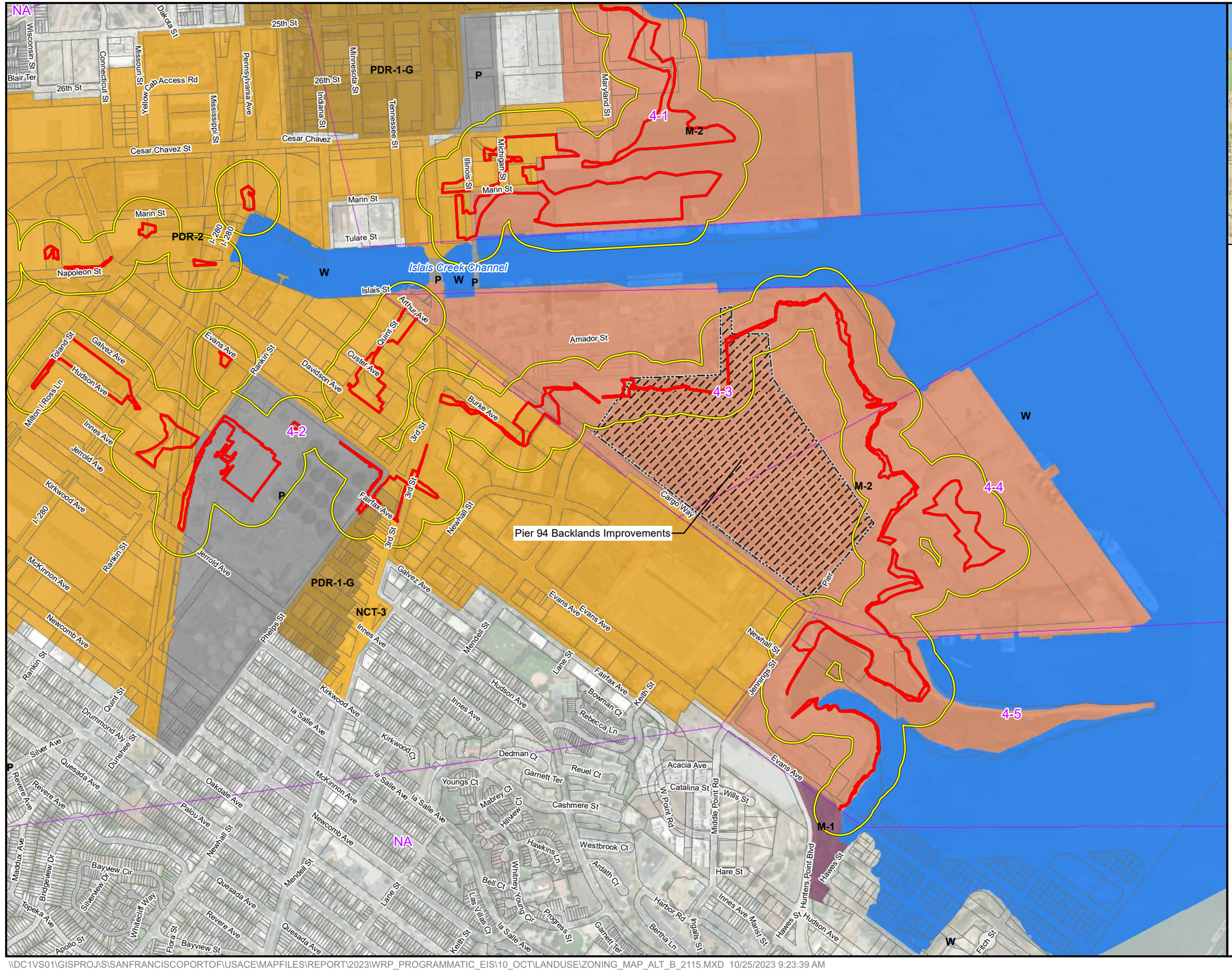
USACE and Port of San Francisco

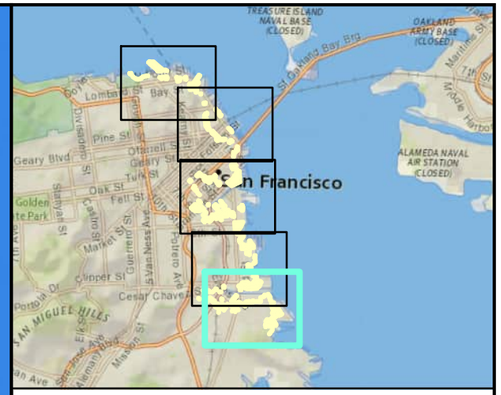
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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LEGEND

Alternative B 2115
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Moderate Scale Neighborhood Commercial Transit District, NCT-3
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2
- Light Industrial, M-1

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-5E
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

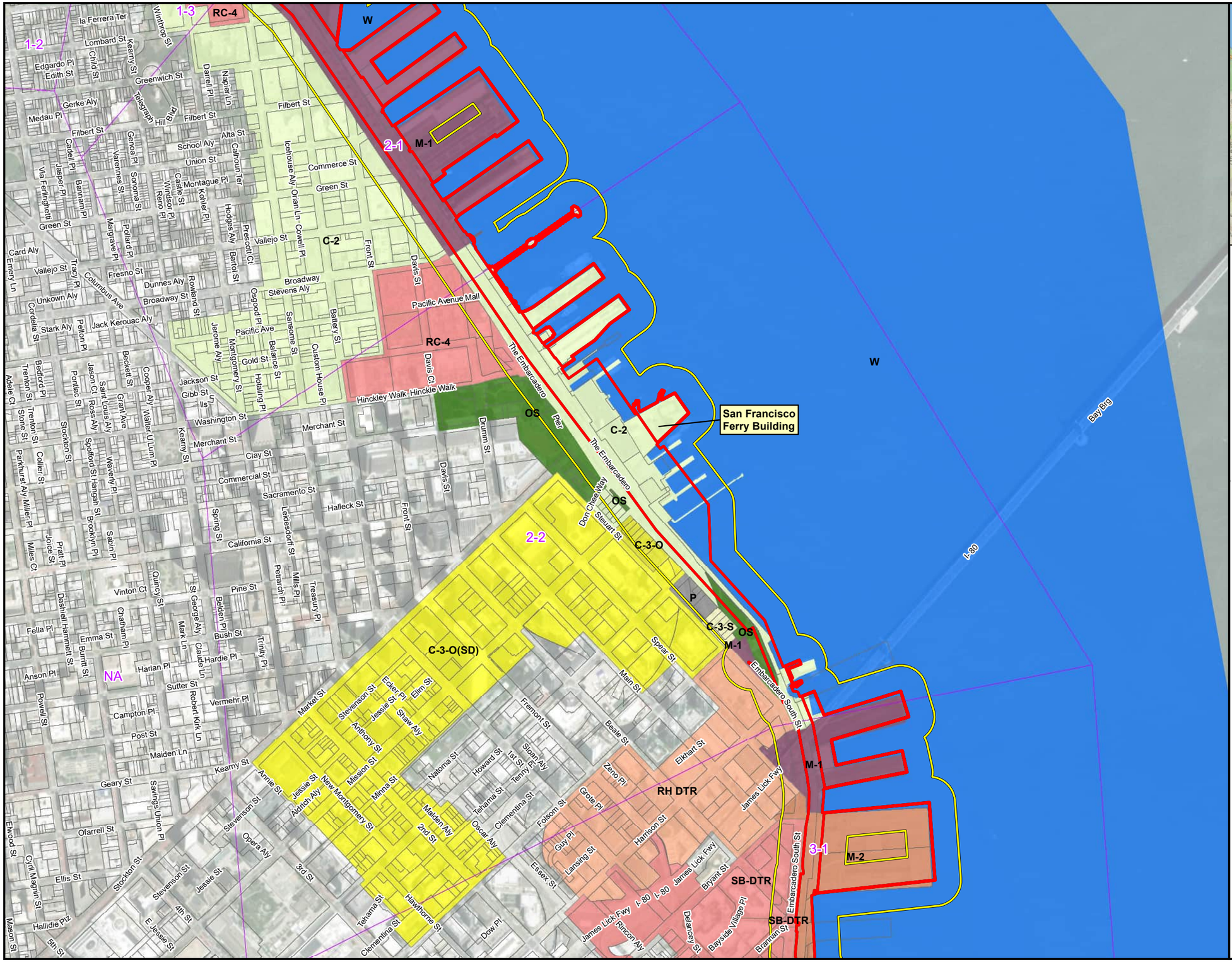
US Army Corps of Engineers
San Francisco District

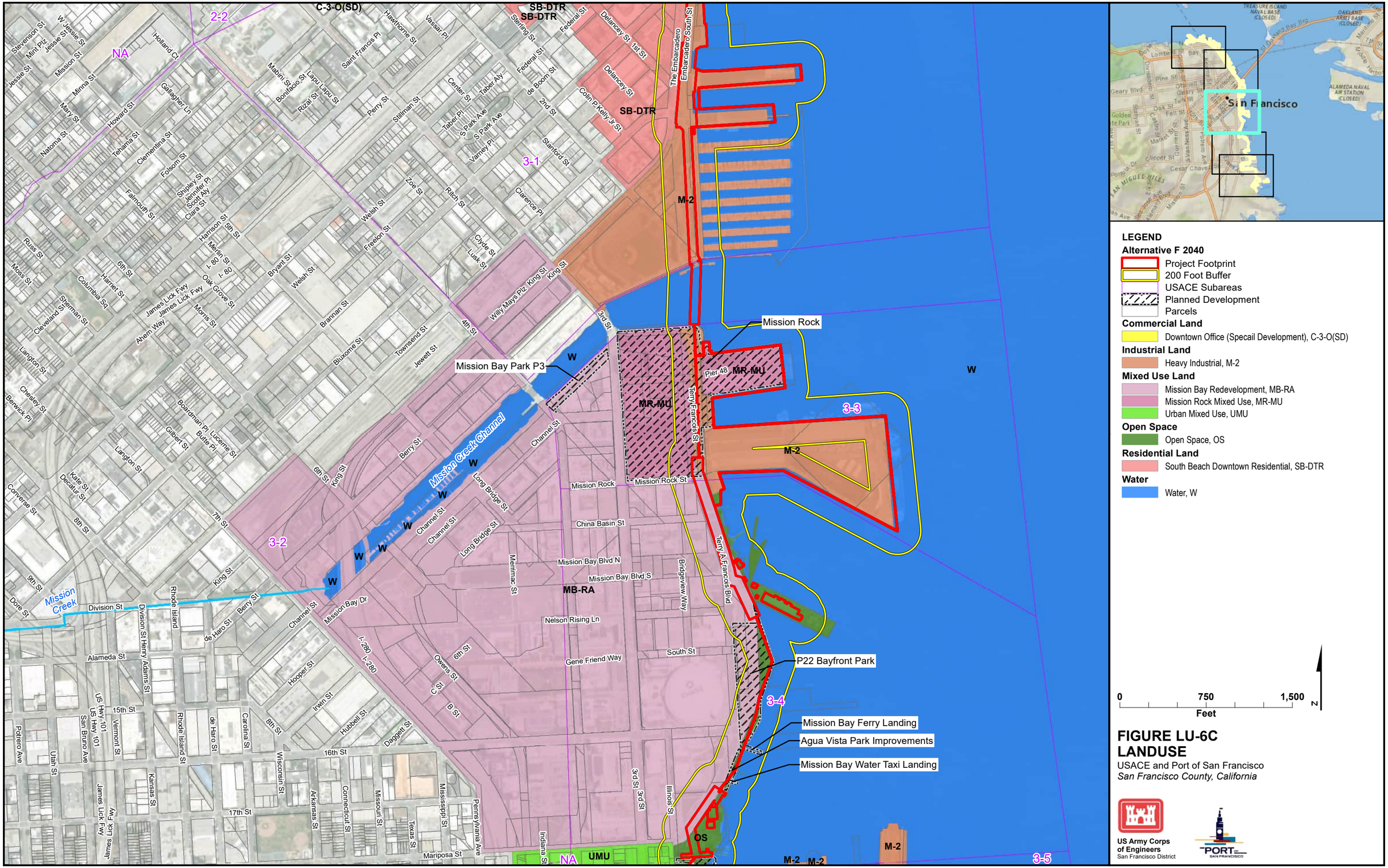
PORT of SAN FRANCISCO

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Alternative F 2040


1-1
1-2
1-3
2-1
2-2
NA
W
OS
C-2
P
M-1
RC-4
Fishermans Wharf
Jones St
Tonquin St
Embarcadero North St
Jefferson St
Beach St
N Point St
Grant Ave
Kearny St
Francisco St
The Embarcadero
Bay St
Bergen Aly
Vandewater St
Water St
Chestnut St
Houston St
Fielding St
Wrinthrop St
Child St
Edgardo Pl
Edith St
Lombard St
Gerke Alley
Telegraph Hill Blvd
Filbert St
Napier Ln
Darrell Pl
Medau Pl
Stockton St
Greenwich St
Valparaiso St
Columbus Ave
Redfield Aly
Kent St
Union St
Webb Pl
Winter Pl
Macondray Ln
Green St
Vallejo St
Fresno St
Dunnes Aly
Broadway St
Broadway
Pacific Ave
Jack Kerouac Aly
Unkown Aly
Stevens Aly
Osgood Pl
Rowland St
Jerome Aly
Gold St
Balance St
Custom House Pl
Washington St
Hinckle Walk
Pacific Avenue Mall
Davis St
Davis Ct
Drumm St
Front St
Battery St
Sansome St
Icehouse Alley
Orian Ln
Cowell Pl
Commerce St
Green St
Vallejo St
Montgomery St
Hodges Alley
Prescott Ct
Bartol St
Montague Pl
Castle St
Windsor Pl
Reno Pl
Sonoma St
Varennes St
Genoa Pl
Grant Ave
Barnam Pl
Jasper Pl
Via Ferlinghetti
Cadell Pl
Calhoun Ter
School Alley
Alta St
Margrave Pl
Pollard Pl
Kearny St
Tracy Pl
Emery Ln
Eaton Pl
August Alley
Black Pl
Maron Pl
Moore Pl
Allen St
Hastings Ter
Sharp Pl
Hamlin St
Warner Pl
Delgado Pl
Macondary Ln
Easman Pl
Alta Vista Ter
Fallon Pl
Tuck Murphy Ln
Cordelia St
Stark Alley
Pelton Pl
Fisher Alley
Worden St
Midway St
Bellair Pl
Pfeiffer St
Wrinthrop St
Ia Ferrera Ter
Verant Aly
Newell St
Tuscany Aly
Brant Aly
Powell St
Via Bufano
Mason St
Scotland St
Taylor St
Jansen St
Roach St
Jones St
Leavenworth St
Hyde St
Lurmont Ter
Greenwich Ct
Montclair Ter
Culebra Ter
Francisco St
Chestnut St
Lombard St
Filbert St
Alta St
Green St
Vallejo St
Broadway
Broadway St
Pacific Ave
Jack Kerouac Aly
Gibb St
Jackson St
Pontiac St
Ross Aly
Becket St
Cooper Aly
Bedford Pl
Trenton St
Stone St
Adele Ct
Phoenix Ter
Auburn St
Salmon St
Himmelmann Pl
Robert C Levy Tunl
Bernard St
John St
Lynch St
Morrell St
Broadway St
Waldo Aly
Glover St
Bonita St
White St
Florence St
Russian Hill Pl
Francisco St
Culebra Ter
Fort Mason 10
Fort Mason 11
Macarthur Ave
Pope Rd
Schofield Rd
Funston Rd
McDowell Ave
Van Ness Ave
US Hwy 101
US Hwy 101 Bus
Lombard St
Franklin St
Imperial Ave
Gough St
Octavia St
Larkin St
Polk St
Grenard Ter
Havens St
Filbert St
Green St
Vallejo St
Broadway
Pacific Avenue Mall
Stevens Alley
Dunnes Alley
Fresno St
Tracy Pl
Kearny St
Front St
Battery St
Commerce St
Green St
Vallejo St
Montgomery St
Hodges Alley
Prescott Ct
Bartol St
Montague Pl
Castle St
Windsor Pl
Reno Pl
Sonoma St
Varennes St
Genoa Pl
Grant Ave
Barnam Pl
Jasper Pl
Via Ferlinghetti
Cadell Pl
Calhoun Ter
School Alley
Alta St
Filbert St
Gerke Alley
Telegraph Hill Blvd
Napier Ln
Darrell Pl
Medau Pl
Stockton St
Greenwich St
Valparaiso St
Columbus Ave
Redfield Aly
Kent St
Union St
Webb Pl
Winter Pl
Macondray Ln
Green St
Vallejo St
Fresno St
Dunnes Alley
Broadway St
Broadway
Pacific Ave
Jack Kerouac Aly
Unkown Aly
Stevens Alley
Osgood Pl
Rowland St
Jerome Alley
Gold St
Balance St
Custom House Pl
Washington St
Hinckle Walk
Pacific Avenue Mall
Davis St
Davis Ct
Drumm St
Front St
Battery St
Sansome St
Icehouse Alley
Orian Ln
Cowell Pl


1-3
RC-4
1-2
W
2-1
M-1
C-2
RC-4
OS
C-2
San Francisco
Ferry Building
W
OS
C-3-O
2-2
P
C-3-S
OS
M-1
C-3-O(SD)
NA
RH DTR
M-1
3-1
M-2
SB-DTR
SB-DTR
I-80
Bay Brg
Pacific Avenue Mall
Hinckley Walk
The Embarcadero
Pier
Don Chee Way
Embarcadero South St
Spear St
Main St
Beale St
Fremont St
James Lick Fwy
Bryant St
Harrison St
Folsom St
Howard St
Mission St
Market St
Geary St
Kearny St
Post St
Sutter St
Bush St
Pine St
California St
Clay St
Washington St
Jackson St
Broadway
Vallejo St
Filbert St
Green St
Union St
Lombard St
Greenwich St
Commerce St
Merchant St
Commercial St
Sacramento St
Halleck St
Ellis St
Ofarrell St
Hallidie Plz
Embarcadero South St
Brannan St
Bayside Village Pl
Rincon Alley
Dow Pl
Clementina St
Tehama St
Hawthorne St
Essex St
Lansing St
Guy Pl
Zeno Pl
Grote Pl
Elkhart St
Natoma St
Minna St
Jessie St
Annie St
Aldrich Alley
New Montgomery St
Maiden Alley
2nd St
3rd St
4th St
5th St
Front St
Davis St
Battery St
Sansome St
Leidesdorff St
Spring St
Stevenson St
Ecker Pl
Elim St
Shaw Alley
Anthony St
Sloan Alley
1st St
Tenny Pl
Oscar Alley
Clementina St
Tehama St
Harlan Pl
Hardie Pl
Claude Ln
Mark Ln
St George Alley
Belden Pl
Trinity Pl
Treasury Pl
Mills Pl
Petrarch Pl
Quincy St
Vinton Ct
Dashiell Hammett St
Chatham Pl
Fella Pl
Emma St
Burritt St
Anson Pl
Powell St
Campton Pl
Vermehr Pl
Robert Kirk Ln
Maiden Ln
Savings Union Pl
Ellwood St
Cyril Magnin St
Stockton St
Mason St
Opera Aly
Ofarrell



LEGEND

Alternative F 2040
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Downtown Office (Specail Development), C-3-O(SD)

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Mission Bay Redevelopment, MB-RA
- Mission Rock Mixed Use, MR-MU
- Urban Mixed Use, UMU

Open Space
- Open Space, OS

Residential Land
- South Beach Downtown Residential, SB-DTR

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-6C LANDUSE

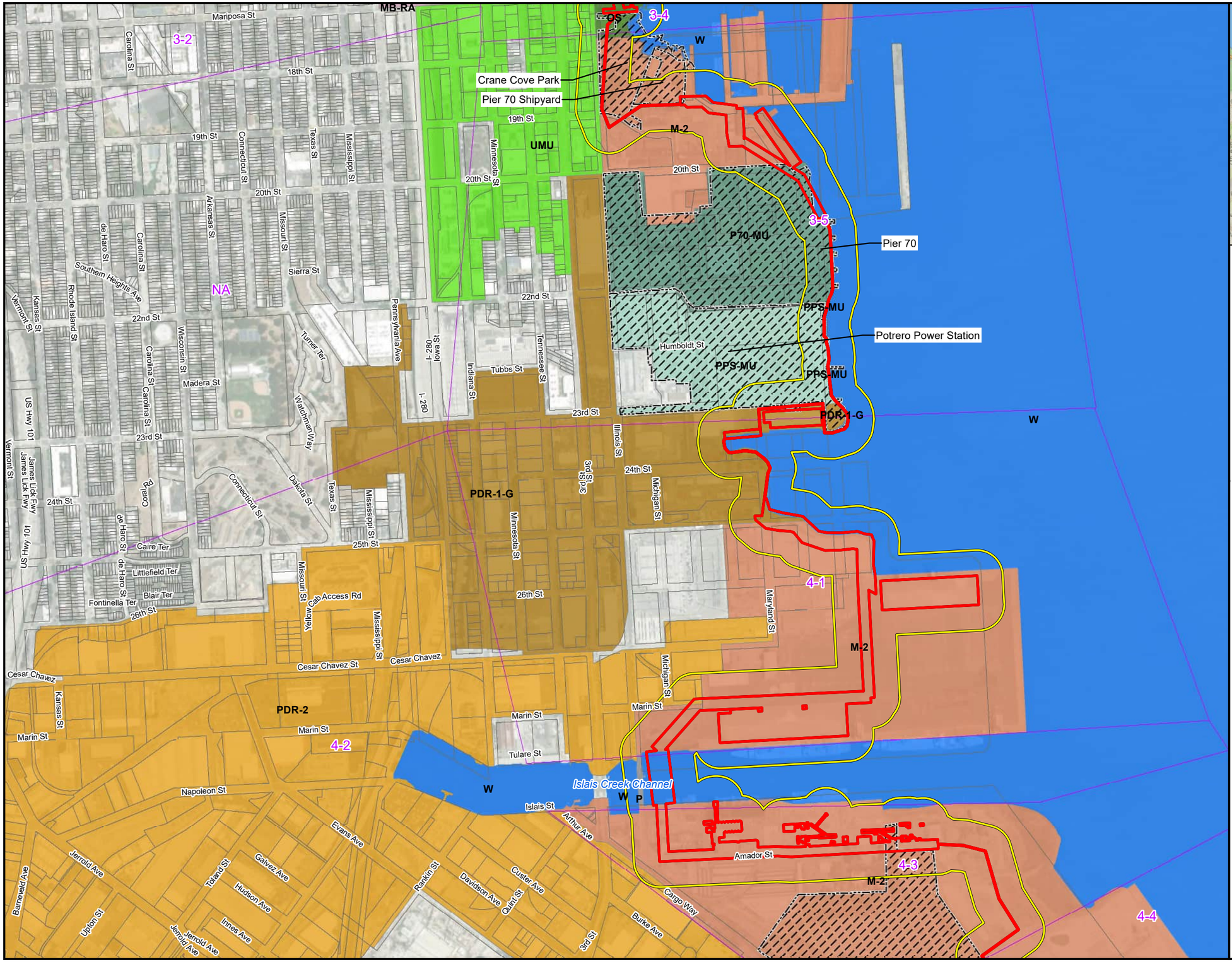
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San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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LEGEND

Alternative F 2040
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Mission Bay Redevelopment, MB-RA
- Urban Mixed Use, UMU
- Potrero Power Station Mixed Use, PPS-MU
- Pier70 Mixed Use, P70-MU

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-6D LANDUSE

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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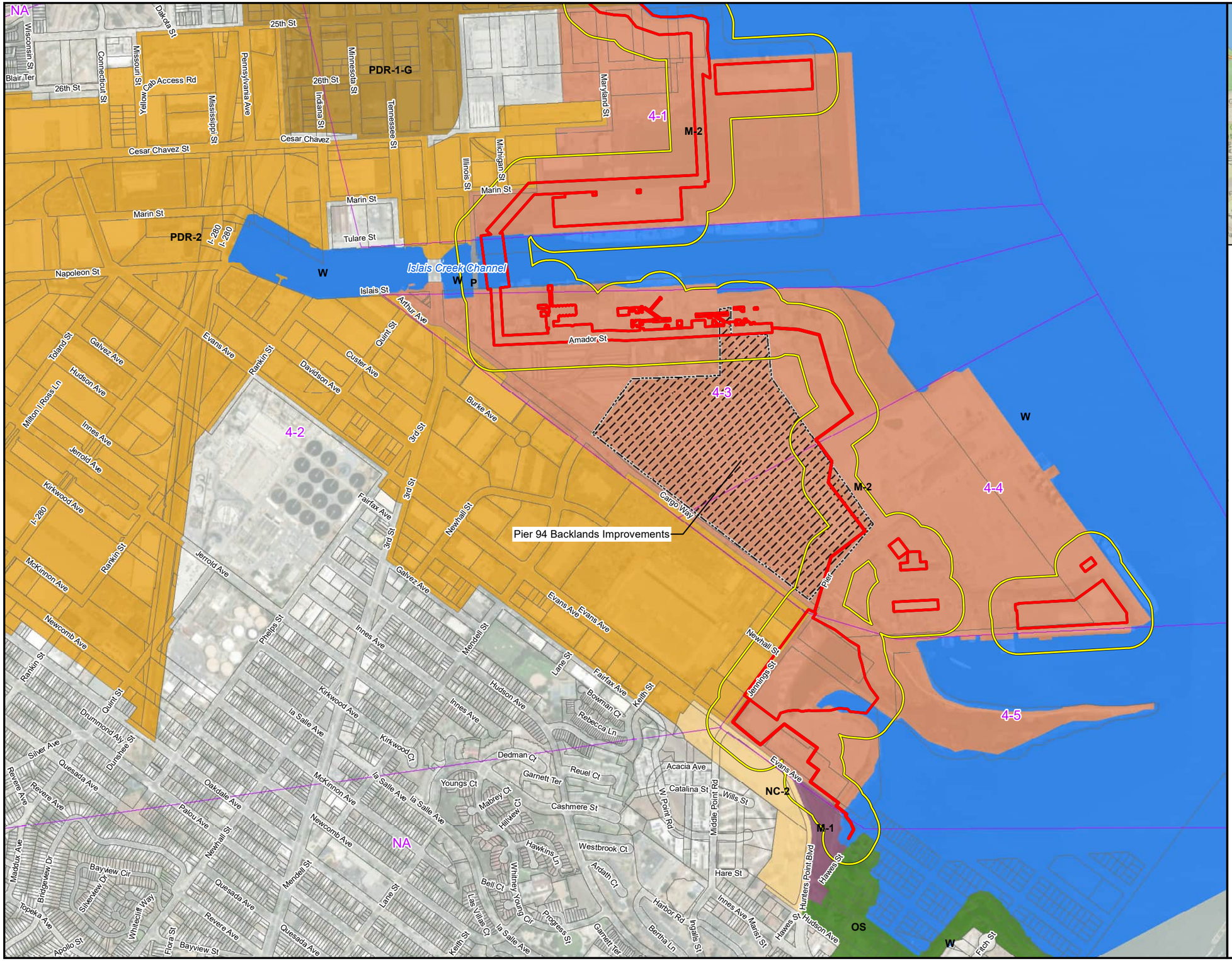


FIGURE LU-6E
LANDUSE

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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Alternative F 2090


1-1
1-2
1-3
2-1
2-2
NA
W
OS
C-2
P
M-1
Fishermans Wharf
Jones St
Tonquin St
Embarcadero North St
Jefferson St
Beach St
N Point St
Bay St
Francisco St
Chestnut St
Lombard St
Filbert St
Green St
Vallejo St
Broadway
Broadway St
Pacific Ave
Washington St
Hinckle Walk
Pacific Avenue Mall
The Embarcadero
Grant Ave
Kearny St
Columbus Ave
Van Ness Ave
Lombard St
US Hwy 101
Bergen Aly
Francisco St
Water St
Houston St
Chestnut St
Fielding St
Edgardo Pl
Edith St
Gerke Aly
Medau Pl
Filbert St
School Aly
Alta St
Commerce St
Green St
Vallejo St
Broadway St
Pacific Ave
Jack Kerouac Aly
Stevens Aly
Osgood Pl
Gold St
Balance St
Custom House Pl
Davis St
Davis Ct
Drumm St
Front St
Battery St
Sansome St
Montgomery St
Kearny St
Telegraph Hill Blvd
Lombard St
Columbus Ave
Bay St
Francisco St
Beach St
N Point St
Jefferson St
Jones St
Tonquin St
Embarcadero North St
Fisherman's Wharf
Grant Ave
Kearny St
Van Ness Ave
McDowell Ave
Schofield Rd
Funston Rd
Fort Mason 10
Fort Mason 11
MacArthur Ave
Pope Rd
N View Ct
Culebra Ter
Hyde St
Leavenworth St
Jones St
Taylor St
Jansen St
Mason St
Scotland St
Stockton St
Powell St
Via Bufano
Brant Aly
Tuscany Aly
Newell St
Venard Aly
Child St
Winthrop St
Darrell Pl
Napier Ln
Calhoun Ter
Icehouse Aly
Orian Ln
Cowell Pl
Sansome St
Battery St
Front St
Davis St
Pacific Avenue Mall
Montague Pl
Kohler Pl
Hodges Aly
Prescott Ct
Bartol St
Rowland St
Jerome Aly
Balance St
Custom House Pl
Drumm St
Davis Ct
Gibb St
Jackson St
Becket St
Cooper Aly
Pontiac St
Ross Aly
Bedford Pl
Trenton St
Stone St
Adele Ct
Fisher Aly
Broadway
Broadway St
Robert C Levy Tunl
Bernard St
Lynch St
John St
Morrell St
Phoenix Ter
Auburn St
Salmon St
Himmelmann Pl
Fallon Pl
Alta Vista Ter
Russian Hill Pl
Florence St
White St
Bonita St
Waldo Aly
Glover St
Delgado Pl
Green St
Macondray Ln
Union St
Webb Pl
Winter Pl
Kent St
Redfield Aly
Marion Pl
Black Pl
Allen St
Hastings Ter
Havens St
Sharp Pl
Hamlin St
Eastman Pl
Moore Pl
Warner Pl
Eaton Pl
August Aly
Emery Ln
Tuck Murphy Ln
Cordelia St
Stark Aly
Pelton Pl
Unkown Aly
Tracy Pl
Fresno St
Dunnes Aly
Margrave Pl
Pollard Pl
Varennes St
Genoa Pl
Sonoma St
Castle St
Windsor Pl
Reno Pl
Barnard Pl
Grant Ave
Jasper Pl
Cadell Pl
Via Ferlinghetti
Octavia St
Gough St
Imperial Ave
Franklin St
Grenard Ter
Polk St
Larkin St
Greenwich St
Greenwich Ct
Lurmont Ter
Montclair Ter
Culebra Ter
Francisco St
Chestnut St
Lombard St
Francisco St
Francisco St
Francisco St
Broadway
Broadway St
Broadway St
Broadway
Vallejo St
Bonita St
Green St
Filbert St
Union St
Valparaiso St
Greenwich St
Jones St
Leavenworth St
Hyde St
Culebra Ter
Francisco St
Chestnut St
Lombard St
Francisco St
Francisco St

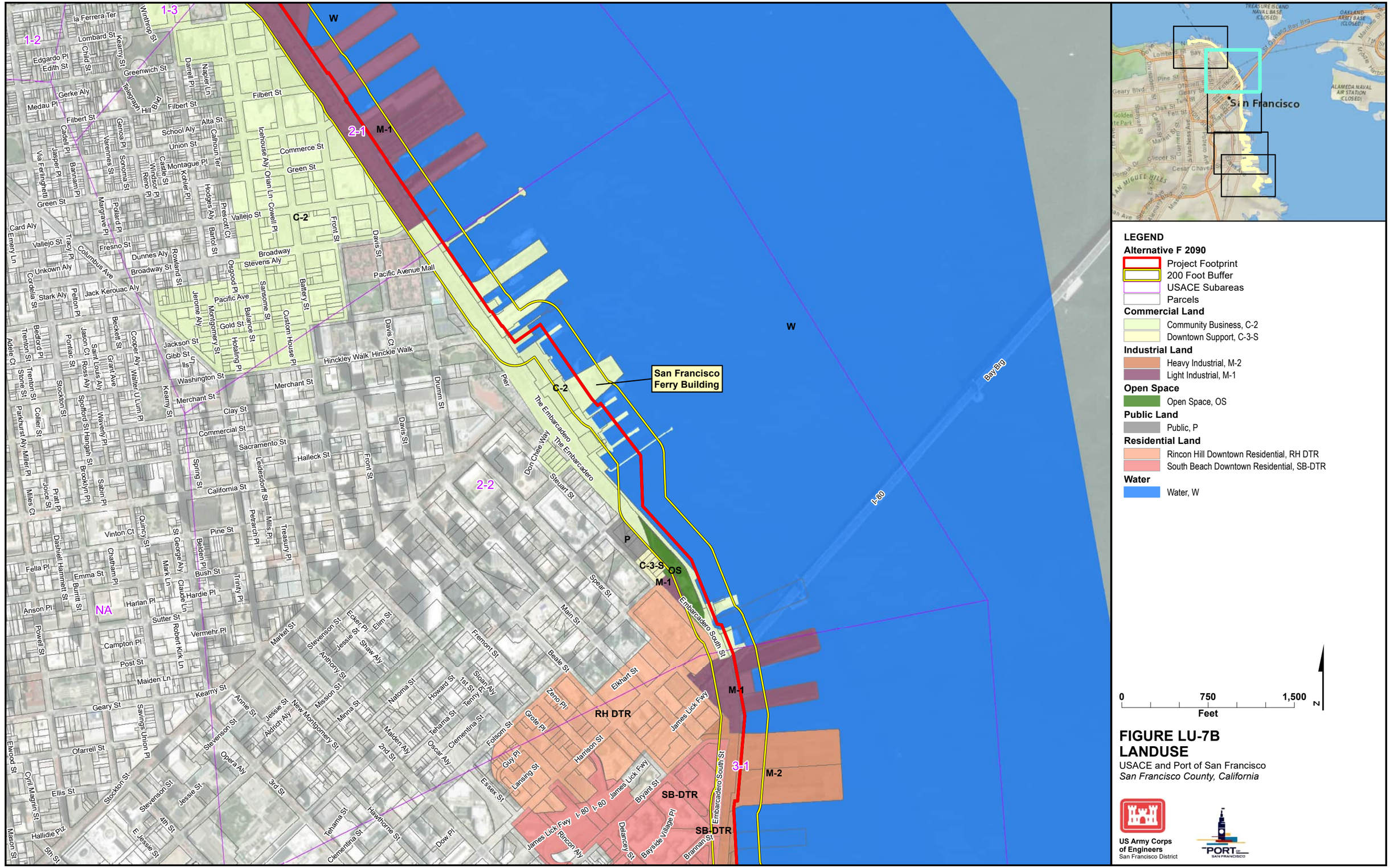


FIGURE LU-7B
LANDUSE

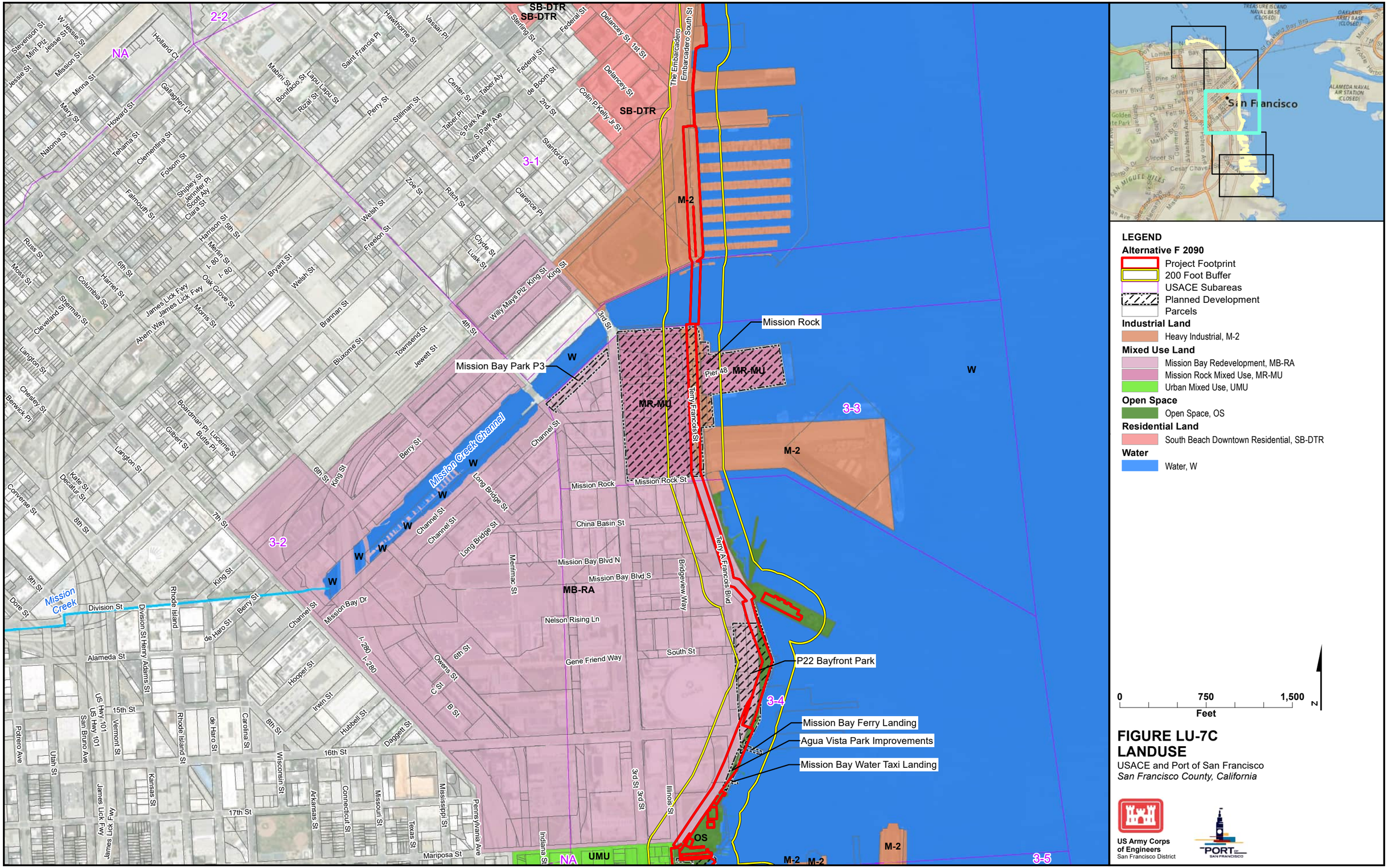
USACE and Port of San Francisco

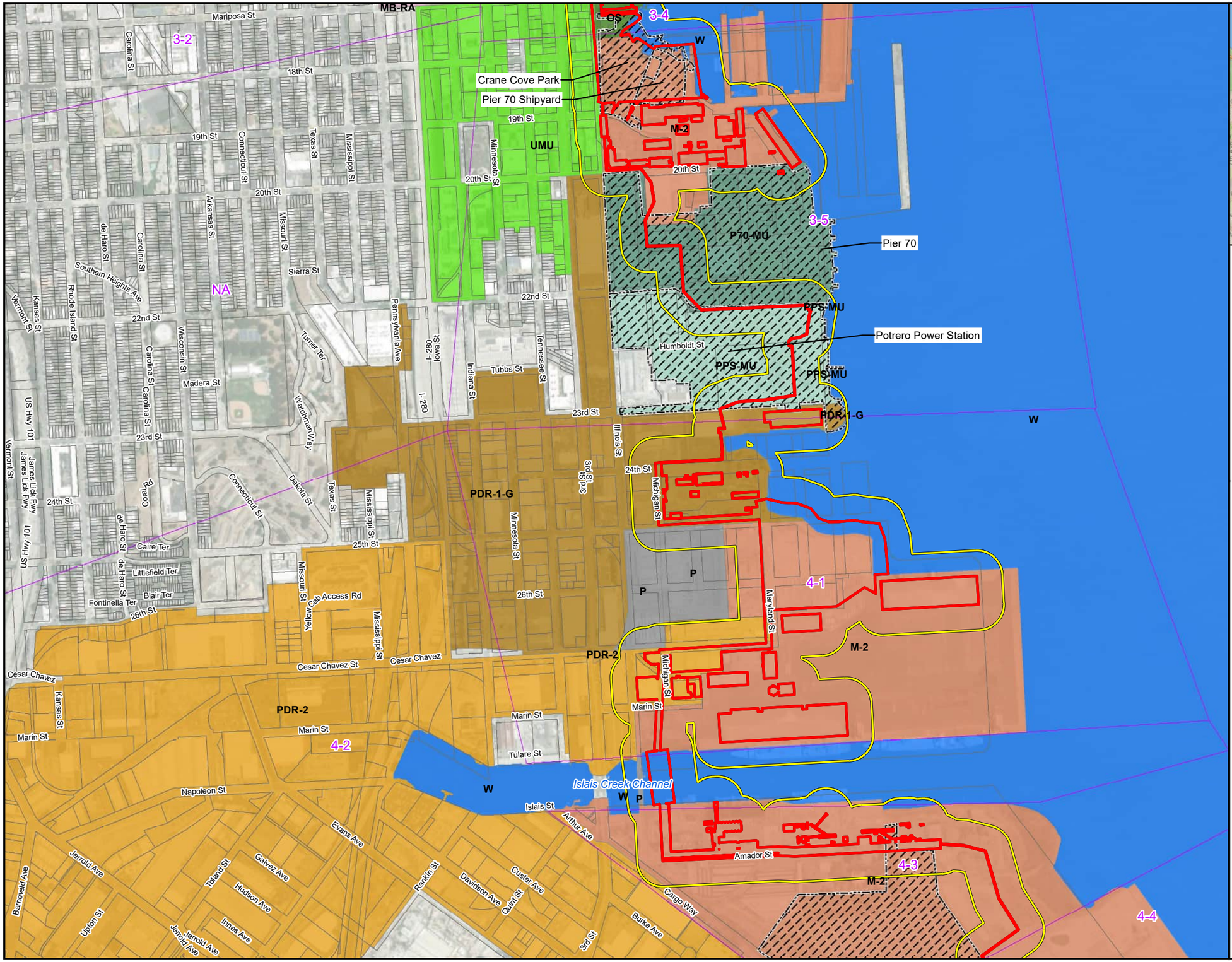
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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SB-DTR
SB-DTR
2-2
NA
3-1
SB-DTR
M-2
3-3
M-2
W
MR-MU
MR-MU
Mission Rock
Mission Bay Park P3
Pier 48
Terry Francois St
Mission Creek Channel
3-2
MB-RA
Mission Bay Blvd N
Mission Bay Blvd S
Nelson Rising Ln
Gene Friend Way
China Basin St
Mission Rock St
Terry A Francois Blvd
Bridgeview Way
Merrimac St
Long Bridge St
Channel St
Mission Bay Dr
Mission Creek
Division St
3-4
P22 Bayfront Park
Mission Bay Ferry Landing
Agua Vista Park Improvements
Mission Bay Water Taxi Landing
OS
NA
UMU
M-2
M-2
M-2
3-5
Mariposa St
17th St
16th St
15th St
Alameda St
South St
3rd St
4th St
6th St
7th St
8th St
9th St
King St
Berry St
Channel St
Division St
Mission Rock
Willy Mays Plz
King St
Brannan St
Townsend St
Jewett St
Bryant St
Welsh St
Harrison St
Folsom St
Howard St
Natoma St
Minna St
Mission St
Jessie St
Stevenson St
Mint Plz
Jessie St
Mary St
Tehama St
Clementina St
Falmouth St
Russ St
Moss St
Harriet St
Columbia Sq
Sherman St
Cleveland St
Langton St
Chesley St
Benwick Pl
Ahern Way
James Lick Fwy
Oak Grove St
Morris St
Merlin St
I- 80
5th St
6th St
Clara St
Jennifer Pl
Scott Alley
Shipley St
Zoe St
Freelon St
Rich St
Clyde St
Lusk St
Clarence Pl
Stanford St
Varney Pl
S Park Ave
Taber Pl
Taber Alley
Center St
Stillman St
Perry St
Rizal St
Lapu Lapu St
Bonifacio St
Mabini St
Saint Francis Pl
Hawthorne St
Vassar Pl
Sterling St
Federal St
de Boom St
2nd St
Colin P Kelly Jr St
Delancey St
1st St
The Embarcadero
Embarcadero South St
Gallagher Ln
Holland Ct
W Jessie St
Boardman Pl
Lucerne St
Butte Pl
Gilbert St
Katie St
Decatur St
Converse St
Dore St
Rhode Island
Division St Henry Adams St
de Haro St
Hooper St
Irwin St
Hubbell St
Daggett St
Carolina St
Rhode Island St
Wisconsin St
Arkansas St
Connecticut St
Missouri St
Texas St
Mississippi St
Pennsylvania Ave
Illinois St
Indiana St
Potrero Ave
San Bruno Ave
US Hwy 101
Vermont St
Utah St
Kansas St
James Lick Fwy
Owens St
C St
B St
I-280
Merrimac St
Bridgeview Way
Terry A Francois Blvd
Channel St
Long Bridge St
Mission Bay Blvd N
Mission Bay Blvd S
Nelson Rising Ln
Gene Friend Way
China Basin St
Mission Rock St
South St
3rd St
Illinois St
Pier 48
Terry Francois St
Willy Mays Plz
King St
Brannan St
Townsend St
4th



LEGEND

Alternative F 2090
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Mission Bay Redevelopment, MB-RA
- Urban Mixed Use, UMU
- Potrero Power Station Mixed Use, PPS-MU
- Pier70 Mixed Use, P70-MU

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-7D LANDUSE

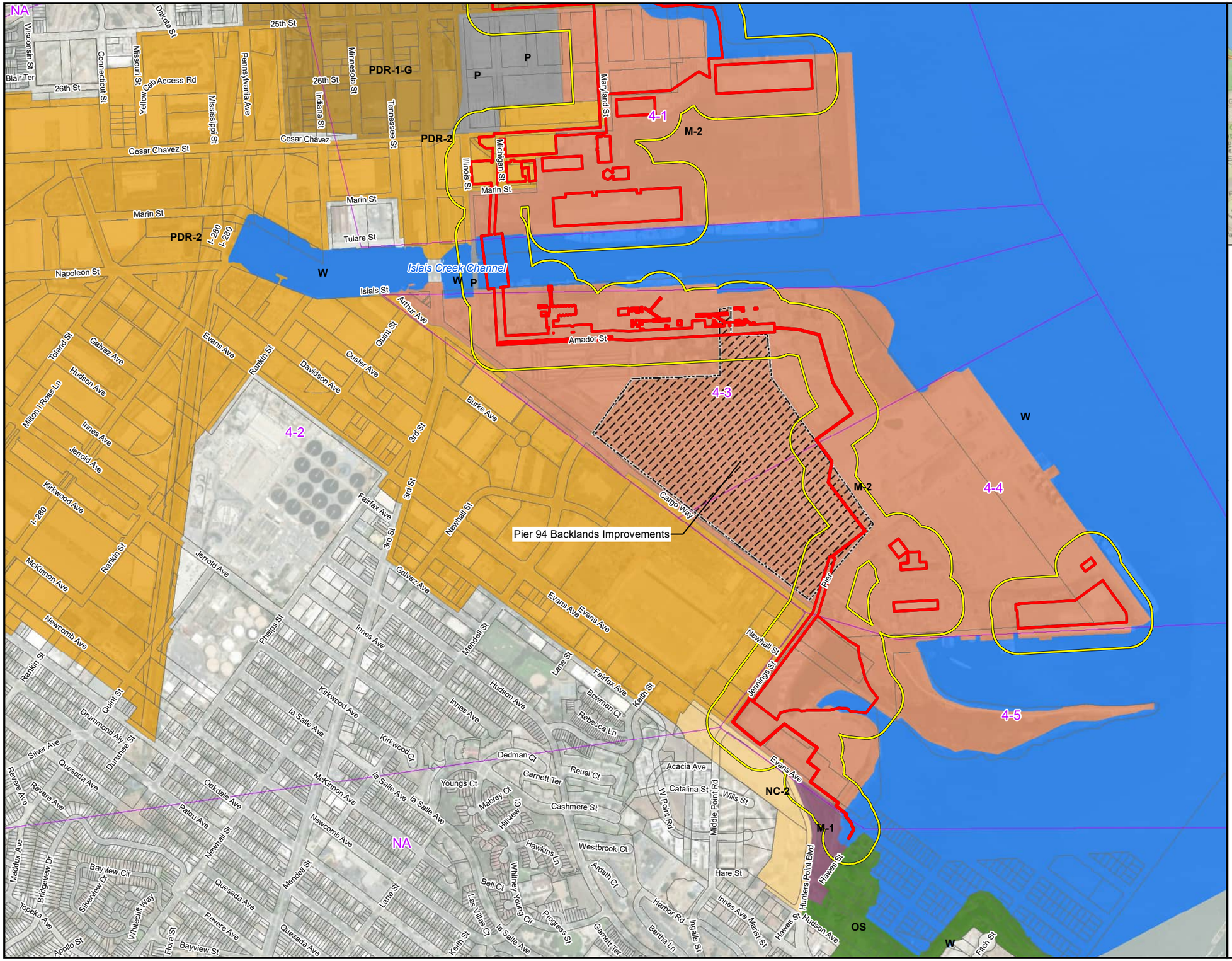
USACE and Port of San Francisco

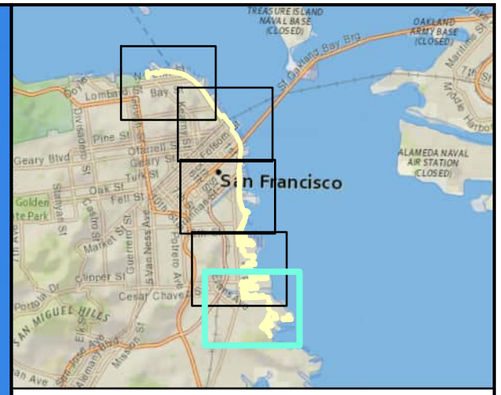
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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LEGEND

Alternative F 2090
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Neighborhood Commercial Small Scale, NC-2
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2
- Light Industrial, M-1

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-7E
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

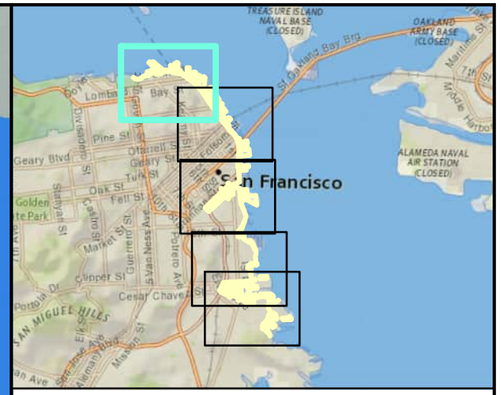
US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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Alternative G 2040





LEGEND

Alternative G 2040
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Parcels

Commercial Land
- Community Business, C-2

Industrial Land
- Light Industrial, M-1

Mixed Use Land
- Residential Commercial High Density, RC-4

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

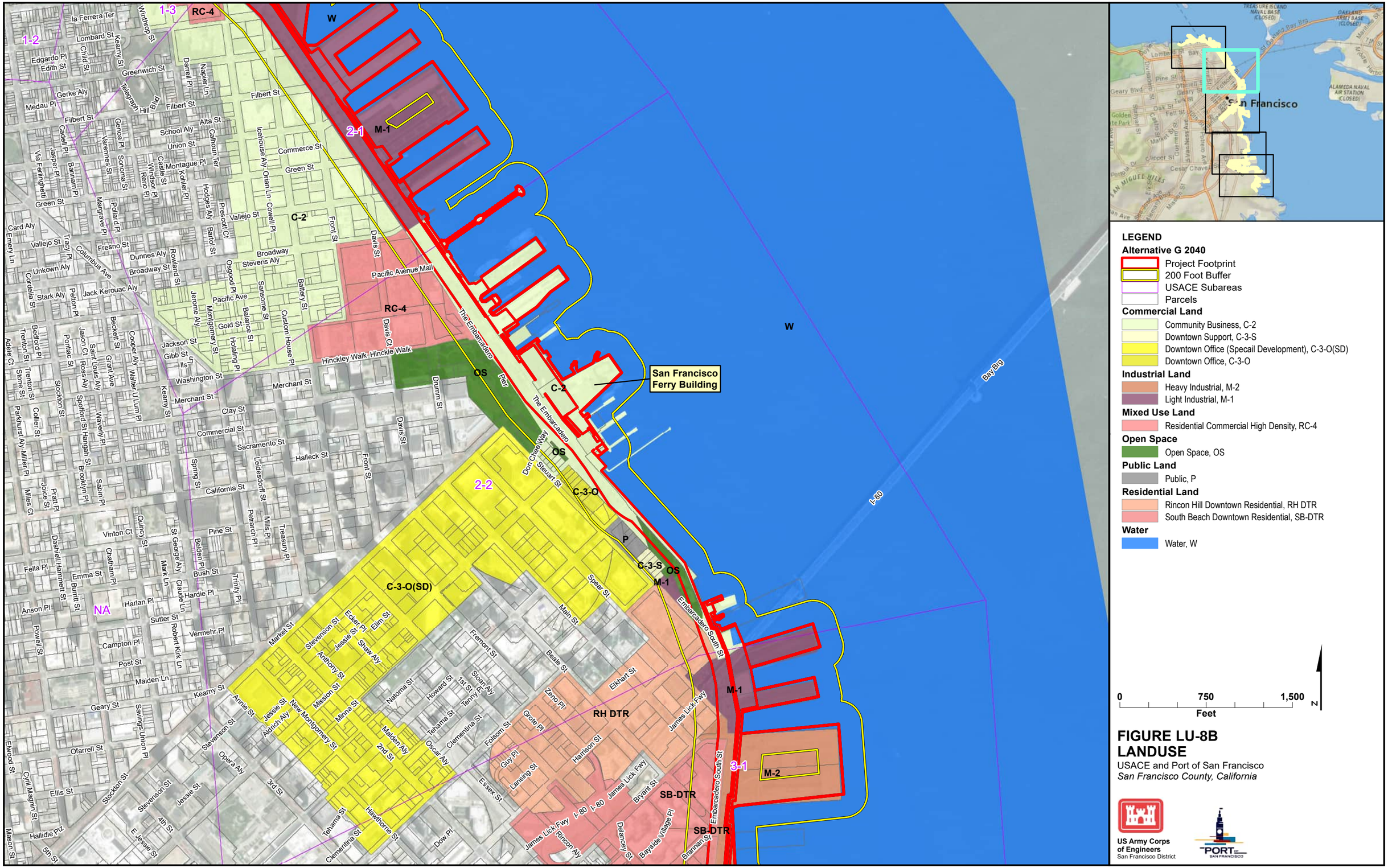
FIGURE LU-8A
LANDUSE

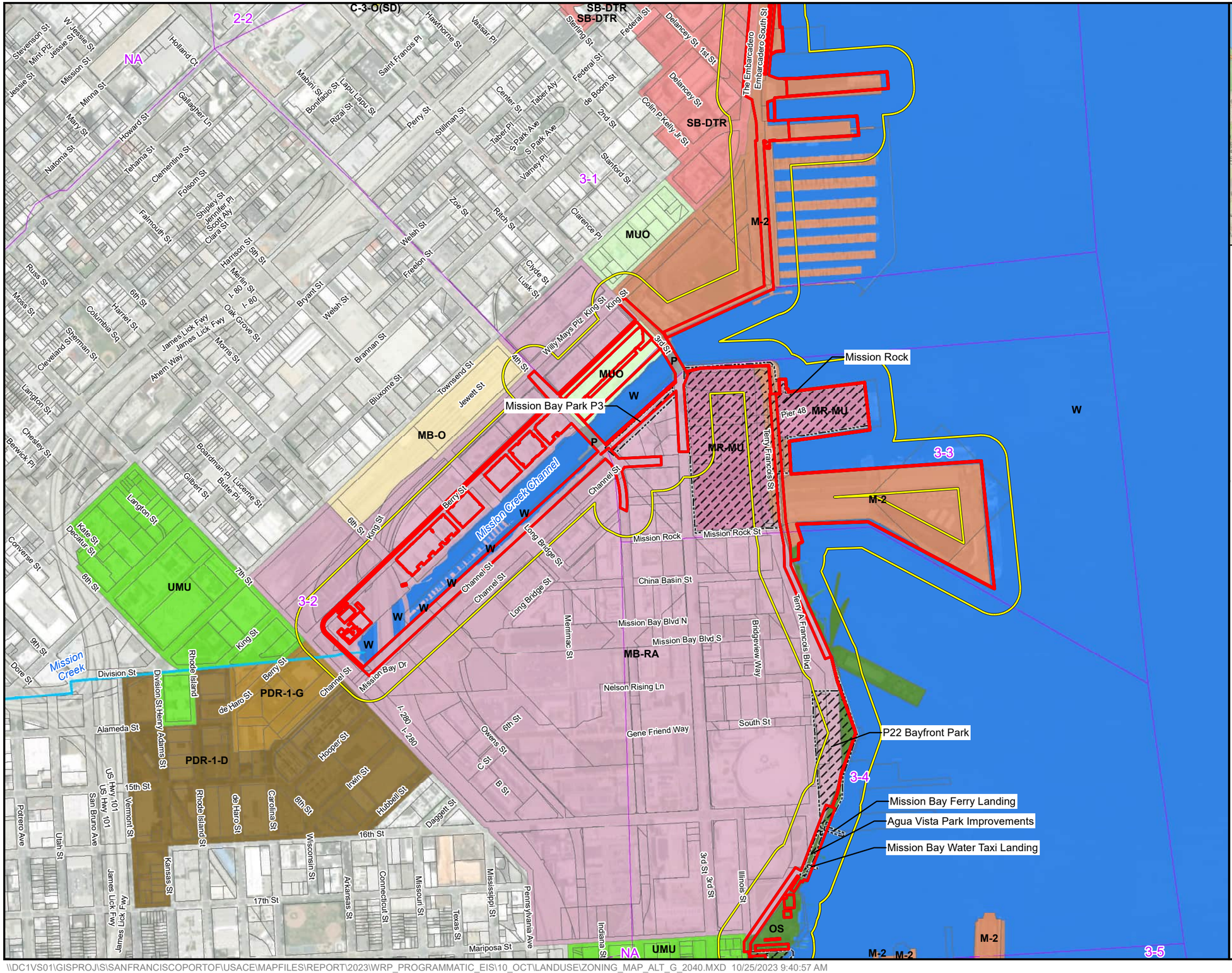
USACE and Port of San Francisco
San Francisco County, California

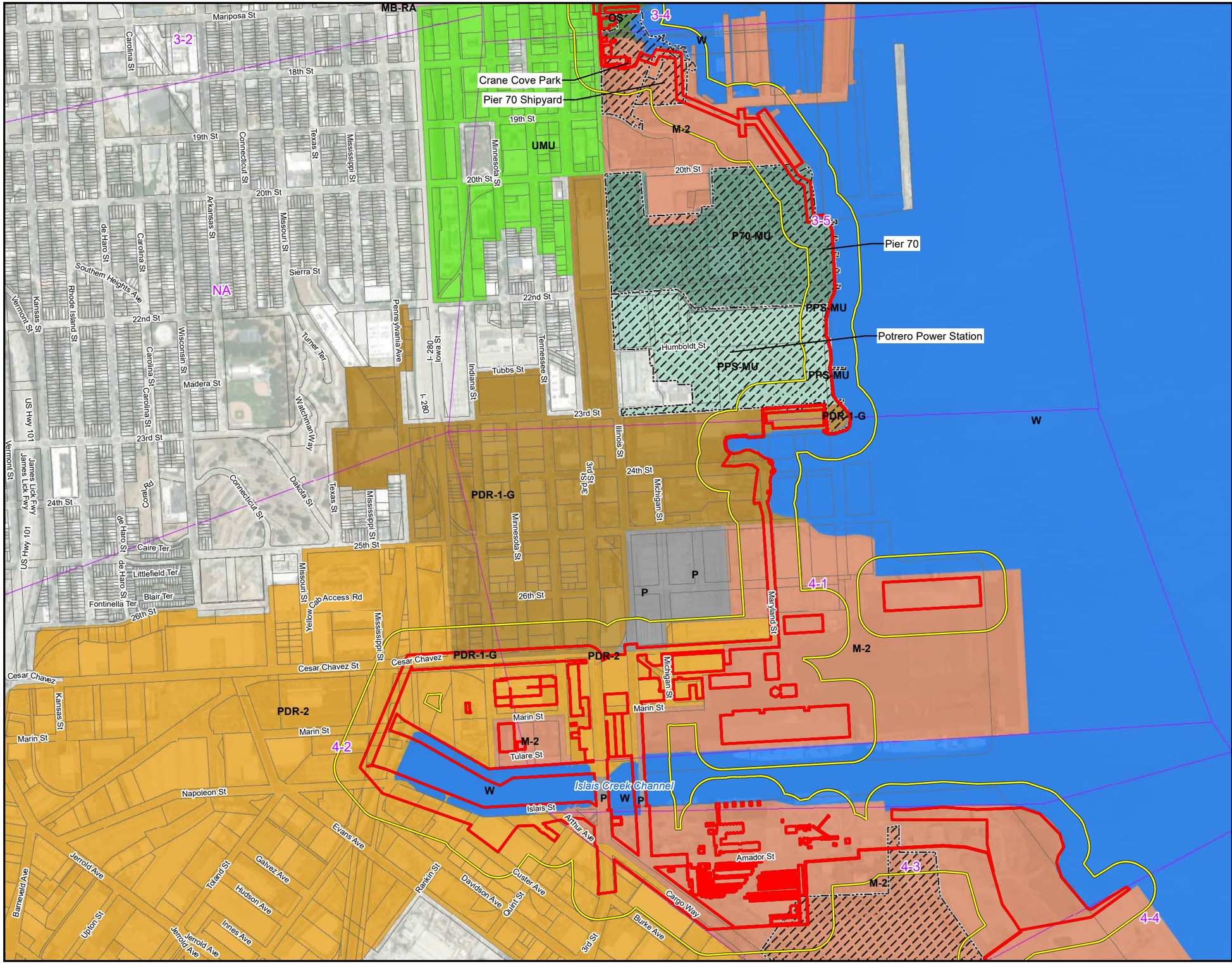
US Army Corps of Engineers
San Francisco District

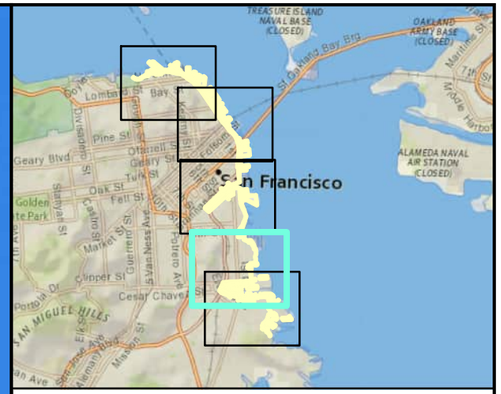
PORT of SAN FRANCISCO

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1-3
RC-4
1-2
W
2-1
M-1
C-2
RC-4
OS
C-2
San Francisco
Ferry Building
W
OS
C-3-O
2-2
C-3-O(SD)
P
C-3-S
OS
M-1
M-1
RH DTR
3-1
M-2
SB-DTR
SB-DTR
NA
Pacific Avenue Mall
The Embarcadero
Pier
Hinckley Walk
Bay Brg
I-80
Embarcadero South St
James Lick Fwy
Don Chee Way
Stewart St
Spear St
Main St
Beale St
Fremont St
Davis St
Front St
Battery St
Sansome St
Montgomery St
Kearny St
Market St
Geary St
Post St
Maiden Ln
Ofarrell St
Ellis St
Eddy St
Turk St
Golden Gate Ave
Fulton St
Grove St
Hayes St
Oak St
Fell St
Page St
Haight St
Waller St
Frederick St
Carl St
Parnassus Ave
Lincoln Way
Irving St
Judah St
Kirkham St
Lawton St
Moraga St
Quintara St
Rivera St
Sunset Blvd
Ortega St
Pacheco St
Taraval St
Wawona St
Vicente St
Wilder St
Yorba St
Lomita Ave
Santiago St
Ulloa St
Randolph St
Rockaway Beach Ave
Great Hwy
Sloat Blvd
Skyline Blvd
Lake Merced Blvd
Lake Merced
Harding Park Golf Course
Fort Funston
Ocean Beach
Pacific Ocean
Golden Gate Park
Presidio
Golden Gate Bridge
Golden Gate
Fort Point
Crissy Field
Marina Green
Fort Mason
Aquatic Park
Alcatraz Island
Alcatraz Island Light
Angel Island
Angel Island State Park
Treasure Island
Treasure Island Naval Base (Closed)
Oakland Army Base (Closed)
Alameda Naval Air Station (Closed)
San Francisco
San Francisco Bay
San Francisco Bay Brg
San Mateo Brg
Oakland Bay Brg
Richmond-San Rafael Brg
Oakland
Alameda
Berkeley
Emeryville
Richmond
San Rafael
Sausalito
Tiburon
Belvedere
Mill Valley
Corte Madera
Larkspur
Ross
San Anselmo
Fairfax
San Quentin
Point San Pedro
Point Bonita
Point Diablo
Point Blunt
Point Stuart
Point Knox
Point Richmond
Point Pinole
Point Molate
Point Isabel
Point Emery
Point Orient
Point Potrero


C-3-O(SD)
SB-DTR
SB-DTR
2-2
NA
3-1
M-2
MUO
MUO
W
P
MB-O
MR-MU
MR-MU
3-3
M-2
Mission Rock
Mission Bay Park P3
Pier 48
Terry Francois St
Mission Rock
Mission Rock St
Mission Creek Channel
W
W
W
W
W
3-2
UMU
MB-RA
PDR-1-G
PDR-1-D
3-4
P22 Bayfront Park
Mission Bay Ferry Landing
Agua Vista Park Improvements
Mission Bay Water Taxi Landing
OS
NA
UMU
M-2
M-2
M-2
3-5
The Embarcadero
Embarcadero South St
Delancey St
1st St
Federal St
Colin P Kelly Jr St
Stanford St
Clarence Pl
Zoe St
Rich St
Welsh St
Freelon St
Clyde St
Lusk St
Willy Mays Plz
King St
3rd St
4th St
Townsend St
Jewett St
Bluxome St
Brannan St
Bryant St
Welsh St
Harrison St
5th St
Merlin St
I- 80
Oak Grove St
James Lick Fwy
Morris St
Ahern Way
Harriet St
Columbia Sq
Sherman St
Cleveland St
Moss St
Russ St
Natoma St
Tehama St
Clementina St
Folsom St
Howard St
Mary St
Minna St
Mission St
Jessie St
Stevenson St
Mint Plz
W Jessie St
Holland Ct
Gallagher Ln
Shipley St
Jennifer Pl
Scott Alley
Clara St
Falmouth St
Hawthorne St
Vassar Pl
Saint Francis Pl
Mabini St
Bonifacio St
Lapu Lapu St
Rizal St
Perry St
Stillman St
Center St
Taber Pl
Taber Alley
S Park Ave
S Park Ave
Varney Pl
Sterling St
Federal St
de Boom St
2nd St
Delancey St
Channel St
Berry St
6th St
King St
Long Bridge St
China Basin St
Mission Bay Blvd N
Mission Bay Blvd S
Mission Bay Dr
Merrimac St
Bridgeview Way
Terry A Francois Blvd
Nelson Rising Ln
Gene Friend Way
South St
3rd St
Illinois St
Owens St
6th St
C St
B St
I- 280
I- 280
Division St
Henry Adams St
Rhode Island
de Haro St
Alameda St
Hooper St
Irwin St
Hubbell St
Daggett St
15th St
16th St
17th St
Wisconsin St
Arkansas St
Connecticut St
Missouri St
Texas St
Mississippi St
Pennsylvania Ave
Mariposa St
Indiana St
Carolina St
8th St
Vermont St
Rhode Island St
Kansas St
Potrero Ave
Utah St
San Bruno Ave
US Hwy 101
US Hwy 101
James Lick Fwy
James Lick Fwy
Langton St
Kate St
Decatur St
Converse St
8th St
7th St
9th St
Dore St
Mission Creek
Division St
Berry St
King St
Rhode Island
Channel St
Channel St
Channel St
Long Bridge St
Mission Bay Dr
Mission Rock
Mission Rock St
Terry Francois St
Channel St
Berry St
6th St
King St
Langton St
Gilbert St
Boardman Pl
Lucerne St
Butte Pl
Chesley St
Benwick Pl
Jessie St
Mission St
Minna St
Mary St
Natoma St
Howard St
Gallagher Ln
Folsom St
Clementina St
Tehama St
Falmouth St
Harrison St
5th St
Merlin St
I- 80
Oak Grove St
James Lick Fwy
Morris St
Ahern Way
Harriet St
Columbia Sq
Sherman St
Cleveland St
Moss St
Russ St
Shipley St
Jennifer Pl
Scott Alley
Clara St
Zoe St
Rich St
Welsh St
Freelon St
Clyde St
Lusk St
Willy Mays Plz
King St
3rd St
4th St
Townsend St
Jewett St
Bluxome St
Brannan St
Bryant St
Welsh St
Oak Grove St
James Lick Fwy
Morris St
Ahern Way
Harriet St
Columbia Sq
Sherman St
Cleveland St
Moss St
Russ St
Natoma St
Tehama St
Clementina St
Folsom St
Howard St
Mary St
Minna St
Mission St
Jessie St
Stevenson St
Mint Plz
W Jessie St
Holland Ct
Gallagher Ln
Hawthorne St
Vassar Pl
Saint Francis Pl
Mabini St
Bonifacio St
Lapu Lapu St
Rizal St
Perry St
Stillman St
Center St
Taber Pl
Taber Alley
S Park Ave
S Park Ave
Varney Pl
Sterling St
Federal St
de Boom St
2nd St
Delancey St
Colin P Kelly Jr St
Stanford St
Clarence Pl
Zoe St
Rich St
Welsh St
Freelon St
Clyde St
Lusk St
Willy Mays Plz
King St
3rd St
4th St
Townsend St
Jewett St
Bluxome St
Brannan St
Bryant St
Welsh St
Harrison St
5th St
Merlin St
I- 80





LEGEND

Alternative G 2040
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Mission Bay Redevelopment, MB-RA
- Urban Mixed Use, UMU
- Potrero Power Station Mixed Use, PPS-MU
- Pier70 Mixed Use, P70-MU

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-8D LANDUSE

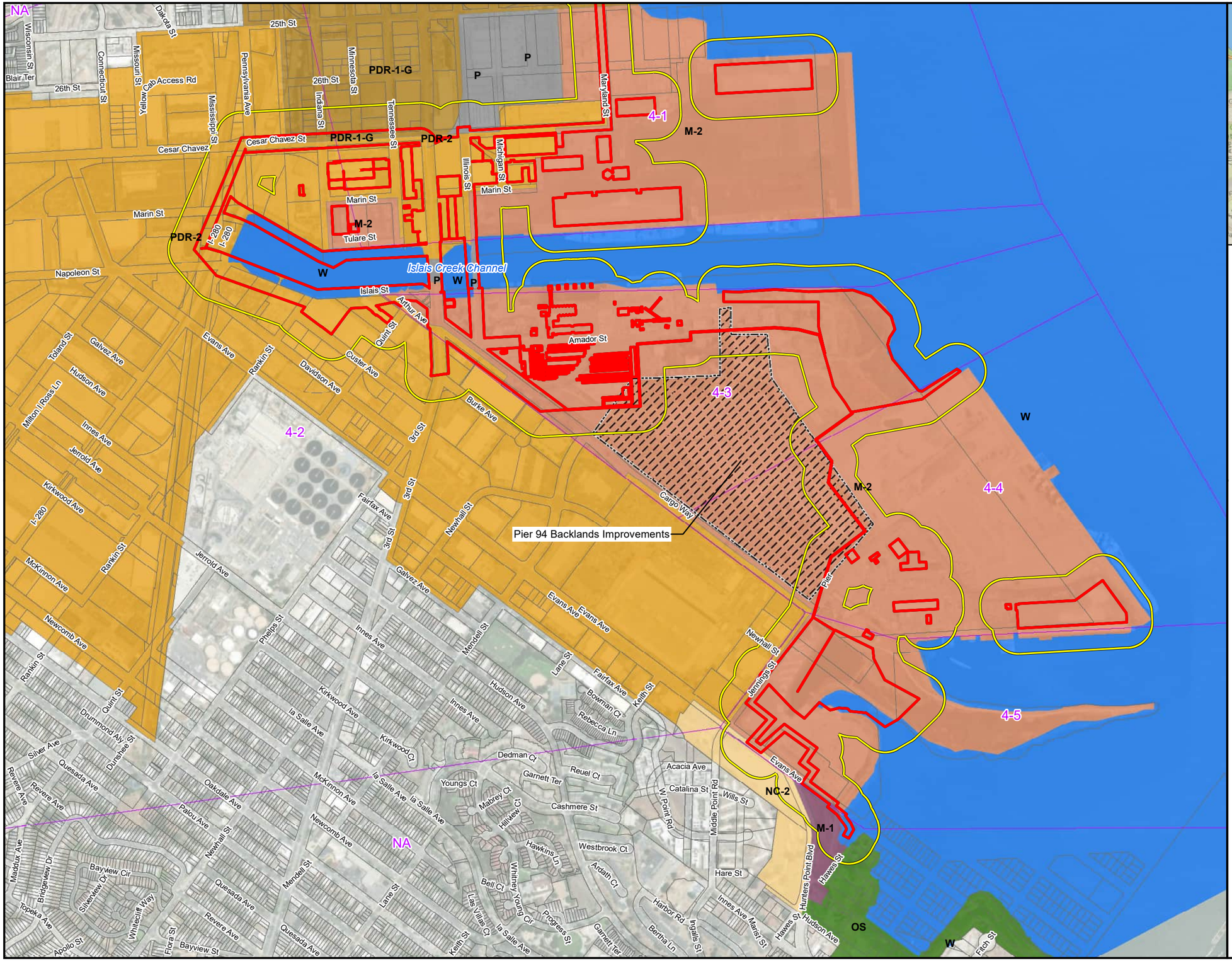
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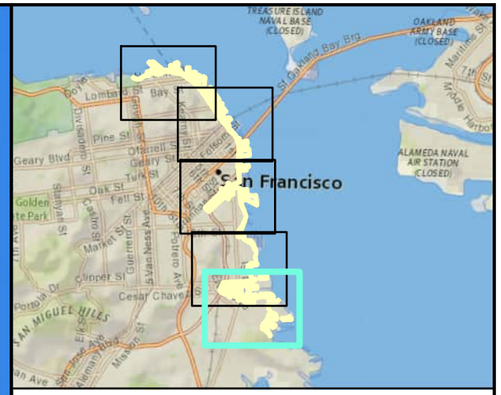
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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LEGEND

Alternative G 2040
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Neighborhood Commercial Small Scale, NC-2
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2
- Light Industrial, M-1

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-8E
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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Alternative G 2090



LEGEND

Alternative G 2090
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Parcels

Commercial Land
- Community Business, C-2

Industrial Land
- Light Industrial, M-1

Mixed Use Land
- Residential Commercial High Density, RC-4

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

FIGURE LU-9A
LANDUSE

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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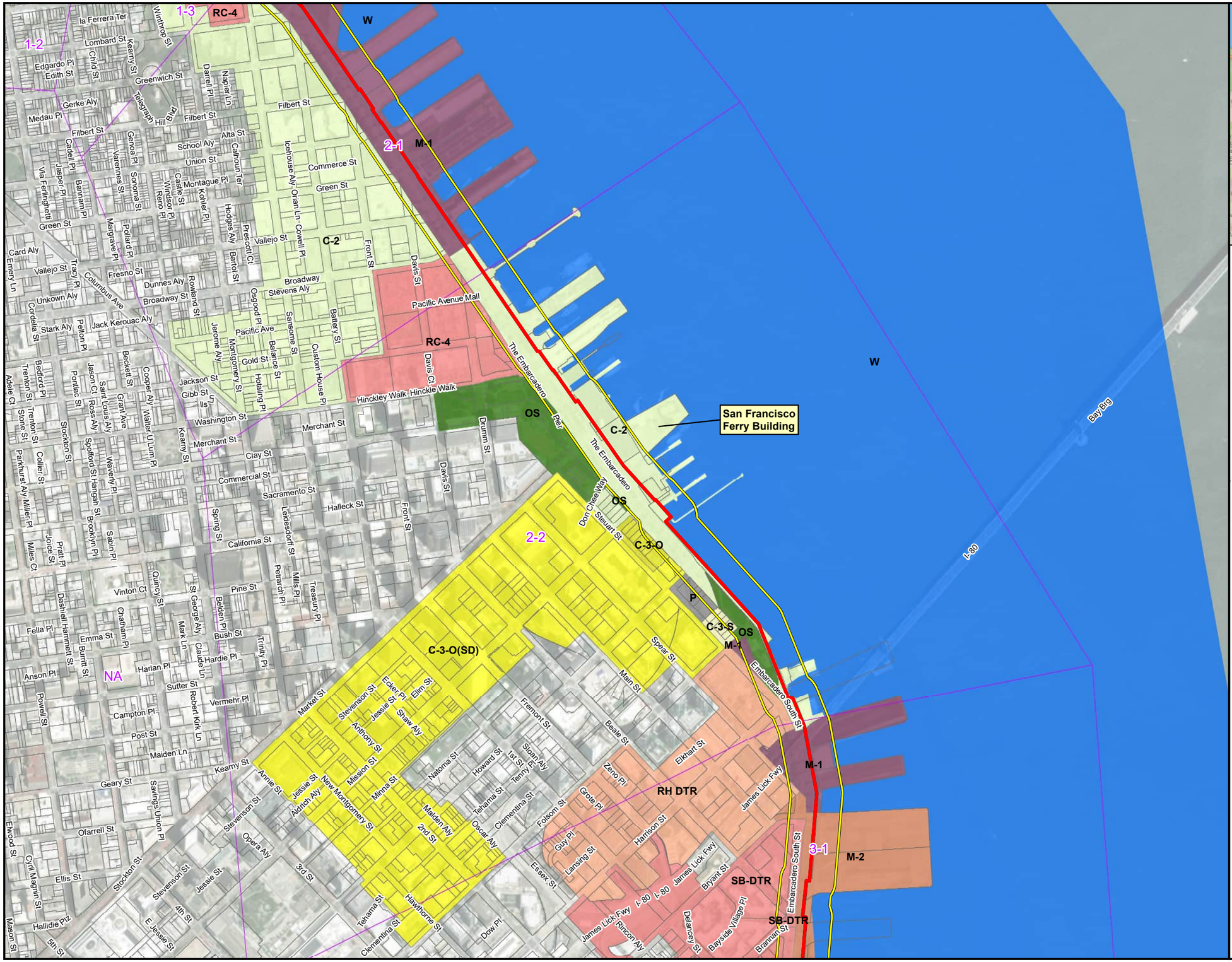


FIGURE LU-9B
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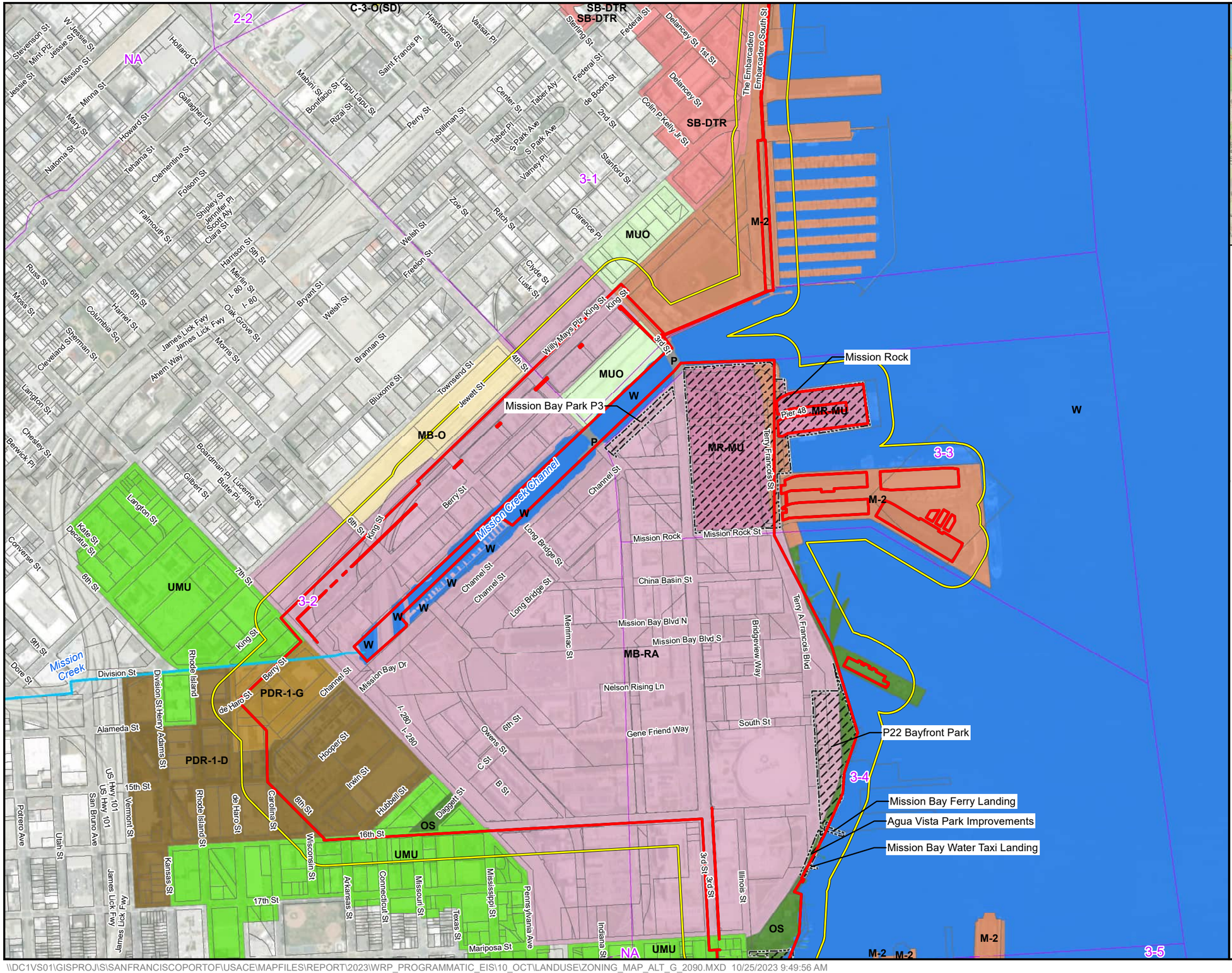
USACE and Port of San Francisco

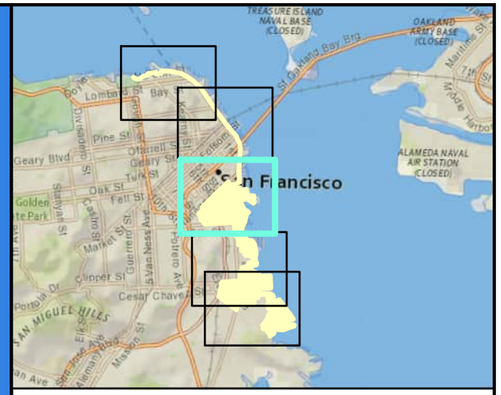
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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LEGEND

Alternative G 2090
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Downtown Office (Specail Development), C-3-O(SD)
- Mission Bay Office Distrcit, MB-O
- Production Distribution and Repair - General, PDR-1-G
- Production Distribution and Repair - Design, PDR-1-D

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Mission Bay Redevelopment, MB-RA
- Mission Rock Mixed Use, MR-MU
- Mixed Use Office, MUO
- Urban Mixed Use, UMU

Open Space
- Open Space, OS

Public Land
- Public, P

Residential Land
- South Beach Downtown Residential, SB-DTR

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-9C
LANDUSE

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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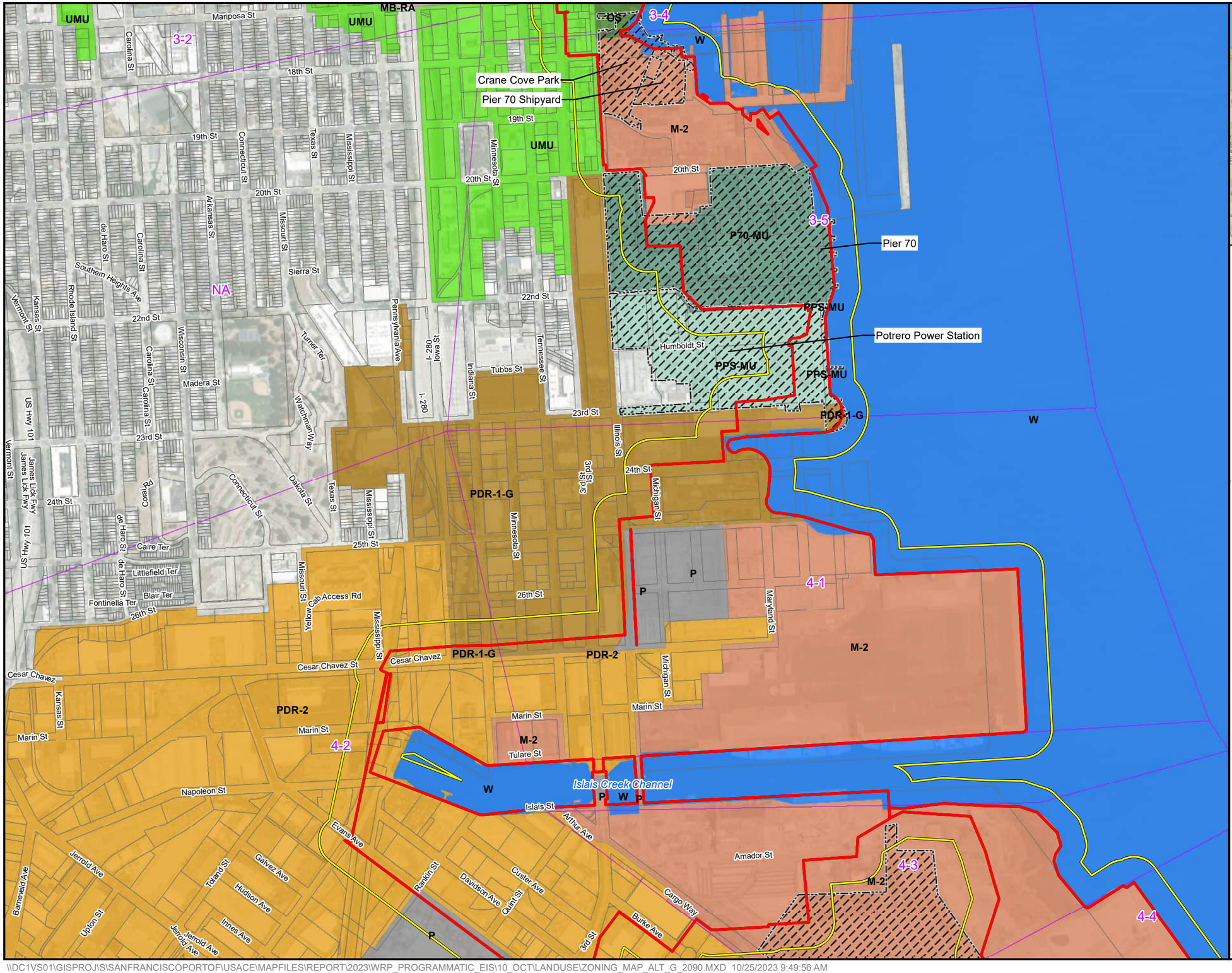


FIGURE LU-9D
LANDUSE

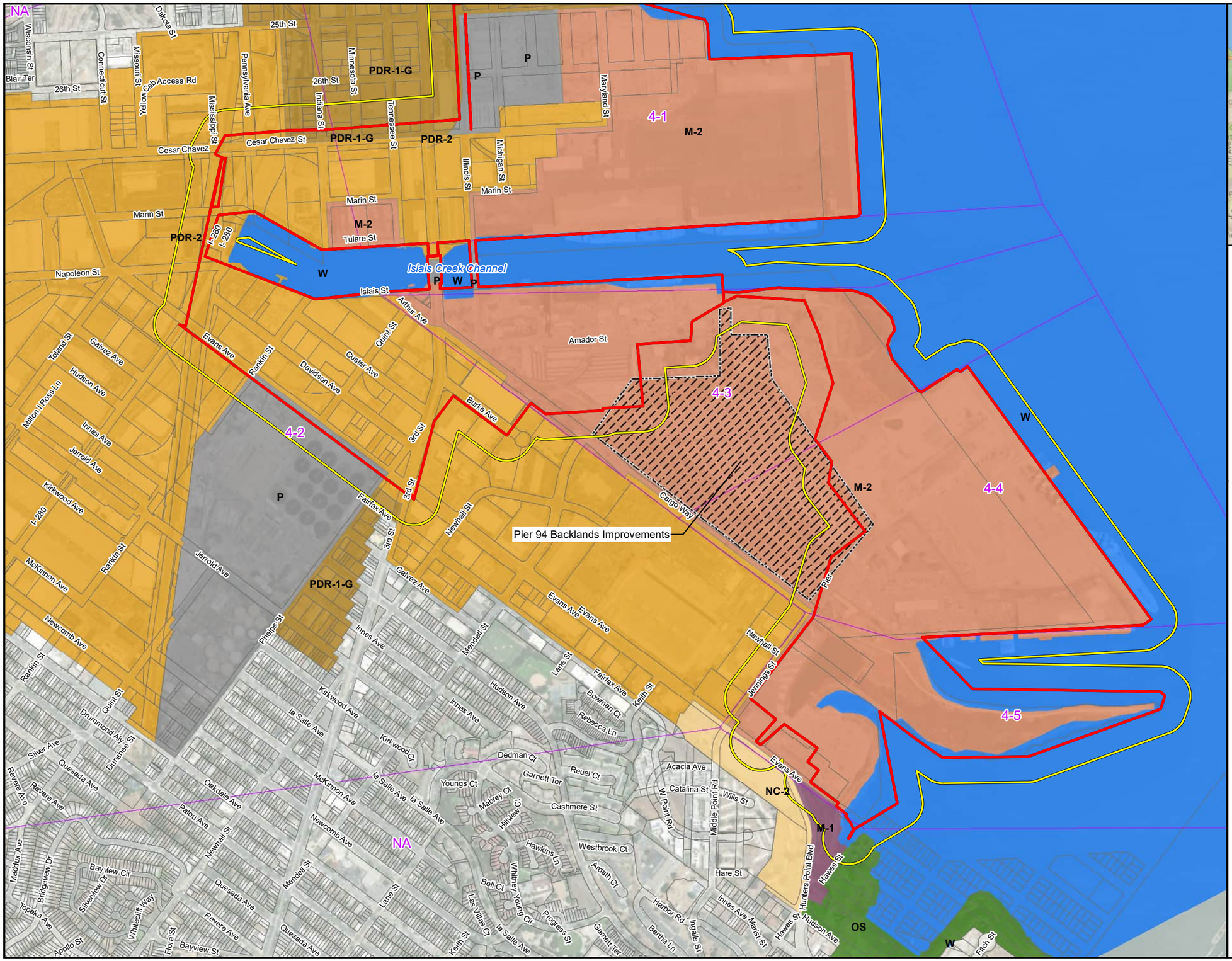
USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

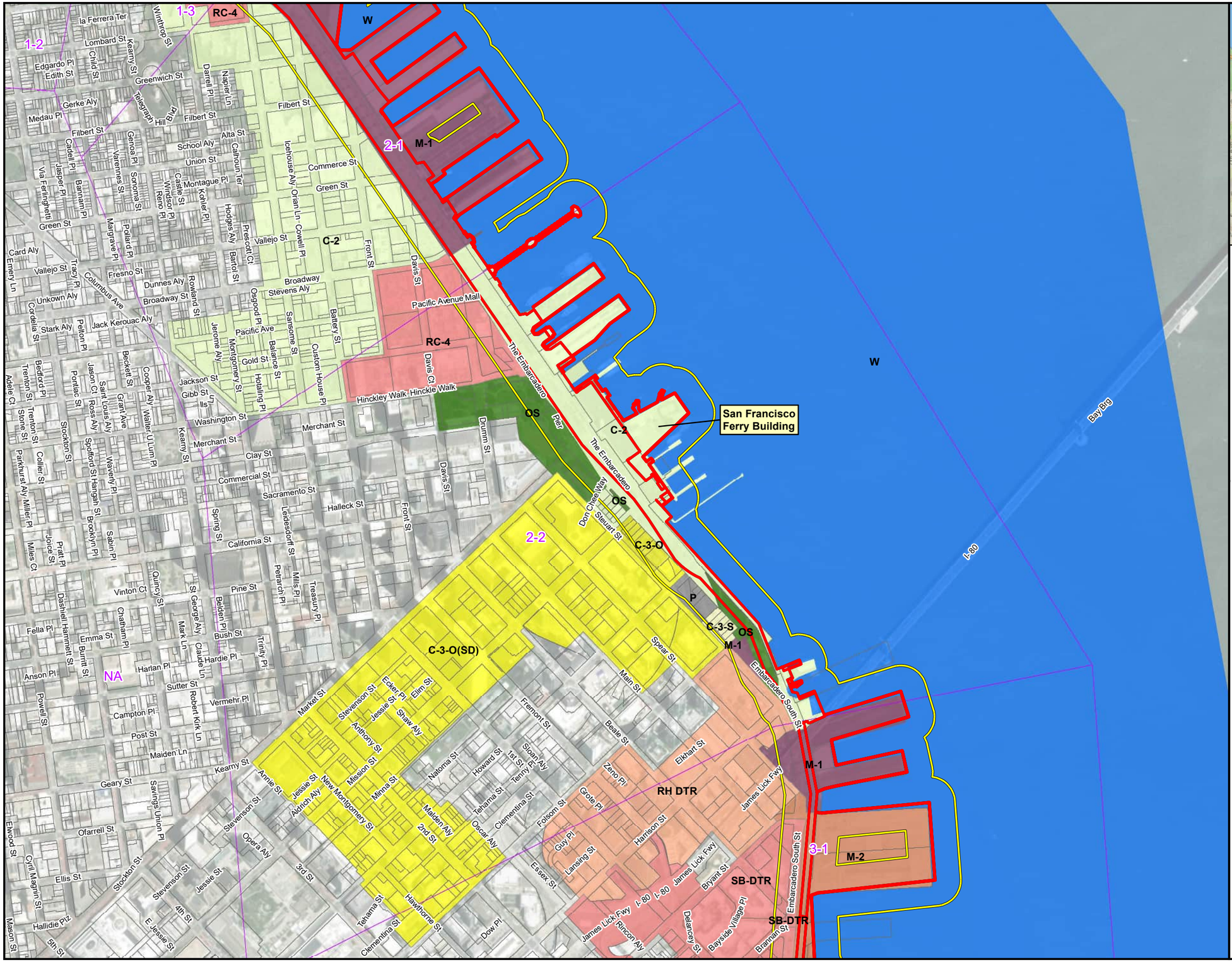
PORT OF SAN FRANCISCO

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NA
Islais Creek Channel
Pier 94 Backlands Improvements
4-1
4-2
4-3
4-4
4-5
PDR-1-G
PDR-2
M-2
P
W
NC-2
M-1
OS
NA
25th St
26th St
Cesar Chavez
Cesar Chavez St
Marin St
Tulare St
Islais St
Amador St
Arthur Ave
Evans Ave
Cargo Way
Pier
Jennings St
Newhall St
3rd St
Fairfax Ave
Galvez Ave
Innes Ave
Jerrold Ave
Kirkwood Ave
McKinnon Ave
Newcomb Ave
Quesada Ave
Revere Ave
Palou Ave
Oakdale Ave
Hudson Ave
Burke Ave
Custer Ave
Quint St
Rankin St
Davidson Ave
Mendell St
Lane St
Phelps St
Keith St
Hawes St
Hunters Point Blvd
Middle Point Rd
W Point Rd
Wills St
Catalina St
Acacia Ave
Hare St
Harbor Rd
Innes Ave
Hudson Ave
Fitch St
Napoleon St
Toland St
Galvez Ave
Hudson Ave
Innes Ave
Jerrold Ave
Kirkwood Ave
McKinnon Ave
Newcomb Ave
Quesada Ave
Revere Ave
Palou Ave
Oakdale Ave
Bayview Cir
Bayview St
Apollo St
Topeka Ave
Whitecliff Way
Silverview Dr
Bridgeview Dr
Maddux Ave
Milton I Ross Ln
Silver Ave
Drummond Alley St
Dunshee St
Ia Salle Ave
Youngs Ct
Dedman Ct
Garnett Ter
Reuel Ct
Cashmere St
Mabrey Ct
Hillview Ct
Whitney Young Cir
Bell Ct
Las Villas Ct
Progress St
Hawkins Ln
Westbrook Ct
Ardath Ct
Bertha Ln
Ingalis St
Bowman Ct
Rebecca Ln
Lane St
Mendell St
Fairfax Ave
Keith St
Jennings St
Hawes St
Hunters Point Blvd
Middle Point Rd
W Point Rd
Wills St
Catalina St
Acacia Ave
Hare St
Harbor Rd
Innes Ave
Hudson Ave
Fitch St
Marist St
Evans Ave
Evans Ave
Evans Ave

TNBP 1st Action


1-1
1-2
1-3
2-1
2-2
NA
W
OS
C-2
RC-4
M-1
Fisherman's Wharf
Jones St
Tonquin St
Jefferson St
Embarcadero North St
McDowell Ave
Beach St
N Point St
Grant Ave
Kearny St
Francisco St
Bay St
Bergen Aly
Schofield Rd
Funston Rd
Van Ness Ave
Pope Rd
Fort Mason 10
Fort Mason 11
Macarthur Ave
N View Ct
Culebra Ter
Chestnut St
Lombard St
Hyde St
Leavenworth St
Jones St
Taylor St
Jansen St
Mason St
Scotland St
Powell St
Stockton St
Columbus Ave
Telegraph Hill Blvd
Filbert St
Greenwich St
Valparaiso St
Redfield Aly
Kent St
Union St
Macondray Ln
Green St
Vallejo St
Broadway
Broadway St
Pacific Ave
Jack Kerouac Aly
Stark Aly
Unkown Aly
Fallon Pl
Water St
Houston St
Chestnut St
Fielding St
Tuscany Aly
Edgardo Pl
Edith St
Child St
Winthrop St
Ia Ferrera Ter
Pfeiffer St
Bellair Pl
Vandewater St
Worden St
Midway St
Venard Aly
Newell St
Brant Aly
Via Bufano
Medau Pl
Gerke Aly
Genoa Pl
Sonoma St
Varennes St
Jasper Pl
Cadell Pl
Via Ferlinghetti
Grant Ave
Barnam Pl
Castle St
Montague Pl
Kohler Pl
Windsor Pl
Reno Pl
Montgomery St
Hodges Aly
Bartol St
Prescott Ct
Vallejo St
Sansome St
Icehouse Aly
Orian Ln
Cowell Pl
Commerce St
Green St
Battery St
Front St
Davis St
Pacific Avenue Mall
Stevens Aly
Osgood Pl
Broadway
Rowland St
Jerome Aly
Gold St
Balance St
Custom House Pl
Hidalgo Pl
Drumm St
Davis Ct
Washington St
Hinckle Walk
Filbert St
Darrell Pl
Napier Ln
Calhoun Ter
School Aly
Alta St
Tracy Pl
Fresno St
Dunnes Aly
Margrave Pl
Pollard Pl
Kearny St
Eaton Pl
August Aly
Webb Pl
Winter Pl
Allen St
Hastings Ter
Havens St
Warner Pl
Sharp Pl
Hamlin St
Delgado Pl
Eastman Pl
Moore Pl
Black Pl
Marion Pl
Larkin St
Polk St
Grenard Ter
Van Ness Ave
Imperial Ave
Gough St
Octavia St
Franklin St
Lombard St
US Hwy 101
US Hwy 101 Bus
Lurmont Ter
Greenwich Ct
Montclair Ter
Culebra Ter
Bonita St
White St
Florence St
Russian Hill Pl
Alta Vista Ter
Emery Ln
Tuck Murphy Ln
Cordelia St
Peiton Pl
Beckett St
Cooper Aly
Jackson St
Gibb St
Ills
Pontiac St
Ross Aly
Bedford Pl
Trenton St
Stone St
Adele Ct
Auburn St
Salmon St
Himmelmann Pl
Robert C Levy Tunl
Broadway Broadway St
Morrell St
Phoenix Ter
Bernard St
John St
Lynch St
Waldo Aly
Glover St
Valparaiso St
Greenwich St
Jones St
Hyde St
Leavenworth St
Montclair Ter
Culebra Ter
Francisco St
Chestnut St
Lombard St
Filbert St
Green St
Vallejo St
Broadway
Pacific Ave
Jack Kerouac Aly
Broadway St
Washington St
Hinckle Walk
Davis St
Drumm St
Davis Ct
Pacific Avenue Mall
Stevens Aly
Osgood Pl
Jerome Aly
Gold St
Balance St
Custom House Pl
Hidalgo Pl
Commerce St
Green St
Battery St
Front St
Sansome St
Icehouse Aly
Orian Ln
Cowell Pl
Vallejo St
Montgomery St
Hodges Aly
Bartol St
Prescott Ct
Kearny St
Fresno St
Dunnes Aly
Rowland St
Broadway
Tracy Pl
Margrave Pl
Pollard Pl


1-3
RC-4
1-2
W
2-1
M-1
C-2
RC-4
OS
C-2
San Francisco
Ferry Building
W
OS
C-3-O
2-2
P
C-3-S
OS
M-1
C-3-O(SD)
NA
RH DTR
M-1
3-1
M-2
SB-DTR
SB-DTR
I-80
Bay Brg
Pacific Avenue Mall
The Embarcadero
Pier
Hinckley Walk
Merchant St
Commercial St
Clay St
Sacramento St
Halleck St
California St
Pine St
Bush St
Sutter St
Post St
Geary St
Ofarrell St
Ellis St
Market St
Kearny St
Washington St
Jackson St
Gibb St
Broadway
Vallejo St
Green St
Union St
Filbert St
Greenwich St
Lombard St
Commerce St
Embarcadero South St
Spear St
Main St
Beale St
Fremont St
Davis St
Front St
Battery St
Drumm St
Leidesdorff St
Spring St
Stockton St
Powell St
Mason St
Taylor St
Jones St
Leavenworth St
Hyde St
Larkin St
Polk St
Van Ness Ave
Franklin St
Gough St
Octavia St
Laguna St
Buchanan St
Webster St
Fillmore St
Steiner St
Pierce St
Scott St
Divisadero St
Broderick St
Baker St
Lyon St
Presidio Ave
Walnut St
Locust St
Spruce St
Maple Dr
Presidio Ter
Arguello Blvd
Cherry St
Parker Ave
Collins St
Funston Ave
Palm Ave
Anza St
Cornwall St
Mayfair Dr
Clement St
Geary Blvd
Fulton St
Grove St
Hayes St
Oak St
Fell St
Haight St
Waller St
Page St
Beulah St
Frederick St
Carl St
Cole St
Parnassus Ave
Lincoln Way
Irving St
Judah St
Kirkham St
Lawton St
Ortega St
Pacheco St
Quintara St
Rivera St
Santiago St
Taraval St
Wawona St
Vicente St
Ulloa St
Wilder St
Yorba St
Randolph St
Darien Way
Lake St
Edgewood Ave
Forest Hill Station
Laguna Honda Blvd
Woodside Ave
Portola Dr
Twin Peaks Blvd
Clarendon Ave
Crestlake Dr
Market St
Castro St
Diamond St
Douglass St
Hoffman Ave
Duncan St
Day St
26th St
24th St
Cesar Chavez St
Valencia St
Guerrero St
Dolores St
San Jose Ave
Alabama St
Florida St
Harrison St
Bryant St
Brannan St
Townsend St
King St
Berry St
3rd St
4th St
5th St
Embarcadero
Don Chee Way
Stewart St
Folsom St
Howard St
Mission St
Natoma St
Minna St
Tehama St
Clementina St
Harrison St
Bryant St
Brannan St
Townsend St
Zeno Pl
Grote Pl
Guy Pl
Lansing St
Essex St
Dow Pl
Bayside Village Pl
Delancey St
Rincon Alley
James Lick Fwy
Elkhart St
Sloan Alley
1st St
Tenny Pl
Aldrich Alley
New Montgomery St
Opera Alley
Annie St
Jessie St
Ecker Pl
Elim St
Shaw Alley
Anthony St
Stevenson St
Maiden Alley
2nd St
Oscar Alley
Clementina St
Folsom St
Harrison St
Bryant St
Brannan St
Townsend St
Embarcadero South St
Jessie St
Stevenson St
Ellis St
Ofarrell St
Geary St
Post St
Sutter St
Bush St
Pine St
California St
Sacramento St
Clay St
Washington St
Jackson St
Broadway
Vallejo St
Green St
Union St
Filbert St
Greenwich St
Lombard St
Commerce St
Embarcadero South St
Spear St
Main St
Beale St
Fremont St
Davis St
Front St
Battery St
Drumm St
Leidesdorff St
Spring St
Stockton St
Powell St
Mason St
Taylor St
Jones St
Leavenworth St
Hyde St
Larkin St
Polk St
Van Ness Ave
Franklin St
Gough St
Octavia St
Laguna St
Buchanan St
Webster St
Fillmore St
Steiner St
Pierce St
Scott St
Divisadero St
Broderick St
Baker St
Lyon St
Presidio Ave
Walnut St
Locust St
Spruce St
Maple Dr
Presidio Ter
Arguello Blvd
Cherry St
Parker Ave
Collins St
Funston Ave
Palm Ave
Anza St
Cornwall St
Mayfair Dr
Clement St
Geary Blvd
Fulton St
Grove St
Hayes St
Oak St
Fell St
Haight St
Waller St
Page St
Beulah St
Frederick St
Carl St
Cole St
Parnassus Ave
Lincoln Way
Irving St
Judah St
Kirkham St
Lawton St
Ortega St
Pacheco St
Quintara St
Rivera St
Santiago St
Taraval St
Wawona St
Vicente St
Ulloa St
Wilder St
Yorba St
Randolph St
Darien Way
Lake St
Edgewood Ave
Forest Hill Station
Laguna Honda Blvd
Woodside Ave
Portola Dr
Twin Peaks Blvd
Clarendon Ave
Crestlake Dr
Market St
Castro St
Diamond St
Douglass St
Hoffman Ave
Duncan St
Day St
26th St
24th St
Cesar Chavez St
Valencia St
Guerrero St
Dolores St
San Jose Ave
Alabama St
Florida St
Harrison St
Bryant St
Brannan St
Townsend St
King St
Berry St
3rd St
4th St
5th St
Embarcadero
Don Chee Way
Stewart St
Folsom St
Howard St
Mission St
Natoma St
Minna St
Tehama St
Clementina St
Harrison St
Bryant St
Brannan St
Townsend St
Zeno Pl
Grote Pl
Guy Pl
Lansing St
Essex St
Dow Pl
Bayside Village Pl
Delancey St
Rincon Alley
James Lick Fwy
Elkhart St
Sloan Alley
1st St
Tenny Pl
Aldrich Alley
New Montgomery St
Opera Alley
Annie St
Jessie St
Ecker Pl
Elim St
Shaw Alley
Anthony St
Stevenson St
Maiden Alley
2nd St
Oscar Alley
Clementina St
Folsom St
Harrison St
Bryant St
Brannan St
Townsend St
Embarcadero South St
Jessie St
Stevenson St
Ellis St
Ofarrell St
Geary St
Post St
Sutter St
Bush St
Pine St
California St
Sacramento St
Clay St
Washington St
Jackson St
Gibb

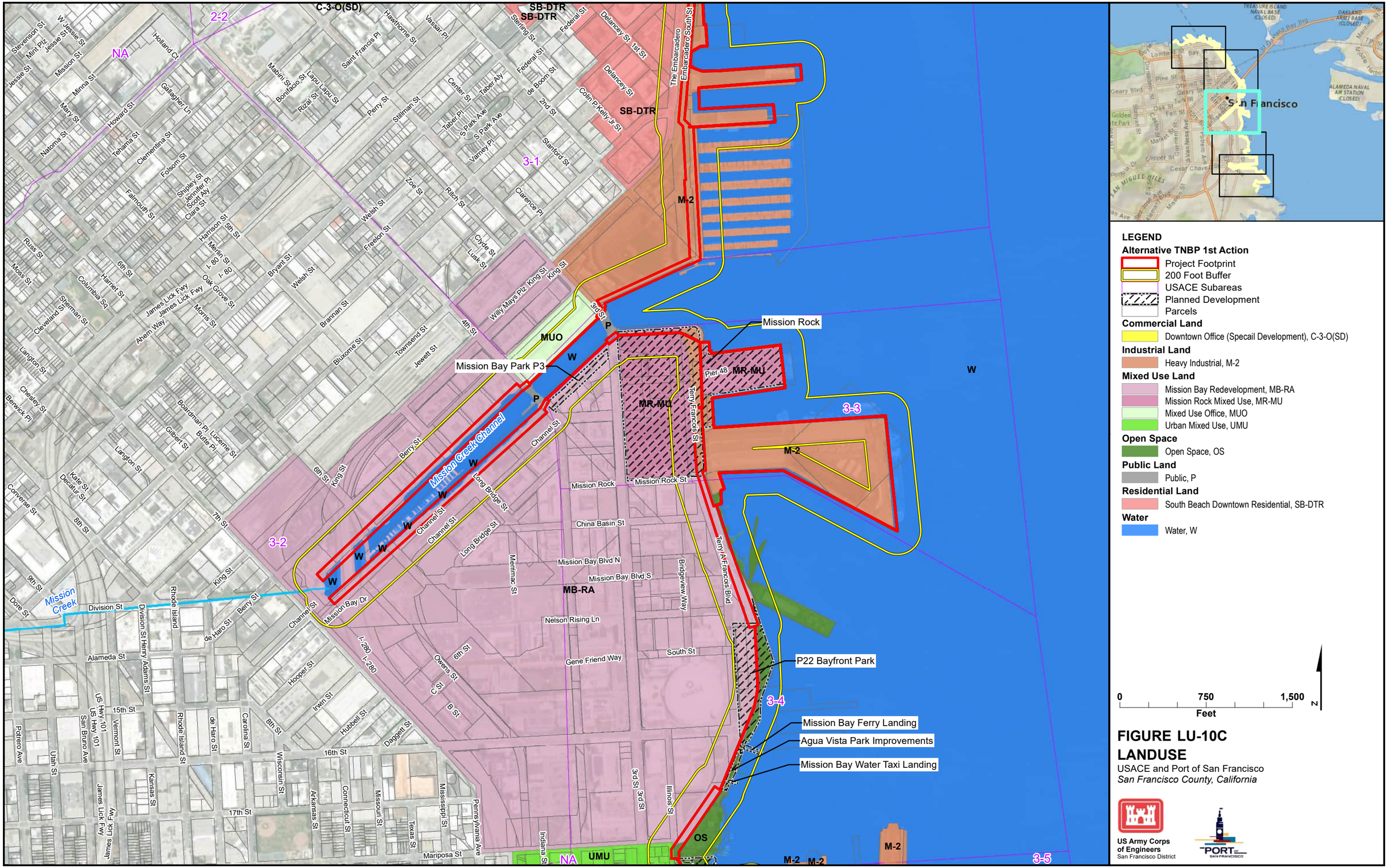


FIGURE LU-10C
LANDUSE

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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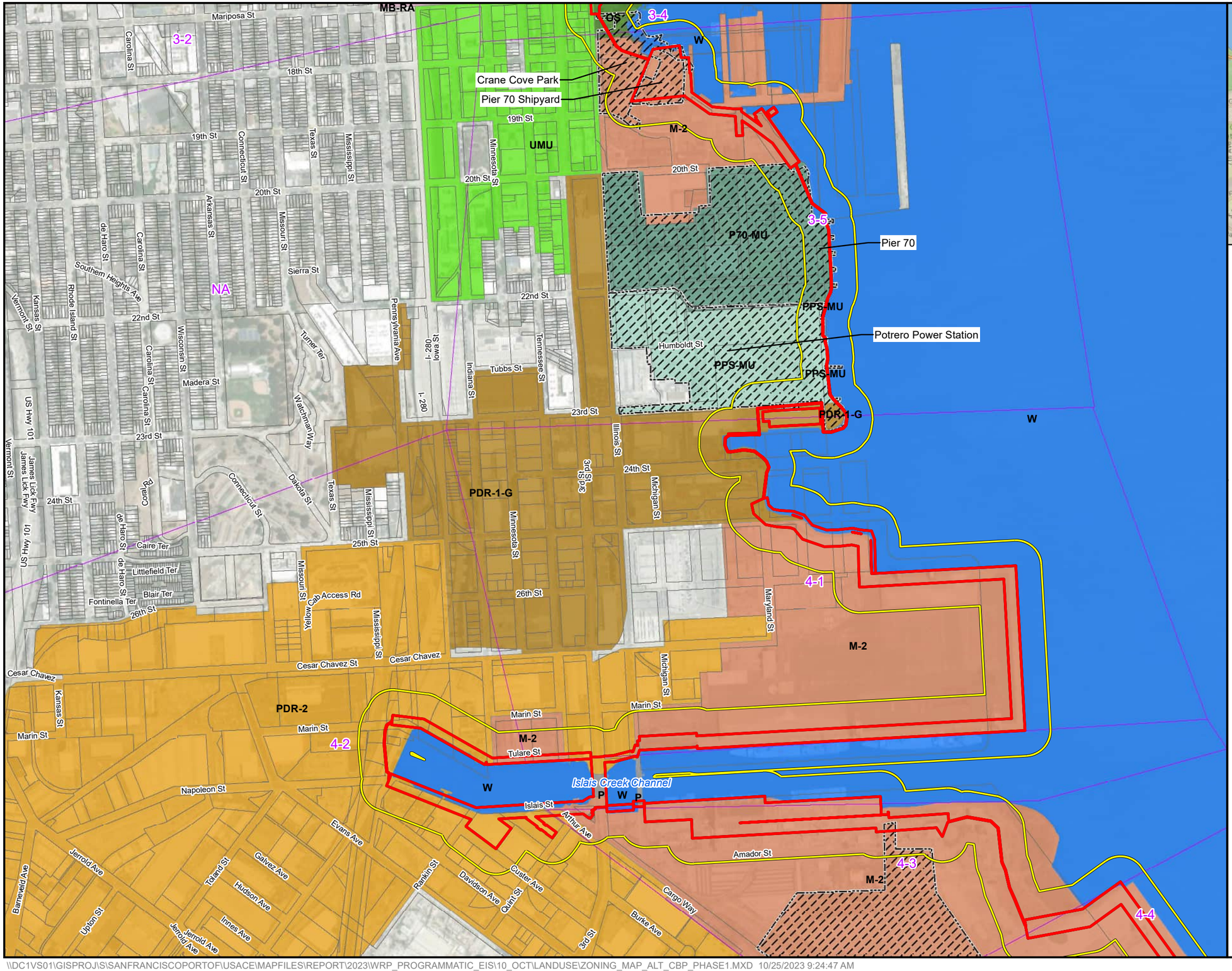


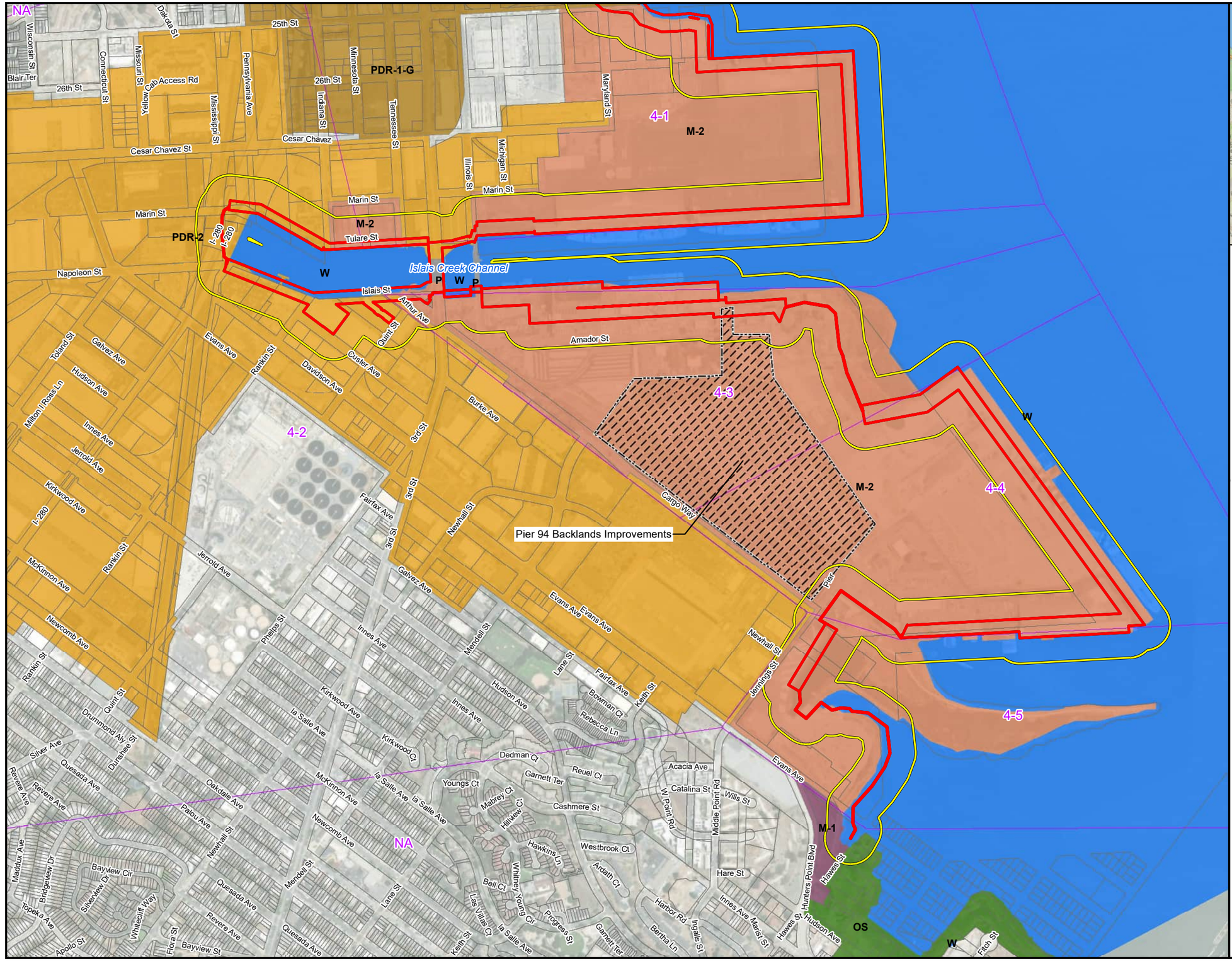
FIGURE LU-10D
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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LEGEND

Alternative TNBP 1st Action
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2
- Light Industrial, M-1

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-10E
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

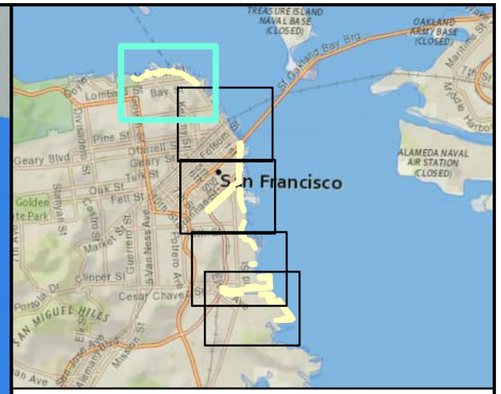
US Army Corps of Engineers
San Francisco District

PORT SAN FRANCISCO

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TNBP 2nd Action





LEGEND

Alternative TNBP 2nd Action
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Parcels

Commercial Land
- Community Business, C-2

Industrial Land
- Light Industrial, M-1

Mixed Use Land
- Residential Commercial High Density, RC-4

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

FIGURE LU-11A
LANDUSE

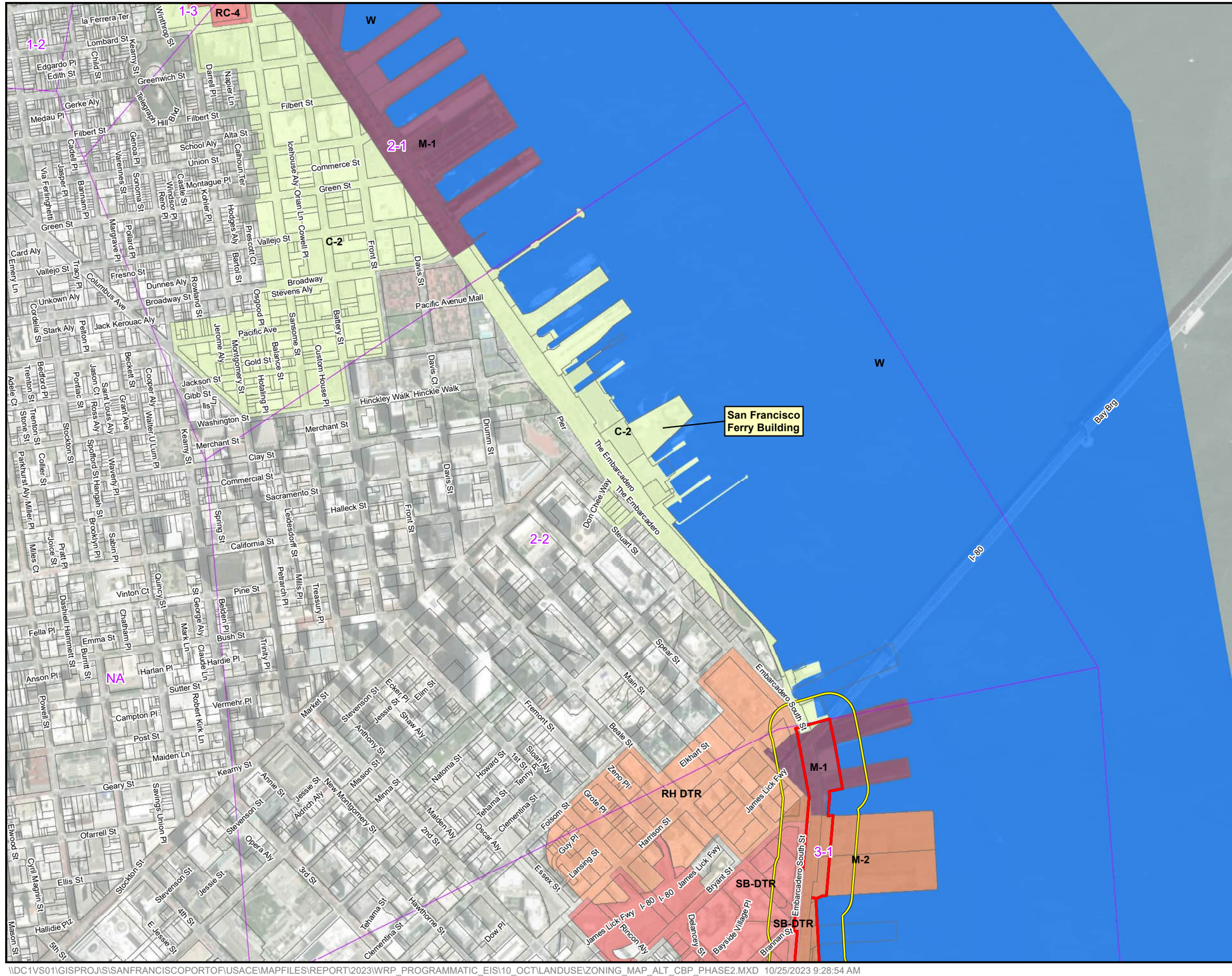
USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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W
1-3
RC-4
1-2
2-1
M-1
C-2
2-2
NA
W
C-2
San Francisco
Ferry Building
RH DTR
M-1
3-1
M-2
SB-DTR
SB-DTR
Bay Brg
I-80
Pacific Avenue Mall
Broadway
Commerce St
Green St
Vallejo St
Filbert St
Union St
Pine St
Bush St
Sutter St
Post St
Geary St
Kearny St
Market St
Front St
Davis St
Battery St
Sansome St
Montgomery St
Jackson St
Washington St
Merchant St
Clay St
Commercial St
Sacramento St
California St
Halleck St
Spear St
Main St
Beale St
Fremont St
Embarcadero South St
The Embarcadero
Don Chee Way
Steuart St
Drumm St
Pier
Hinckley Walk
Davis Ct
Gold St
Balance St
Custom House Pl
Jerome Aly
Osgood Pl
Stevens Aly
Dunnes Aly
Fresno St
Columbus Ave
Tracy Pl
Pollard Pl
Margrave Pl
Varennes St
Genoa Pl
Sonoma St
Castle St
Montague Pl
Korbel Pl
Hodges Aly
Prescott Ct
Bartol St
Icehouse Aly
Orian Ln
Cowell Pl
Calhoun Ter
School Aly
Alta St
Napier Ln
Darrell Pl
Telegraph Hill Blvd
Greenwich St
Lombard St
Edgardo Pl
Edith St
Child St
Kearny St
Winthrop St
la Ferrera Ter
Gerke Aly
Medau Pl
Cadell Pl
Jasper Pl
Via Ferlinghetti
Barnaby Pl
Green St
Card Aly
Emery Ln
Unkown Aly
Cordelia St
Stark Aly
Jack Kerouac Aly
Pelton Pl
Broadway St
Rowland St
Osgood Pl
Pacific Ave
Jerome Aly
Montgomery St
Gold St
Balance St
Sansome St
Battery St
Custom House Pl
Hotaling Pl
Gibb St
Jackson St
Washington St
Merchant St
Clay St
Commercial St
Sacramento St
Halleck St
Spring St
Leidesdorff St
Front St
Davis St
Drumm St
Pier
The Embarcadero
Don Chee Way
Steuart St
Spear St
Main St
Beale St
Fremont St
Embarcadero South St
Elkhart St
Zeno Pl
Grote Pl
Folsom St
Harrison St
Guy Pl
Lansing St
Essex St
Bryant St
James Lick Fwy
Delancey St
Bayside Village Pl
Brannan St
Embarcadero South St
Howard St
1st St
Sloan Aly
Terry Pl
Natoma St
Minna St
Mission St
Anthony St
Ecker Pl
Elim St
Shaw Aly
Stevenson St
Jessie St
Ecker Pl
Elim St
Shaw Aly
Anthony St
Mission St
Minna St
Natoma St
Howard St
1st St
Sloan Aly
Terry Pl
Tehama St
Clementina St
Folsom St
Grote Pl
Zeno Pl
Harrison St
Guy Pl
Lansing St
Essex St
Bryant St
James Lick Fwy
I-80
Embarcadero South St
Maiden Ln
Kearny St
Geary St
Post St
Sutter St
Bush St
Pine St
Vinton Ct
Quincy St
St George Aly
Belden Pl
Petrarch Pl
Mills Pl
Treasury Pl
Fella Pl
Emma St
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Stone St
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Ross Aly
Saint Louis Aly
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Cooper Aly
Walter U Lum Pl
Waverly Pl
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Hangar St
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James Lick Fwy
Delancey St
Bayside Village Pl
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Zeno Pl
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Don Chee Way
Steuart St
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Drumm St
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Front St
Halleck St
Sacramento St
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Clay St
Merchant St
Washington St
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Gibb St
Hinckley Walk
Davis Ct
Gold St
Balance St
Custom House Pl
Jerome Aly
Montgomery St
Hotaling Pl
Osgood Pl
Pacific Ave
Stevens Aly
Broadway St
Broadway
Pacific Avenue Mall
Dunnes Aly
Fresno St
Columbus Ave
Tracy Pl
Pollard Pl
Margrave Pl
Varennes St
Genoa Pl
Sonoma St
Castle St
Montague Pl
Korbel Pl
Hodges Aly
Prescott Ct
Bartol St
Icehouse Aly
Orian Ln
Cowell Pl
Calhoun Ter
School Aly
Alta St
Napier Ln
Darrell Pl
Telegraph Hill Blvd
Greenwich St
Lombard St
Edgardo Pl
Edith St
Child St
Kearny St
Winthrop St
la Ferrera Ter
Gerke Aly
Medau Pl
Cadell Pl
Jasper Pl
Via Ferlinghetti
Barnaby Pl
Green St
Card Aly
Emery Ln
Unkown Aly
Cordelia St
Stark Aly
Jack Kerouac Aly
Pelton Pl
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Rowland St
Filbert St
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Green St
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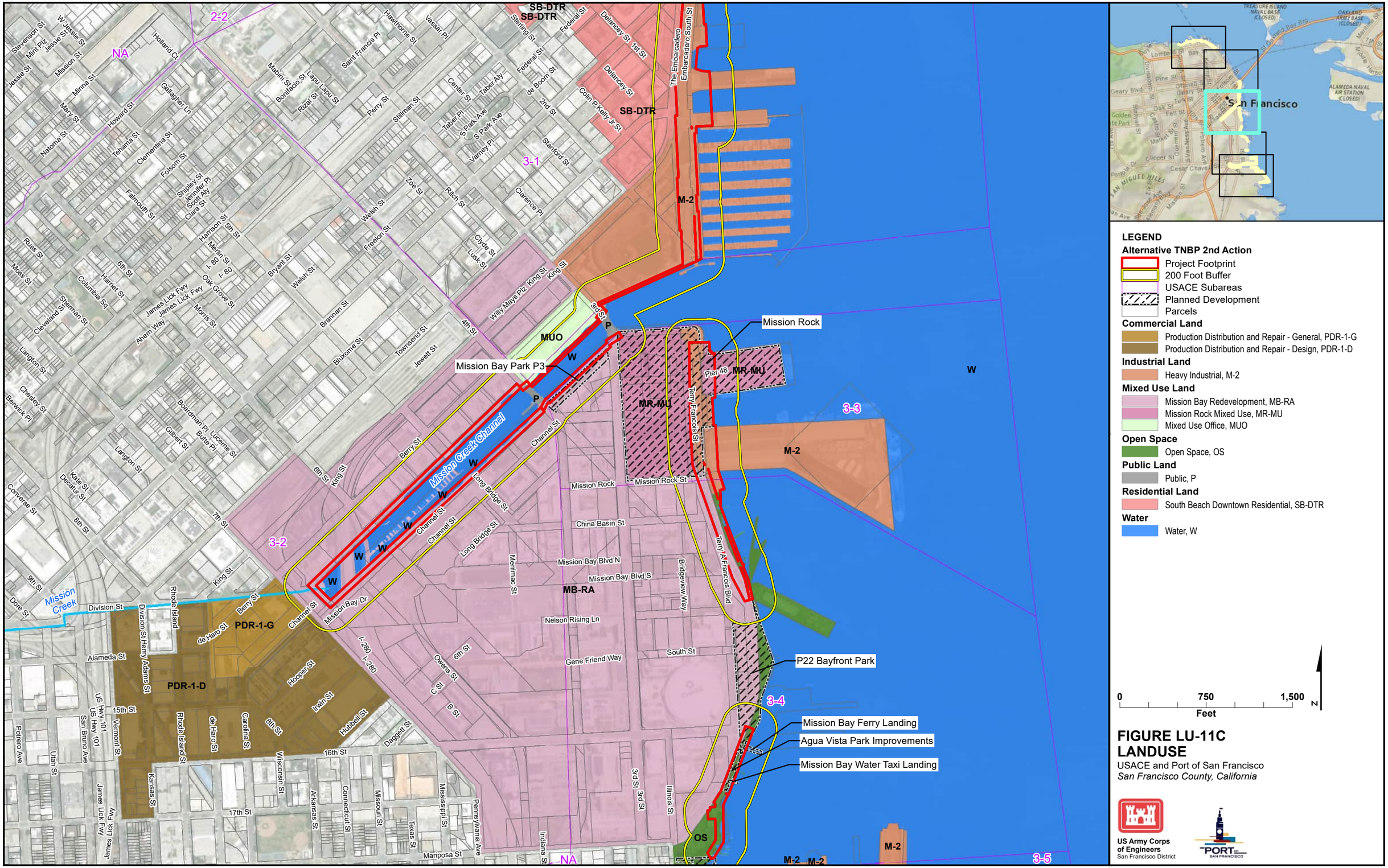


FIGURE LU-11C LANDUSE

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

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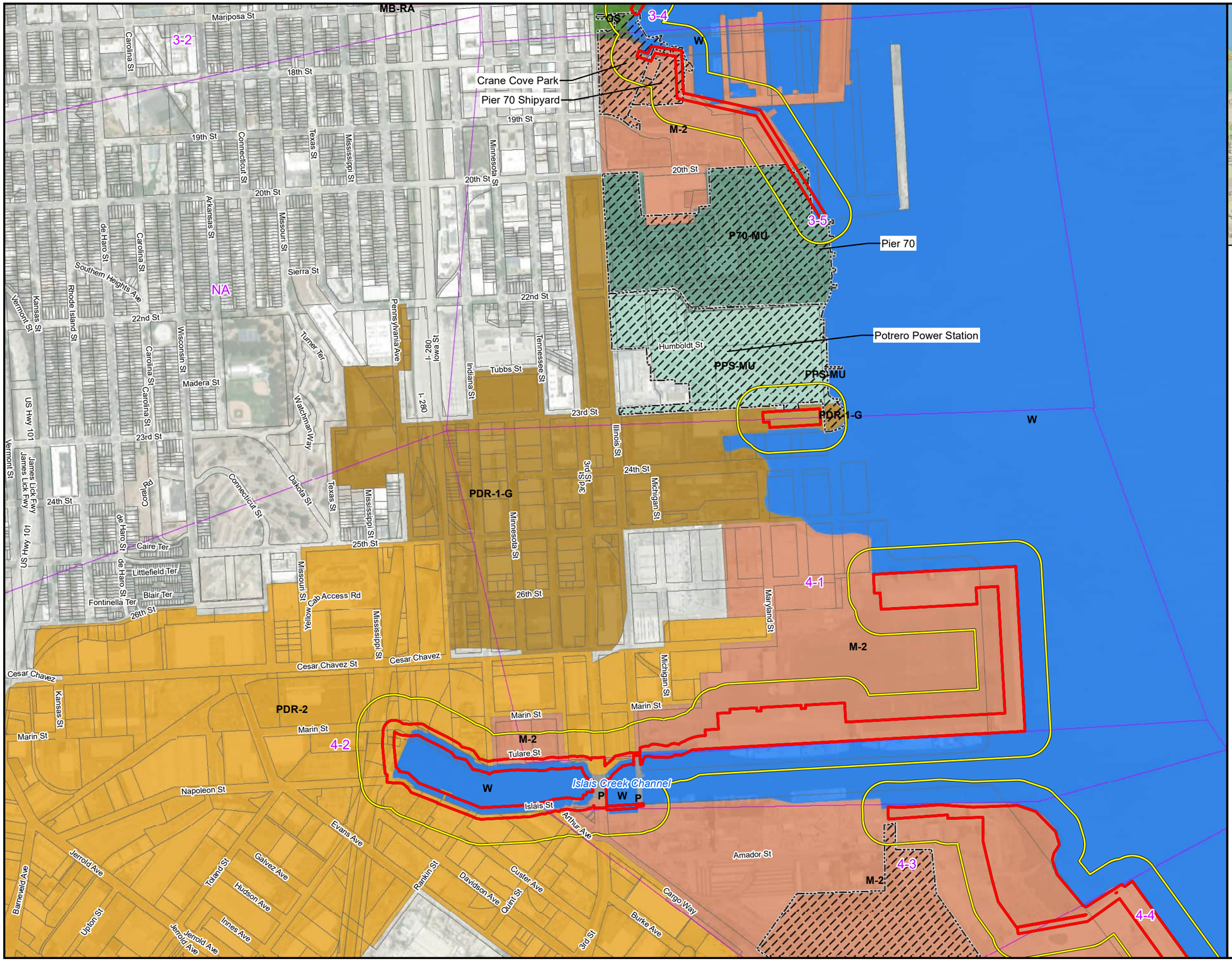


FIGURE LU-11D LANDUSE

USACE and Port of San Francisco

San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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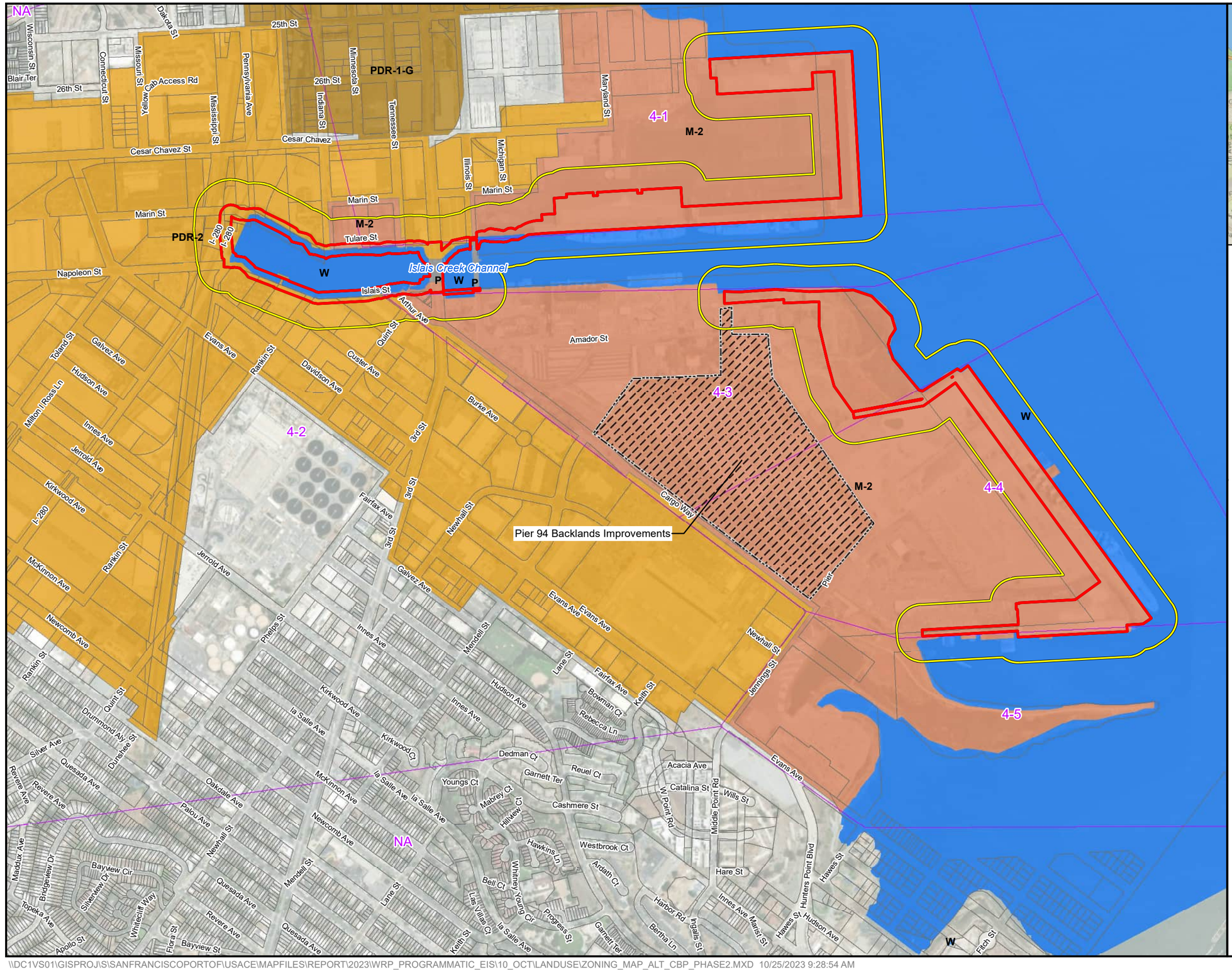


FIGURE LU-11E
LANDUSE

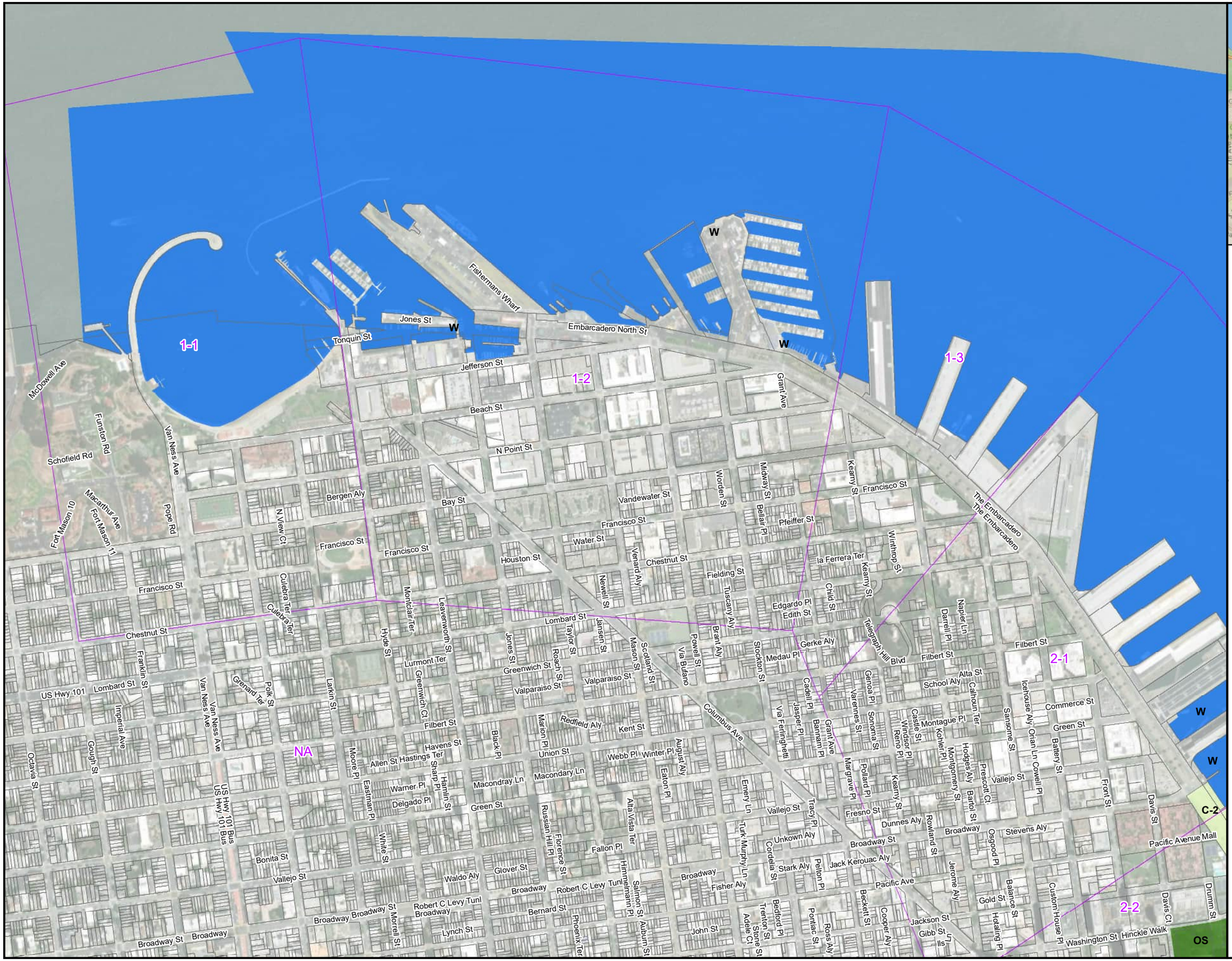
USACE and Port of San Francisco
San Francisco County, California

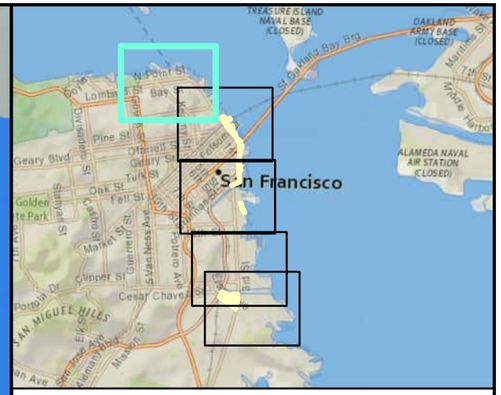
US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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Independent Measures





LEGEND

- USACE Subareas
- Parcels

Commercial Land

- Community Business, C-2

Open Space

- Open Space, OS

Water

- Water, W

0 750 1,500 Feet

N

FIGURE LU-12A
LANDUSE

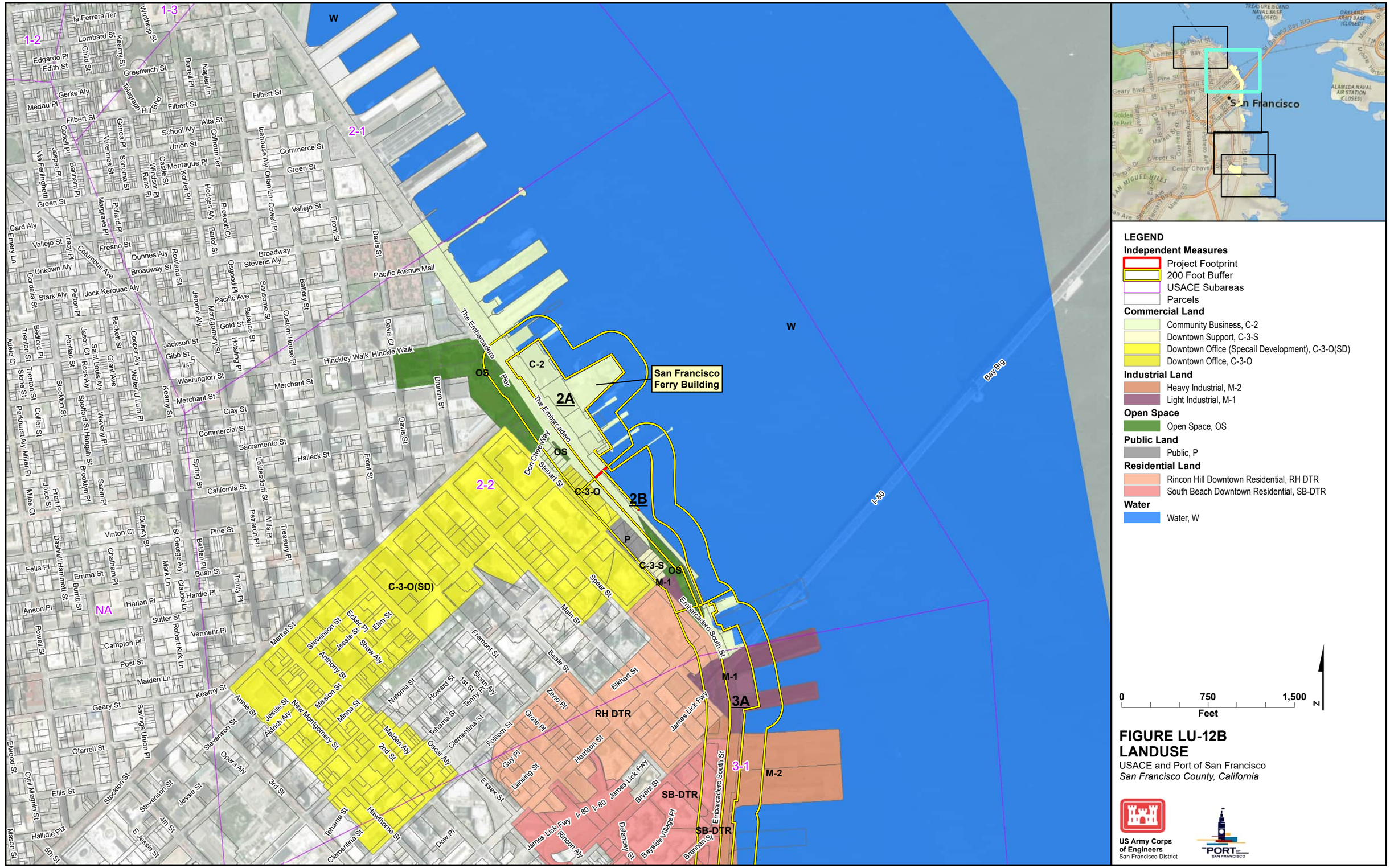
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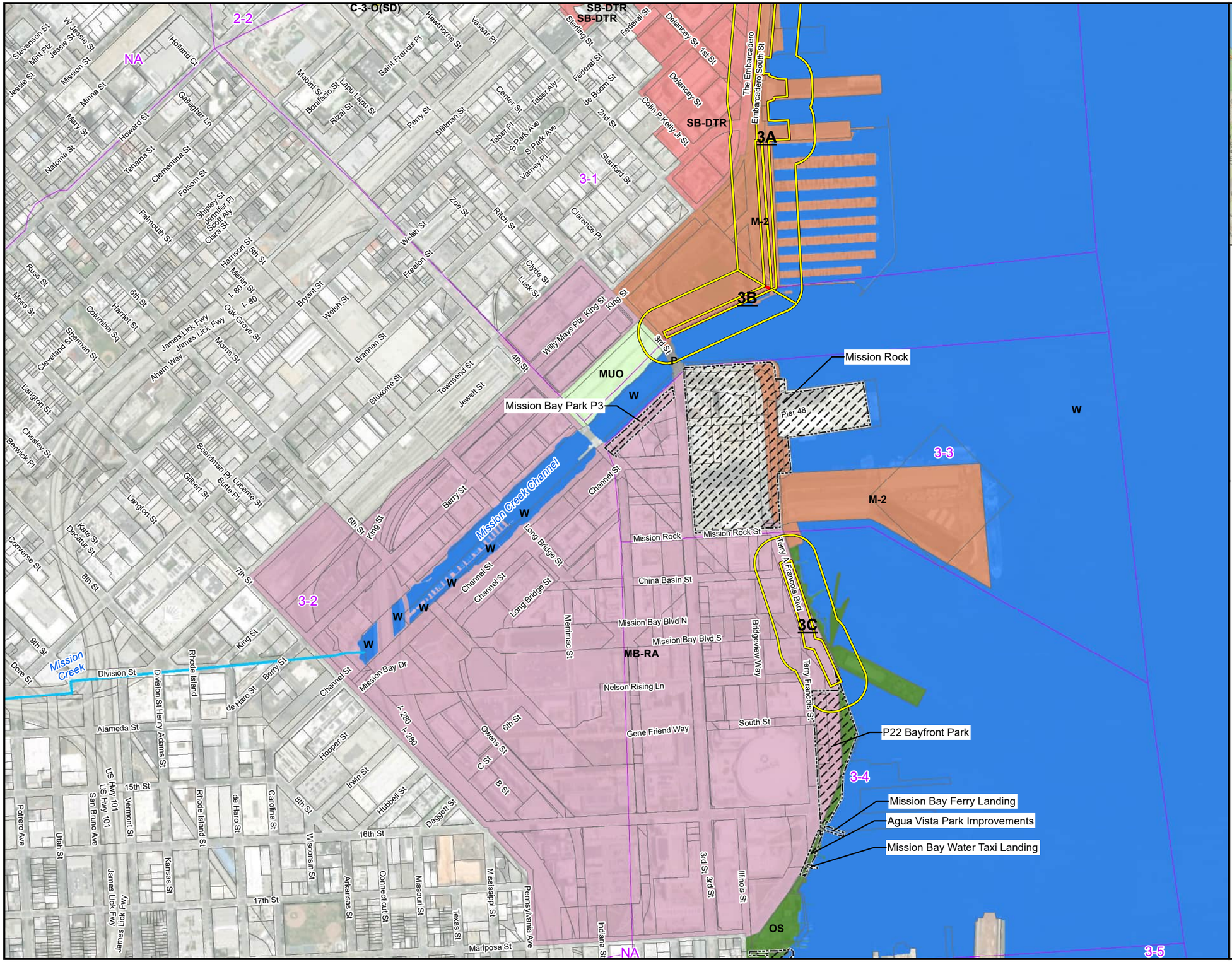
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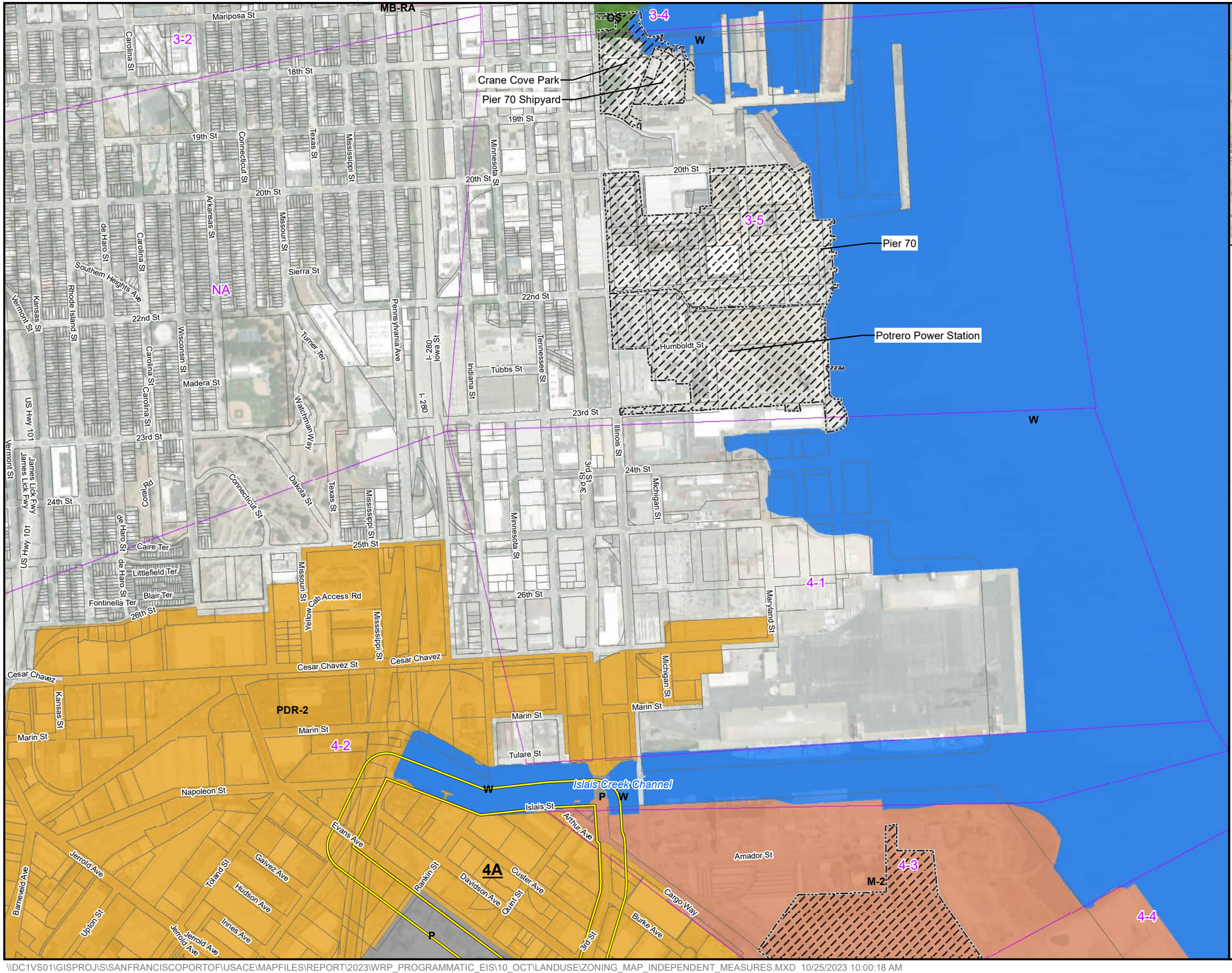
US Army Corps of Engineers
San Francisco District

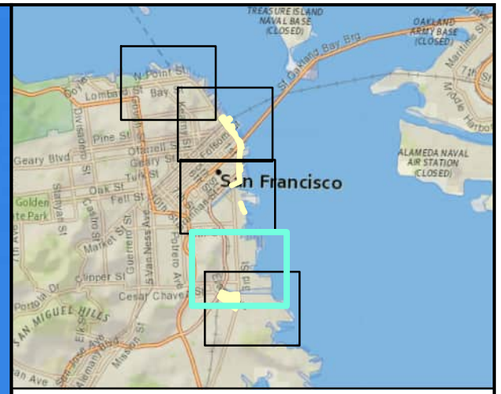
PORT of SAN FRANCISCO

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W
1-3
1-2
2-1
2-2
NA
2A
2B
3A
3-1
OS
C-2
C-3-O
C-3-O(SD)
C-3-S
P
M-1
M-2
RH DTR
SB-DTR
San Francisco Ferry Building
Pier
The Embarcadero
Bay Brg
I-80
Hinckley Walk
Pacific Avenue Mall
Broadway
Vallejo St
Green St
Union St
Filbert St
Greenwich St
Lombard St
Commerce St
Washington St
Merchant St
Clay St
Commercial St
Sacramento St
California St
Pine St
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Post St
Geary St
Ofarrell St
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Howard St
Folsom St
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Embarcadero South St
Main St
Beale St
Fremont St
Spear St
Davis St
Front St
Battery St
Sansome St
Montgomery St
Kearny St
Columbus Ave
Telegraph Hill Blvd
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Powell St
Jackson St
Gibb St
Halleck St
Vinton Ct
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Anson Pl
Harlan Pl
Campton Pl
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Jessie St
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New Montgomery St
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Cyril Magnin St
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Ofarrell St
Geary St
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Post St
Sutter St
Bush St
Pine St
Vallejo St
Broadway St
Pacific Ave
Gold St
Clay St
Merchant St
Washington St
Jackson St
Filbert St
Green St
Union St
Lombard St
Greenwich St
Vallejo St
Broadway
Pacific Avenue Mall
Hinckley Walk
Drumm St
Davis Ct
Custom House Pl
Balance St
Hotaling Pl
Osgood Pl
Stevens Aly
Dunnes Aly
Jack Kerouac Aly
Unkown Aly
Stark Aly
Card Aly
Emery Ln
Cordelia St
Adele Ct
Trenton St
Bedford Pl
Parkhurst Aly
Miller Pl
Miles Ct
Joice St
Pratt Pl
Dashiell Hammett St
Fella Pl
Emma St
Burritt St
Mark Ln
Claude Ln
Hardie Pl
Robert Kirk Ln
Vermehr Pl
Powell St
Annie St
Jessie St
Stevenson St
Ecker Pl
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Jessie St Pl
Natoma St
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Terry Pl
Zeno Pl
Grote Pl
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James Lick Fwy
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Haywthorne St
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Hangen St
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Mason St
Cyril Magnin St
Stockton St
Powell St
Jackson St
Gibb St
Halleck St
Vinton Ct


C-3-O(SD)
SB-DTR
2-2
NA
3-1
3A
3B
M-2
MUO
W
Mission Rock
Mission Bay Park P3
Pier 48
3-3
Mission Creek Channel
3-2
3C
MB-RA
P22 Bayfront Park
3-4
Mission Bay Ferry Landing
Agua Vista Park Improvements
Mission Bay Water Taxi Landing
OS
3-5
Mission Creek
I-280
I-80
The Embarcadero
Embarcadero South St
Delancey St
1st St
2nd St
3rd St
4th St
6th St
7th St
8th St
9th St
King St
Berry St
Channel St
Long Bridge St
Mission Rock St
China Basin St
Mission Bay Blvd N
Mission Bay Blvd S
Mission Bay Dr
Nelson Rising Ln
Gene Friend Way
South St
Terry A Francois Blvd
Terry Francois St
Bridgeview Way
Merrimac St
Illinois St
Indiana St
Pennsylvania Ave
Mariposa St
16th St
17th St
Division St
Alameda St
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Clementina St
Tehama St
Falmouth St
Shipley St
Jennifer Pl
Scott Alley
Clara St
Zoe St
Rich St
Welsh St
Freelon St
Clyde St
Lusk St
Clarence Pl
Stanford St
Varney Pl
S Park Ave
Taber Pl
Taber Alley
Center St
Stillman St
Perry St
Rizal St
Bonifacio St
Mabini St
Lapu Lapu St
Saint Francis Pl
Hawthorne St
Vassar Pl
Sterling St
Federal St
de Boom St
Colin P Kelly Jr St
Willy Mays Plz
King St
Oak Grove St
Merlin St
Morris St
Ahern Way
James Lick Fwy
Columbia Sq
Harriet St
Moss St
Russ St
Sherman St
Cleveland St
Langton St
Chesley St
Benwick Pl
Boardman Pl
Lucerne St
Butte Pl
Gilbert St
Kate St
Decatur St
Converse St
Dore St
Rhode Island
Division St Henry Adams St
de Haro St
Hooper St
Irwin St
Hubbell St
Daggett St
Carolina St
Wisconsin St
Arkansas St
Connecticut St
Missouri St
Mississippi St
Texas St
Kansas St
Potrero Ave
Utah St
San Bruno Ave
US Hwy 101
Vermont St
Rhode Island St
James Lick Fwy
Owens St
C St
B St
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Harrison St
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Merlin St
I-80
Oak Grove St
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Ahern Way
Morris St
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Townsend St
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King St
3rd St
Channel St
Berry St
6th St
King St
Long Bridge St
Mission Rock
Mission Rock St
Terry A Francois Blvd
China Basin St
Mission Bay Blvd N
Mission Bay Blvd S
Merrimac St
Bridgeview Way
Nelson Rising Ln
Gene Friend Way
South St
Terry Francois St
Illinois St
3rd St
Indiana St
Mariposa St
16th St
17th St
Division St
Alameda St
15th St
Mission Creek





LEGEND

Independent Measures
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Production Distribution and Repair, PDR-2

Industrial Land
- Heavy Industrial, M-2

Mixed Use Land
- Mission Bay Redevelopment, MB-RA

Open Space
- Open Space, OS

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

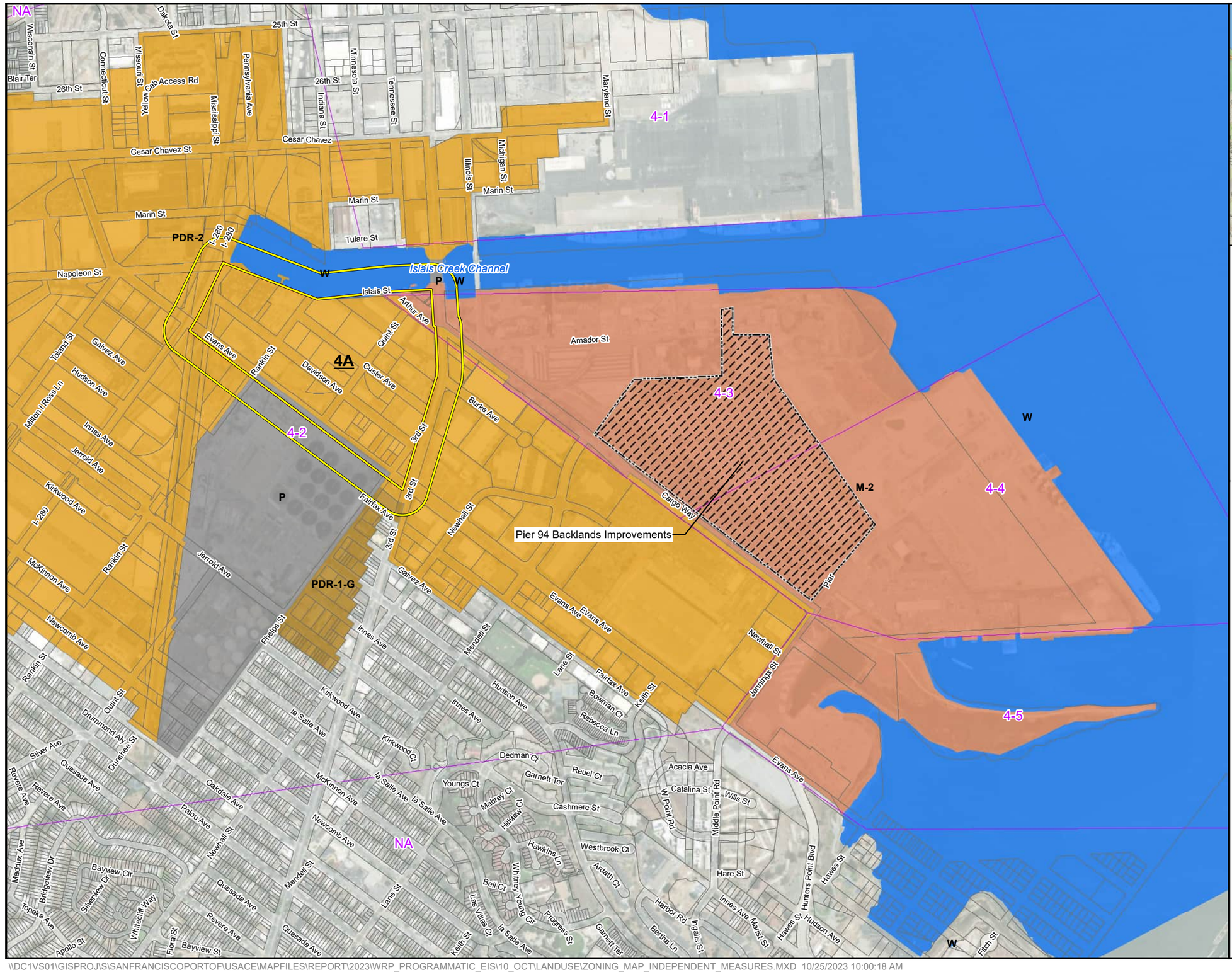
FIGURE LU-12D
LANDUSE

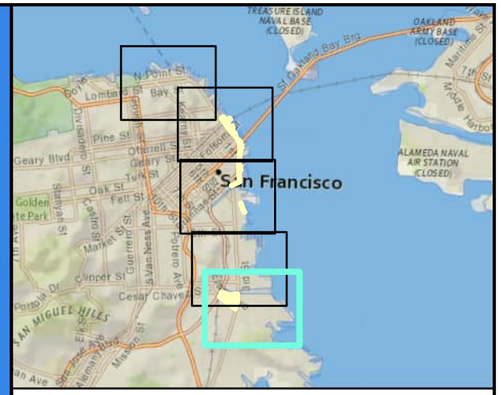
USACE and Port of San Francisco
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT of SAN FRANCISCO

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LEGEND

Independent Measures
- Project Footprint
- 200 Foot Buffer
- USACE Subareas
- Planned Development
- Parcels

Commercial Land
- Production Distribution and Repair, PDR-2
- Production Distribution and Repair - General, PDR-1-G

Industrial Land
- Heavy Industrial, M-2

Public Land
- Public, P

Water
- Water, W

0 750 1,500 Feet

N

FIGURE LU-12E
LANDUSE

USACE and Port of San Francisco
San Francisco County, California

US Army Corps of Engineers
San Francisco District

PORT OF SAN FRANCISCO

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.1.8
REGULATORY FRAMEWORK

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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1.0 Federal Regulations

1.1 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668) enacted in 1940, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald or golden eagles, including their parts (including feathers), nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle [or any golden eagle], alive or dead, or any part (including feathers), nest, or egg thereof."

The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." Regulations further define "disturb" as “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (50 CFR 22.6).

In addition to immediate impacts, this definition also covers effects that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

1.2 Clean Air Act of 1970

The Clean Air Act (CAA) is the comprehensive Federal law that regulates air emissions from area, stationary, and mobile sources. To protect public health and welfare nationwide, the CAA requires the Environmental Protection Agency (EPA) to establish national ambient air quality standards for certain common and widespread pollutants based on the latest science. EPA has set air quality standards for six common criteria pollutants: particulate matter (also known as particle pollution), ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead.

States are required to adopt enforceable plans to achieve and maintain air quality meeting the air quality standards. State plans also must control emissions that drift across state lines and harm air quality in downwind states. Other key provisions are designed to minimize pollution increases from growing numbers of motor vehicles, and from new or expanded industrial plants. The law calls for new stationary sources (e.g., power plants and factories) to use the best available technology and allows less stringent standards for existing sources. Congress drafted the Act with general authorities that can be used to address pollution problems that emerge over time, such as greenhouse gases.

Once EPA sets new air quality standards for the common criteria pollutants, EPA, considering state recommendations, determines whether areas do or do not meet the

air quality standards. Areas the air quality does not meet national standards are designated as “non-attainment areas”. Areas that meet air quality standards are called “attainment areas.” Areas for which data is lacking are designated “unclassifiable” and generally have the same obligations as attainment areas. An area can be in attainment for one pollutant and out of attainment for another.

States are required to devise and carry out state implementation plans (SIPs) to clean up polluted air and protect clean air from degradation. The Act sets minimum requirements for measures that must be included in these plans. SIPs contain emission limits and compliance schedules for stationary pollution sources and may also include state measures to reduce emissions from existing vehicles.

Section 176 of the CAA prohibits federal agencies from taking actions that initiate or cause emissions of criteria or precursor pollutants to originate within nonattainment and maintenance areas unless the emissions from the actions conform to the applicable implementation plan for the nonattainment or maintenance areas. “Conform” means the activities will not cause or contribute to new air quality violations, worsen existing violations, or delay attainment of air quality standards. *De minimis* emission levels are minimum thresholds for which a conformity determination must be performed. The EPA has promulgated *de minimis* emission threshold rates for each of the criteria pollutants and their precursor pollutants (40 CFR 93.153). If the direct and indirect emissions from the action are below the *de minimis* threshold rates, the emissions are exempt from the provisions of the General Conformity regulations.

1.3 Clean Water Act

The Federal Water Pollution Control Act of 1972, as amended in 1977 via the Clean Water Act (CWA), which establishes the basic structure for regulating discharges of pollutants into the waters of the U.S. and regulating quality standards for surface waters. Under the CWA, the EPA has the authority to implement pollution control programs such as setting wastewater standards for industry. EPA also develops national water quality criteria recommendations for pollutants in surface waters.

EPA works with its federal, state, and tribal regulatory partners to monitor and ensure compliance with clean water laws and regulations to protect human health and the environment. The CWA is the primary federal law governing water pollution.

Section 401 of CWA provides states and authorized tribes with an important tool to help protect the water quality of federally regulated waters within their borders, in collaboration with federal agencies. EPA’s regulations (40 CFR 121) address Section 401 certification generally. Under Section 401 of CWA, a federal agency may not issue a permit or license to conduct any activity that may result in any discharge into waters of the United States unless a Section 401 water quality certification is issued, or certification is waived. States and authorized tribes where the discharge would originate are generally responsible for issuing water quality certifications. In cases where a state or tribe does not have authority, EPA is responsible for issuing certification (33 U.S.C. 1341).

Section 404 of the CWA regulates the placement of dredged or fill material into wetlands, lakes, streams rivers, estuaries, and certain other types of waters. The goal of Section 404 is to avoid and minimize losses to wetlands and other waters and to compensate for unavoidable loss through mitigation and restoration. Section 404 is jointly implemented by EPA and U.S. Army Corps of Engineers (USACE). The USACE issues Section 404 permits and monitors compliance with the issued permits. Both the USACE and EPA are responsible for on-site investigations and enforcement of unpermitted discharges under CWA Section 404.

1.4 Coastal Zone Management Act of 1972

The Coastal Zone Management Act (CZMA) is a federal law passed in 1972 to encourage coastal states to develop and implement plans to manage and balance competing uses of the coastal zone. The CZMA establishes a voluntary national program within the Department of Commerce, administered by the National Oceanic and Atmospheric Administration (NOAA), that provides for the protection, preservation, development, and restoration of the nation's coastal resources, including the Great Lakes. The goal is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone."

Section 307 of the CZMA (16 U.S.C. § 1456) directs each Federal agency activity occurring within or outside the coastal zone that affects any land or water use or natural resources of the coastal zone shall coordinate with the state agency responsible for the Coastal Zone Management Program. Federal agencies will carry out activities in a manner which is consistent to the maximum extent practicable with the enforceable policies of approve State management programs. The CZMA directs federal agencies to submit a consistency determination to the state for review of enforceable policies and approval by the state agency.

1.5 Endangered Species Act

The Endangered Species Act (ESA), as amended, establishes a national policy designed to protect and conserve threatened and endangered species and the ecosystems upon which they depend (16 U.S.C. 1531-1543). The ESA is administered by the Department of Interior, through the U.S. Fish and Wildlife Service (USFWS), which oversees protection of non-marine species or marine species when not in the marine environment, and by the Department of Commerce, through the National Marine Fisheries Service (NMFS), which oversees marine species in the marine environment. The ESA ensures that federal agencies and departments use their authorities to protect and conserve threatened and endangered species. Section 7 of ESA requires federal agencies prevent or modify any projects authorized, funded, or carried out by the agencies that are "likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat of such species." The procedures for Section 7 Consultation are defined in regulations issued by USFWS and NMFS (50 CFR Part 402).

1.6 Estuary Restoration Act of 2000

The Estuary Restoration Act (ERA) was created to address accelerating wetland losses and ongoing damage from development, silting, and contamination. The ERA declared estuaries a national priority and promotes restoration and monitoring of estuary habitat around the country. The ERA promotes a coordinated approach to habitat restoration, forging effective partnerships with public and private agencies to promote and support these valuable waterways. The purpose of the ERA is to:

Promote a coordinated federal approach to estuary habitat restoration.

Forge effective partnerships among public agencies and between the public and private sectors.

Provide financial and technical assistance for estuary habitat restoration projects.

Develop and enhance monitoring and research capabilities.

Authorize funding and implementation of estuary restoration projects by EPA, NOAA, USACE, U.S. Department of Agriculture (USDA), and USFWS.

The ERA established an interagency Estuary Habitat Restoration Council dedicated to directing policy relating to the directives of the ERA. The Council is responsible for the development and implementation of the Estuary Habitat Restoration Program, including a national Estuary Habitat Restoration strategy, monitoring standards for estuary habitat restoration projects, and recommending estuary restoration projects to the Secretary of the Army for funding. The ERA appoints NOAA to lead the development of monitoring standards for restoration projects implemented under the Estuary Habitat Restoration Program.

1.7 Executive Order 11988, Flood Plain Management

Executive Order (E.O.) 11988 requires Federal agencies avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, “each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities.”

The Water Resources Council Floodplain Management Guidelines for implementation of E.O. 11988, as referenced in USACE Engineering Regulations (E.R.) 1165-2-26, requires an eight-step process that agencies should carry out as part of their decision making on projects that have potential impacts to, or are within, the floodplain. The eight steps include:

- Determine if a proposed action is in the base floodplain (area which has a one percent or greater change of flooding in any given year).
- If the action is in the base flood plain, identify and evaluate practicable alternatives to the action or to location of the action in the base flood plain.
- If the action must be in the flood plain, advise the general public in the affected areas and obtain their views and comments.
- Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial flood plain values. Where actions proposed to be located outside the base flood plain will affect the base flood plain, impacts resulting from these actions should also be identified.
- If the action is likely to induce development in the base flood plain, determine if a practicable non-flood plain alternative for the development exists.
- As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impacts of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial flood plain values. This should include re-evaluation of the “no action” alternative.
- If the final determination is made that no practicable alternative exists to locating the action in the flood plain, advise the public in the affected area of the findings.
- Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the E.O.

1.8 Executive Order 11990, Protection of Wetlands

The purpose of E.O. 11990 is to “minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.” To meet these objectives, this E.O. requires Federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if any activity affecting a wetland cannot be avoided. The E.O. applies to:

- Acquisition, management, and disposition of Federal lands and facilities construction and improvement projects which are undertaken, financed, or assisted by Federal agencies; and
- Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

1.9 Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks

E.O. 13045 directs Federal agencies to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. Examples of risks to children include increased traffic volumes and industrial or production-oriented activities that would generate substances or pollutants that children may come into contact with or ingest.

1.10 Executive Order 13112 on Invasive Species

E.O. 13112 addresses the prevention of the introduction of invasive species and provides for their control and minimization of the economic, ecological, and human health impacts the invasive species causes. It establishes the Invasive Species Council, which is responsible for the preparation and issuance of the National Invasive Species Management Plan, which details and recommends performance-oriented goals and objectives and specific measures of success for Federal agencies.

1.11 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) was enacted in 1934 to protect fish and wildlife when federal actions result in the control or modification of a natural stream or body of water. The Act provides the basic authority for the involvement of the USFWS in evaluating impacts to fish and wildlife from proposed water resource development projects. The FWCA provides for consultation with the USFWS whenever the waters or channel of a body of water are modified by a department or agency of the United States. The intent of consultation is to help prevent the loss of and damage to wildlife resources from water development projects.

1.12 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSFMA; Public Law [PL] 94-265), as amended, provides for the conservation and management of the Nation’s fishery resources through the preparation and implementation of Fishery Management Plans (FMPs; 16 U.S.C 1801 et seq.) The MSFMA calls for NOAA fisheries to work with regional Fishery Management Councils to develop FMPs for each fishery under their jurisdiction.

One of the required provisions of FMPs specifies that essential fish habitat (EFH) be identified and described for the fishery, adverse fishing impacts on EFH be minimized to the extent practicable, and other actions to conserve and enhance EFH be identified. The MSFMA mandates that NMFS coordinate with and provide information to Federal agencies to further the conservation and enhancement of EFH. Federal agencies must consult with NMFS on any action that may adversely affect EFH. When NMFS finds that

a Federal or State action would adversely affect EFH, it is required to provide conservation recommendations.

1.13 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. 1361 et seq.) established a national policy to prevent marine mammal species and population stocks from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part of. The MMPA prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. In the MMPA, “take” is defined “as harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect”. The Department of Commerce, through NMFS, is charged with protecting species that are known to occur in a region. However, manatees are protected by the Department of the Interior through USFWS. The Animal and Plant Health Inspection Service, part of the USDA, is responsible for regulations managing marine mammals in captivity.

Federal agencies conducting activities that may result in “take” of marine mammals must request a letter of authorization from NMFS (50 CFR §§ 216.101- 216.106) pursuant to any regulations in § 216.105.

1.14 Migratory Bird Treaty Act, Migratory Bird Conservation Act, and Executive Order 13186, Responsibility of Federal Agencies to Protect Migratory Birds

The Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. §§ 703-712), as amended, extends Federal protection to migratory bird species. Among other activities, the MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell migratory birds (including, but not limited to, cranes, ducks, geese, shorebirds, hawks, and songbirds). The statute does not discriminate between live or dead birds and also grants full protection to any bird parts including feathers, eggs, and nests. The USFWS issues permits for otherwise prohibited activities under the act, including permits for taxidermy, falconry, propagation, scientific and educational use, and depredation, an example of the last being the killing of geese near an airport, where they pose a danger to aircraft.

E.O. 13186 requires Federal activities to assess and consider potential effects of their actions on migratory birds.

1.15 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires that all Federal agencies use a systematic, interdisciplinary approach to protect the human environment. This approach promotes the integrated use of natural and social sciences in planning and decision-making that could have an impact on the environment.

NEPA requires the preparation of an Environmental Impact Statement (EIS) for any major Federal action that could have a significant impact on the environment (42 United States Code [USC] 4321-4347). The EIS must address any adverse environmental effects that cannot be avoided or mitigated, alternatives to the proposed action, the relationship between short-term resources and long-term productivity, and irreversible and irretrievable commitments of resources.

The NEPA regulations provide for the use of the NEPA process to identify and assess reasonable alternatives to proposed action s that avoid or minimize adverse effects of these actions upon the quality of the human environment. “Scoping” is used to identify the range and significance of environmental issues associated with a proposed Federal action through coordination with Federal, State, and local agencies; the general public; and any interested individuals and organizations prior to the development of an EIS. The process also identifies and eliminates, from further detailed study, issues that are not significant or have been addressed by prior environmental review.

E.O. 14154 rescinded the Council on Environmental Quality (CEQ) NEPA implementing regulations previously enacted in 40 CFR 1500-1508. The CEQ has directed Federal agencies to instead develop their own NEPA procedures. The CEQ *Implementation of the National Environmental Policy Act Memorandum* dated 19 February 2025 directed agencies to follow the NEPA practices and procedures in place at the time the analysis began. Engineer Regulation 200-2-2, codified in 33 CFR 230 in 1988, provides guidance for implementation of the procedural provisions of NEPA for the USACE Civil Works Program.

1.16 National Historic Preservation Act

Compliance with the National Historic Preservation Act of 1966, as amended (54 U.S.C. § 306108), requires the consideration of effects of the undertaking on all historic properties in the project area and development of mitigation measures for those adversely affected properties in coordination with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation. In accordance with 36 CFR 800.14, a programmatic agreement is used to manage implementation of programs or projects that may affect historic properties. The agreement is negotiated between federal agencies, SHPOs, Tribal Historic Preservation Officers, and the Advisory Council on Historic Preservation. Programmatic agreements streamline Section 106 compliance, establish a framework for consultation with relevant parties and the public, as well as allow for flexibility in addressing management of historic properties specific to state or regional needs.

1.16.1 National Register of Historic Places

The NRHP (36 CFR Part 60) was authorized by the NHPA in 1966 as “an authoritative guide to be used by federal, state, and local governments; private groups; and citizens to identify the nation’s cultural resources and to indicate what properties should be considered for protection from destruction or impairment.” The NRHP recognizes

properties that are significant at national, state, and local levels. According to NRHP guidelines, the quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet any of the following criteria (36 CFR 60.4):

- **Criterion A.** A property is associated with events that have made a significant contribution to the broad patterns of our history.
- **Criterion B.** A property is associated with the lives of persons significant in our past.
- **Criterion C.** A property embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; possesses high artistic values; or represents a significant and distinguishable entity whose components may lack individual distinction.
- **Criterion D.** A property yields, or may be likely to yield, information important in prehistory or history.

The NRHP requires that a resource not only meet one of these criteria but must also possess integrity. Integrity is the ability of a property to convey historical significance. The evaluation of a resource's integrity must be grounded in an understanding of that resource's physical characteristics and how those characteristics convey its significance. The NRHP recognizes seven aspects or qualities that, in various combinations, define the integrity of a property: location, design, setting, materials, workmanship, feeling, and association.

The process of identifying and evaluating properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization (i.e., Traditional Cultural Properties [TCPs]), is described in National Register Bulletin (NRB) 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties (National Park Service 1992). NRB 38 is designed to supplement NRB 15 and aid in determining whether properties thought to have traditional cultural or religious significance meet one or more of the NRHP significance criteria and therefore are eligible for inclusion in the NRHP.

1.17 Rivers and Harbors Act of 1899

The Rivers and Harbors Act of 1899 (33 USC § 401 et seq.) is the initial authority for the USACE regulatory permit program to protect navigable waters in the development of harbors and other construction and excavation.

Section 10 of the Rivers and Harbors Act prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. The construction of any structure in or over any navigable water of the U.S., or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. The Secretary's approval authority has since been delegated to the Chief of Engineers. Activities requiring section 10 permits include structures (e.g.,

piers, wharfs, breakwaters, bulkheads, jetties, weirs, transmission lines) and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to the navigable waters of the U.S.

2.0 State Regulations

2.1 California Building Code

The California Building Standards Code is the building code for California, maintained by the California Building Standards Commission which is granted the authority to oversee processes related to the California Building codes by California Building Standards law. The California building codes under Title 24 are established based on several criteria: standards adopted by states based on national model codes, national model codes adapted to meet California conditions, and standards passed by the California legislature that address concerns specific to California.

2.2 California Endangered Species Act

The California Endangered Species Act (CESA) is a California environmental law that conserves and protects plant and animal species at risk of extinction. Plant and animal species may be designated threatened or endangered under CESA after a formal listing process by the California Fish and Game Commission. Approximately 250 species are currently listed under CESA. A CESA-listed species, or any part or product of the plant or animal, may not be imported into the state, exported out of the state, “taken” (i.e., killed), possessed, purchased, or sold without proper authorization. Implementation of CESA has reduced and avoided impacts to California’s most imperiled plants and animals, has protected hundreds of thousands of acres of vital habitat, and has led to a greater scientific understanding of California’s incredible biodiversity.

The California Department of Fish and Wildlife (CDFW) works with agencies, organizations, and other interested persons to study, protect, and preserve CESA-listed species and their habitats. CDFW also conducts scientific reviews of species petitioned for listing under CESA, administers regulatory permitting programs to authorize take of listed species, maintains an extensive database of listed species occurrences, and conducts periodic reviews of listed species to determine if the conditions that led to original listing are still present.

2.3 California Environmental Quality Act

The California Environmental Quality Act (CEQA) is a statewide policy of environmental protection that was passed in 1970. CEQA requires state and local government agencies to inform decision makers and the public about the potential environmental impacts of proposed projects, and to reduce those environmental impacts to the extent feasible. CEQA also requires agencies to consider alternatives and mitigation measures that will substantially reduce or eliminate significant impacts to the environment.

2.4 California Fish and Game Code

The California Fish and Game Code is a collection of laws that govern the management and conservation of fish, wildlife, and other natural resources in California. The code is divided into three parts: fish and game, public resources, and water. The Fish and Game code regulates hunting, fishing, and other recreational activities related to wildlife. The Public Resources Code covers forestry, parks, and recreation. The water code regulates water rights, water quality, and flood control.

2.5 California Green Building Code

The California Green Building Standards Code is a mandatory green building standards code that was developed by the California Building Standards Commission. It is the first-in-the-nation green building standards code and is part of the Title 24 of the California Code of Regulations. The code includes regulations for energy efficiency, water efficiency and conservation, material conservation and resource efficiency, environmental quality, etc. The building code applies to all new residential and nonresidential buildings, as well as additions and alterations to existing buildings where no other state agency has the authority to adopt green building standards applicable to those occupancies. The purpose is to improve public health, safety, and general welfare through enhanced design and construction of buildings using concepts which reduce negative impacts and promote those principles which have a positive environmental impact and encourage sustainable construction practices.

2.6 California Health and Safety Code

The California Health and Safety Code is the codification of general statutory law covering the subject areas of health and safety in the state of California.

2.7 California Native Plant Protection Act

The California Native Plant Protection Act (NPPA) was enacted in 1977 and allows the California Fish and Game Commission to designate plants as rare or endangered. There are 64 species, subspecies, and varieties of plants that are protected as rare under the NPPA. The NPPA prohibits take of endangered or rare native plants, but includes some exceptions for agricultural and nursery operations; emergencies; and after properly notifying CDFW for vegetation removal from canals, roads, and other sites, changes in land use, and in certain other situations. Take is defined as the harvest, transport, sale, or possession of native plants under any circumstance unless a person has a valid permit or wood receipt, and the required tags and seals or the exceptions have been meet. The appropriate permits, tags and seals must be obtained from the sheriff or commissioner of the county where collecting will occur, and the county will charge a fee.

2.8 California State Implementation Plan

The CAA requires areas that exceed the health-based national ambient air quality standards to develop State Implementation Plans (SIP) that demonstrate how they will attain the standards by specified dates.

2.9 California State Water Resource Control Board

The State Water Resources Control Board and the nine Regional Water Quality Control Boards, collectively known as the California Water Boards, are dedicated to a single vision: abundant clean water for human uses and environmental protection to sustain California's future. Under the CWA and the state's pioneering Porter-Cologne Water Quality Control Act, the State and Regional Water Boards have regulatory responsibility for protecting the water quality of nearly 1.6 million acres of lakes, 1.3 million acres of bays and estuaries, 211,000 miles of rivers and streams, and about 1,100 miles of California coastline. The State and Regional Water Boards protect water quality and allocate surface water rights.

2.10 Marine Life Management Act

The Marine Life Management Act (MLMA), which became law on January 1, 1999, opened a new era in the management and conservation of California's marine living resources. In fashioning the MLMA, the Legislature drew upon years of experience in California and elsewhere in the United States and the world.

The Act includes a number of innovative features.

- The MLMA applies not only to fish and shellfish taken by commercial and recreational fishermen, but to all marine wildlife.
- Rather than assuming that exploitation should continue until damage has become clear, the MLMA shifts the burden of proof toward demonstrating that fisheries and other activities are sustainable.
- Through the MLMA, the Legislature delegates greater management authority to the Fish and Game Commission and the California Department of Fish and Wildlife.
- Rather than focusing on single fisheries management, the MLMA requires an ecosystem perspective including the whole environment.
- The MLMA strongly emphasizes science-based management developed with the help of all those interested in California's marine resources.

The fishery management system established by the MLMA applies to four groups of fisheries.

- The nearshore finfish fishery and the white seabass fishery.

- Emerging fisheries - new and growing fisheries that are not currently subject to specific regulation.
- Those fisheries for which the Fish and Game Commission held some management authority before January 1, 1999. Future regulations affecting these fisheries will need to conform to the MLMA.
- Those commercial fisheries for which there is no statutory delegation of authority to the Commission and Department. (In the case of these fisheries, CDFW may prepare, and the Commission may adopt, a fishery management plan, but that plan cannot be implemented without a further delegation of authority through the legislative process.)

The MLMA sets out several underlying goals.

- Conserves Entire Systems: It is not simply exploited populations of marine life that are to be conserved, but the species and habitats that make up the ecosystem of which they are a part.
- Non-Consumptive Values: Marine life need not be consumed to provide important benefits to people, including aesthetic and recreational enjoyment as well as scientific study and education.
- Sustainability: Fisheries and other uses of marine living resources are to be sustainable so that long-term health is not sacrificed for short-term benefits.
- Habitat Conservation: The habitat of marine wildlife is to be maintained, restored or enhanced, and any damage from fishing practices is to be minimized.
- Restoration: Depressed fisheries are to be rebuilt within a specified time.
- Bycatch: The bycatch of marine living resources in fisheries is to be limited to acceptable types and amounts.
- Fishing Communities: Fisheries management should recognize the long-term interests of people dependent on fishing, and adverse impacts of management measures on fishing communities are to be minimized.

2.11 McAteer-Petris Act

The McAteer-Petris Act established the San Francisco Bay Conservation and Development Commission (BCDC). BCDC grants San Francisco Bay Permits for projects that are necessary to the safety, welfare, or health of the public in the entire bay area or are consistent with the provisions of the implementing regulations and the Bay Plan. BCDC has jurisdiction over the bay waters and shoreline areas on or around several parts of the project area and a permit from BCDC will be required.

2.12 Ocean Protection Council Sea Level Rise Guidance

The Ocean Protection Council is a Cabinet-level state body that works jointly with state and federal agencies, NGOs, tribes and the public to ensure that California maintains healthy, resilient, and productive ocean and coastal ecosystems. The Council was created pursuant to the California Ocean Protection Act (COPA) which was signed into law in 2004. The Ocean Protection Council is guided by principles included in COPA:

- Recognizing the interconnectedness of the land and the sea, supporting sustainable uses of the coast, and ensuring the health of ecosystems
- Improving the protection, conservation, restoration, and management of coastal and ocean ecosystems through enhanced scientific understanding, including monitoring and data gathering
- Recognizing the “precautionary principle”: where the possibility of serious harm exists, lack of scientific certainty should not preclude action to prevent the harm
- Identifying the most effective and efficient use of public funds by identifying funding gaps and creating new and innovative processes for achieving success
- Making aesthetic, educational, and recreational uses of the coast and ocean a priority
- Involving the public in all aspects of Ocean Protection Council process through public meetings, workshops, public conferences, and other symposia

The council is tasked with the following responsibilities:

- Coordinate activities of ocean-related state agencies to improve the effectiveness of state efforts to protect ocean resources within existing fiscal limitations
- Establish policies to coordinate the collection and sharing of scientific data related to coast and ocean resources between agencies
- Identify and recommend to the Legislature changes in law
- Identify and recommend changes in federal law and policy to the Governor and Legislature

2.13 Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Action provides for protection of the quality of waters of the State of California for use and enjoyment by the people of California. The act also establishes provisions for a statewide program for the control of water quality, recognizing that waters of the state are increasingly influenced by interbasin water development projects and other statewide considerations, and that factors such as precipitation, topography, population, recreation, agriculture, industry, and economic development vary regionally within the state. The statewide program for water quality control is therefore administered most effectively on a local level with statewide oversight. Within this framework, the act establishes the authority of the state board and

the nine regional boards. The state board administers water rights, sets state policy for water pollution control, and implements various water quality functions throughout the state, while the regional boards conduct planning, permitting, and most enforcement activities.

2.14 Seismic Hazards Mapping Act of 1990

The Seismic Hazards Mapping Act of 1990 was enacted by the California legislature following the Loma Prieta earthquake of 1989. The Act requires the California State Geologist to create maps delineating zones where data suggest amplified ground shaking, liquefaction, or earthquake-induced landsliding may occur. The purpose of the Act is to protect public safety from the effects of strong ground shaking, liquefaction, landslides, and other hazards caused by earthquakes. The Alquist-Priolo Earthquake Fault Zoning Act (1972) and the Seismic Hazards Mapping Act (1990) direct the State Geologist to delineate regulatory "Zones of Required Investigation" to reduce the threat to public health and safety and to minimize the loss of life and property posed by earthquake-triggered ground failures and other hazards.

2.15 The Public Trust

The public trust is a common law doctrine historically designed to protect the use of trust lands for commerce, navigation, and fisheries, but it has evolved over time to embrace a wider range of public purposes, including open space, recreation, and environmental preservation. Public trust lands are generally owned by the state and managed by the California State Lands Commission. The state has considerable discretion over how trust lands will be used, but it holds those lands in trust for the people, and it must exercise that discretion in a manner consistent with the purposes of the trust.

3.0 Local Regulations

3.1 Better Streets Plan

The San Francisco Better Streets Plan (Better Streets Plan) focuses on creating a positive pedestrian environment through measures such as careful streetscape design and traffic-calming measures to increase pedestrian safety. The Better Streets Plan includes guidelines for the pedestrian environment, which it defines as the areas of the street where people walk, sit, shop, play, or interact.

3.2 Construction Regulations Blue Book

The San Francisco MTA published the Regulations for Working in San Francisco Street, also named the “Blue Book”. This provides direction for agencies working in the City, utility crews, private contractors and other organizations that work on city streets. These regulations set the requirements for working with pedestrian, bicycle, transit, and other traffic to cost the least interference (SFMTA 2023).

3.3 Plan Bay Area 2050

The Plan Bay Area 2050 connects the elements of housing, the economy, transportation, and the environment through 35 strategies that will make the Bay Area more equitable for all residents and more resilient in the face of unexpected challenges. Plan Bay Area 2050 is a 30-year plan that charts a course for a Bay Area that is affordable, connected, diverse, healthy, and vibrant for all residents through 2050 and beyond. Thirty-five strategies comprise the heart of the plan to improve housing, the economy, transportation and the environment across the Bay Area's nine counties — Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma. This long-range plan, developed by the Bay Area's two regional planning agencies, the Metropolitan Transportation Commission and the Association of Bay Area Governments, lays out a $1.4 trillion vision for a more equitable and resilient future for Bay Area residents.

3.4 Port of San Francisco Waterfront Plan

The Waterfront Plan describes the Port of San Francisco's long-term goals and policies to guide the use and improvement of Port piers and properties along its 7½ mile waterfront, from Fisherman's Wharf to India Basin/Bayview. The Waterfront Plan was originally adopted in 1997. In 2019, the Waterfront Plan Working Group of citizens and waterfront stakeholders produced comprehensive recommendations to update the Plan approved in 2023. The Waterfront Plan has nine goals and supporting policies which support the detailed work of the Port's Waterfront Resilience Program.

3.5 San Francisco Bay Plan

The Bay Plan was prepared during three years of study and public deliberation by the members of the San Francisco Bay Conservation and Development Commission. The Bay Plan covers the following matters as specified by law:

- The results of the Commission's detailed study of the Bay;
- The comprehensive plan adopted by the Commission for the conservation of the water of San Francisco Bay and the development of its shoreline;
- The Commission's recommendation of the appropriate agency to maintain and carry out the Bay Plan;
- The Commission's estimate of the approximate amount of money that would be required to maintain and carry out the provisions of the Plan for the Bay;
- Other information and recommendations the Commission deemed desirable.

Major plans proposed in the Bay Plan included developing maritime ports, deepening shipping channels, developing and preserving land for water related industries, expanding airport facilities on land, maintaining wildlife refuges in diked historic Baylands, and encouraging private shoreline development with private investments.

The Commission is authorized to control both: (1) Bay filling and dredging, and (2) Bay related shoreline development. Under the CZMA, federal agencies are generally required to carry out their activities and programs in a manner "consistent" with the Commission's coastal management program. To implement this provision, federal agencies make "consistency determinations" on their proposed activities, and applicants for federal permits, licenses, other authorization, or federal financial assistance make "consistency certifications." The Commission then has the opportunity to review the consistency determinations and certifications and to either concur with them or object to them. The Commission's decisions on federal consistency matters are governed by the provisions of the Coastal Zone Management Act and the Department of Commerce regulations.

3.6 San Francisco Bay Trail Plan

The Association of Bay Area Governments administers the San Francisco Bay Trail Plan. The San Francisco Bay Trail is a multi-purpose recreational trail that, when complete, will encircle San Francisco Bay and San Pablo Bay with a continuous 500-mile network of bicycling and hiking trails; to date, 338 miles of the alignment have been completed (Association of Bay Area Governments 2020).

3.7 San Francisco Bay Water Quality Control Plan (Basin Plan)

The Porter-Cologne Water Quality Control Act requires the state board and/or the regional boards to adopt statewide and/or regional water quality control plans, the purpose of which is to establish water quality objectives for specific water bodies. The regional board prepared the Water Quality Control Plan for the San Francisco Bay Basin (the Basin Plan) that identifies existing and potential beneficial uses for surface and ground waters and provides numerical and narrative water quality objectives designed to protect those uses.

3.8 San Francisco Bicycle Plan

The San Francisco Bicycle Plan describes a city program to provide the safe and attractive environment needed to promote bicycling as a transportation mode. The Bicycle Plan identifies the citywide bicycle route network and establishes the level of treatment (i.e., Class I, Class II, or Class III facility) on each route. The Bicycle Plan also identifies near-term improvements, long-term improvements, and minor improvements that would be implemented to facilitate bicycling in San Francisco.

3.9 San Francisco General Plan

The San Francisco General Plan serves to guide the City’s evolution and growth, by providing a set of objectives and policies that influence how residents live, work, and move, as well as the quality and character of San Francisco. The Planning Commission periodically updates the General Plan. State law and San Francisco's Charter require a comprehensive, long-term general plan for the physical development of the city. The San Francisco General Plan ensures that there is adequate infrastructure to support

residential, commercial, recreational, and institutional land uses and facilities, and that neighborhoods are walkable and connected by a robust transportation system geared toward public transit, walking, and biking. Economic growth should position San Francisco for a resilient future sustainably linked to and coordinated with regional development.

The General Plan attempts to navigate complex imperatives between preserving cherished qualities and assets, tackling needed changes, and preparing for both known and unpredictable challenges and crises. The Transportation Element of the General Plan is composed of objectives and policies that relate to the eight aspects of the citywide transportation system: General Regional Transportation, Congestion Management, Vehicle Circulation, Transit, Pedestrians, Bicycles, Citywide Parking, and Goods Management. The Transportation Element references San Francisco's Transit-First Policy in its introduction. It contains objectives and policies, including objectives related to locating development near transit investments, encouraging transit use, and regulating traffic signal timing to emphasize transit, pedestrian, and bicycle traffic as part of a balanced multimodal transportation system.

3.10 San Francisco Noise Ordinance

In San Francisco, it is illegal to create or cause any noise greater than 5 decibels (dBA) above the ambient level in residential areas, and greater than 8 dBA above the ambient level in commercial or industrial areas. The policy of San Francisco is to maintain noise levels in areas with existing healthful and acceptable levels of noise and to reduce noise levels in those areas where noise levels are above acceptable levels.

3.11 San Francisco Planning Code

The San Francisco Planning Code is a legislative policy document that specifies land uses and development standards, along with zoning regulations. The Code determines if a use is permitted, conditional, or not permitted, and also includes other physical controls for land development such as height, setbacks, parking, etc. The Code affects the types of permits required to operate businesses or to perform construction activity in San Francisco.

3.12 San Francisco Planning Code Section 139

This Section establishes standards for bird-safe buildings to help reduce injury and mortality in birds caused by certain types of new construction, replacement facades, and building features.

3.13 San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) is a public agency of the City and County of San Francisco that provides water, wastewater, and electric power services to the city and an additional 1.9 million customers within three San Francisco Bay Area counties.

3.14 San Francisco Waterfront Special Area Plan

The San Francisco Waterfront Special Area Plan articulates a practicable attainable vision of the future San Francisco Waterfront. The Special Area Plan applies the requirements of the McAteer-Petris Act and the provisions of the San Francisco Bay Plan to the San Francisco waterfront in greater detail. The Special Area Plan facilitates non-maritime, maritime, commercial, and recreational shoreline development along the San Francisco waterfront. The goals will benefit the citizenry of the entire Bay Area, while promoting the viability and success of public trust uses along the waterfront. The area covered by the plan are the land and water area located along the existing shoreline of the City and County of San Francisco from Hyde Street Pier through the India Basin, including all areas in the jurisdiction of the Port of San Francisco. The policies apply only to areas within the jurisdiction of BCDC for permit purposes.

3.15 Sea-Level Rise Action Plan

The San Francisco Sea-Level Rise Action Plan aims to establish overarching goals and set of guiding principles for short- and long-term sea-level rise planning that will drive citywide adaptation planning to protect and enhance the City's public and private assets, natural resources, and quality of life for all its residents. The plan discusses the impact of shoreline erosion on recreational opportunities and access, and emphasizes the need for innovative, inter-disciplinary design approaches that increase resilience to sea-level rise while enhancing the city's shoreline qualities, including recreational access.

3.16 Transit-First Policy

In 1998, San Francisco voters amended the City Charter (Charter Article 8A, Section 8A.115) to include a Transit-First Policy, which was first articulated as a City and County of San Francisco priority policy by the Board of Supervisors in 1973. The Transit-First Policy is a set of principles that underscore the City's commitment that travel by transit, bicycle, and foot be given priority over the private automobile. These principles are embodied in the policies and objectives of the Transportation Element of the City.

3.17 Water Emergency Transportation Authority's Water Transportation System Management Plan

The Water Emergency Transportation Authority (WETA) is a regional agency authorized by the State to operate a comprehensive San Francisco Bay Area public water transit system. In 2009, the WETA adopted the Water Transportation System Management Plan, which complements and reinforces other transportation emergency plans that will enable the Bay Area to restore mobility after a regional disaster.

4.0 References

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

SUB-APPENDIX D.2
CLEAN AIR ACT COMPLIANCE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Annexes

Annex D.2.1: Air Quality Calculations

1.0 Introduction

The U.S. Army Corps of Engineers (USACE) is conducting a San Francisco Waterfront Coastal Flood Study (San Francisco Coastal Study) to assess the feasibility of enhancing, restoring, and sustaining the environment, economy, and culture along San Francisco's coast.

The San Francisco Waterfront Coastal Flood Study Final Environmental Impact Statement analyzes several alternatives, including the Recommended Plan. The purpose of this document is to provide a preliminary assessment of the Recommended Plan to inform future analysis conducted in accordance with the Clean Air Act (CAA) 40 Code of Federal Regulations (CFR) Part 93 Subpart B, which prohibits federal actions that do not meet the requirements of the CAA and applicable state implementation plans (SIPs). This analysis provides a rough order of magnitude to the potential emissions that may result from construction of the Recommended Plan and the need to prepare a future general conformity determination (GCD) for the proposed action. This document is not a GCD for the Recommended Plan, and it does not alleviate USACE's responsibility to conduct a thorough conformity analysis of the Recommended Plan once sufficient project-level details are available.

The Recommended Plan will be implemented through a phased approach with separate groups of actions beginning in 2040 and in 2090. The first actions (2040) are analyzed quantitatively using conceptual engineering data from USACE. The subsequent actions (2090) are analyzed qualitatively, as USACE has determined any assumptions or analysis of actions beginning in 2090 would be too speculative to be reasonable. The Recommended Plan would install berms, seawalls, sheet pile walls, and related infrastructure, thus operational emissions would be negligible. Consequently, operational emissions are not analyzed further as there would be no trigger for a GCD or inconsistency with the CAA.

2.0 Project Description

The Recommended Plan is a cost-effective, hybridized strategy that combines retreat and defend measures tailored to address varying levels of sea-level rise. The first actions, beginning in 2040, involve the initial measures to combat sea-level rise in San Francisco's waterfront areas. These include raising shorelines, floodproofing buildings, and constructing protective barriers and walls at Fisherman's Wharf, the Embarcadero, Mission Creek/Mission Bay, and Islais Creek/Bayview. These first actions would occur over a 10-year period. The subsequent actions, beginning in 2090, build on the first actions and are intended to address more advanced stages of sea-level rise. They include further elevating shorelines, enhancing flood defenses with additional barriers, and making necessary infrastructure modifications. These subsequent actions would also occur over a 10-year period.

3.0 Regulatory Background

3.1 Federal Clean Air Act and General Conformity

The federal CAA of 1970 authorized the establishment of national health-based air quality standards and also set deadlines for their attainment. The Federal CAA Amendments of 1990 (1990 CAAA) made major changes in deadlines for attaining National Ambient Air Quality Standards (NAAQS) and in the actions required of areas of the nation that exceeded these standards. Under the CAA, state and local agencies in areas that exceed the NAAQS are required to develop SIPs to show how they will achieve the NAAQS for nonattainment criteria air pollutants by specific dates. SIPs are not single documents; rather, they are a compilation of new and previously submitted plans, programs (such as monitoring, modeling, permitting, etc.), district rules, state regulations and federal controls. The United States Environmental Protection Agency (USEPA) is responsible for enforcing the NAAQS primarily through reviewing SIPs that are prepared by each state.

Pursuant to CAA Section 176(c) requirements, USEPA promulgated the General Conformity Rule (GCR), which applies to most federal actions, including the Recommended Plan. The GCR is used to determine if federal actions meet the requirements of the CAA and the applicable SIP by ensuring that pollutant emissions related to the action do not cause or contribute to new violations of a NAAQS, increase the frequency or severity of any existing violation of a NAAQS, or delay timely attainment of a NAAQS or interim emissions reduction.

Federal projects must undertake an applicability analysis to determine whether all project emissions sources are subject to the GCR. The applicability analysis includes a stepwise process in which the federal agency determines the following.

1. **Is the emissions source located in a federal attainment area?** If yes, the emissions source is not subject to general conformity and no additional analysis is required. If no, document whether the emissions source is in a nonattainment or maintenance area and proceed to step 2.
2. **Does one or more of the specific exemptions apply to the project?**[1] If yes, the project is exempt from general conformity and no further analysis is required. If no, proceed to step 3.
3. **Has the federal agency included the action on its list of presumed-to-conform actions (40 CFR Section 93.153(f))?** If yes, the action is presumed to conform to the applicable SIP and the requirements of general conformity are satisfied. If no, proceed to step 4.
4. **Are the total direct and indirect emissions below the *de minimis thresholds*?** The *de minimis* levels established in the GCR are shown in **Table**

[1] Exemptions include those that meet the narrow exemption for federal actions in response to an emergency or disaster (40 CFR Section 93.153(e)) or one of the topical exemptions identified in 40 CFR Section 93.153(c) or 40 CFR Section 93.153(d).

D.2-1 and **Table D.2-2**. If the levels are exceeded, the action would not cause or contribute to new violations of air quality standards; the requirements of general conformity would be satisfied.

Table D.2-1: De Minimis Levels for Nonattainment Areas

Pollutant and Status	Tons per Year
Ozone (VOC's or NOx)	
Serious nonattainment	50
Severe nonattainment	25
Extreme nonattainment	10
Other ozone nonattainment area outside an ozone transport region	100
Other ozone nonattainment area inside an ozone transport region	
VOC	50
NOx	100
SO_2 or NO_2 (all nonattainment areas)	100
PM10	
Moderate nonattainment	100
Serious nonattainment	70
PM2.5 (direct emissions, SO_2, NOx, VOC, and ammonia):	
Moderate nonattainment	100
Serious nonattainment	70
Pb (all nonattainment areas)	25
Source: CAA 40 CFR Part 93 Subpart B Section 93.153 (a)(1)	

Table D.2-2: De Minimis Levels for Maintenance Areas

Pollutant and Status	Tons per Year
Ozone (NOx), SO_2 or NO_2 (all maintenance areas)	100
Ozone (VOC)	
Maintenance areas inside an ozone transport region	50
Maintenance areas outside an ozone transport region	100
Carbon monoxide (all maintenance areas)	100
PM_{10} (all maintenance areas)	100
$PM_{2.5}$ (SO_2, NO_X, VOC, and ammonia) (all maintenance areas)	100
Pb (all maintenance areas)	25
Source: CAA 40 CFR Part 93 Subpart B Section 93.153 (a)(1)	

If, through the applicability analysis process, the federal agency determines that requirements of general conformity are satisfied, no further analysis or documentation is required. If, however, conformity requirements are not satisfied, the federal agency must conduct a conformity evaluation in accordance with the criteria and procedures in the implementing regulations, publish a draft GCD for public review, and publish the final GCD. A general GCD is made by satisfying any of the following requirements (USEPA 2023a).

- Showing that the emissions increases caused by the federal action are included in the SIP. This typically means that the SIP accounts for and accommodates the emissions from the proposed action.

- Obtaining a written statement from the entity responsible for the SIP that the total indirect and direct emissions from the action, along with other emissions in the area, will not exceed the total SIP emissions budget.
- Fully offsetting the total direct and indirect emissions by reducing emissions of the same pollutant in the same nonattainment or maintenance area, or a nearby area as allowed under the CAA. This maintains the overall emissions balance within SIP limits.
- Conducing air quality modeling to demonstrate that the proposed action would not result in air quality standards violations or a worsening of existing violations. This modeling considers various factors like emissions rates, meteorological conditions, and pollutant dispersion.
- Using a combination of the above strategies.

By adhering to these methods, agencies and organizations can establish that a proposed action conforms to the requirements of the SIP, ensuring that air quality standards are upheld and that the project complies with the CAA.

3.2 Action Area Attainment Status and GCR Applicability

The Recommended Plan falls within San Francisco County, which has been designated as a nonattainment area for three NAAQS: 8-hour ozone (2008 standard), 8-hour ozone (2015 standard), and 24-hour fine particulate matter (PM2.5) (2006 standard). These designations vary in severity, with the classifications being “marginal” nonattainment for the 2008 and 2015 8-hour ozone standards, and moderate nonattainment for the 24-hour PM2.5 standard (USEPA 2023b). Because the action is in a nonattainment area, general conformity applies to the project (applicability step 1).

None of the GCR exemptions apply to the proposed action, and they are not included in USACE’s presumed-to-conform list (applicability steps 2 and 3). As such, the need for a conformity determination must be assessed through a comparison of project emissions to the applicable *de minimis* levels (applicability step 4). The *de minimis* levels apply to direct and indirect emissions generated by the proposed action, including precursor emissions. Based on the current action area nonattainment designations, the following *de minimis* levels from **Table D.2-1** would apply.

- Volatile organic compounds (VOC) (ozone precursor) - 100 tons per year
- Nitrogen oxides (NOx) (ozone precursor) - 100 tons per year
- PM2.5 - 100 tons per year
- Sulfur dioxide (SO_2) (PM2.5 precursor[2]) - 100 tons per year

[2] Ammonia is also a precursor to PM2.5. However, construction of the Recommended Plan would not result in material emissions of ammonia.

4.0 Methods for Estimating Construction Emissions

4.1 First Actions (2040)

Ozone precursor (VOC and NOx), PM2.5, and SO_2 (PM2.5 precursor) emissions generated by construction of the first actions were quantified using the California Emissions Estimator Model (CalEEMod), version 2022.1, the California Air Resources Board's Off-Road Web Tool, and preliminary engineering assumptions provided by USACE.

For the purposes of this high-level assessment, construction activities for the first actions are grouped into 10 general phases: (1) demolition of structures, (2) bedding and riprap, (3) ground improvements, (4) earth fill, (5) raise, (6) sheet pile driving, (7) H-pile driving, (8) steel pile driving, and (9) concrete, and (10) utilities. Specific start dates for these individual phases (e.g., earth fill) are not currently known. It was, therefore, conservatively assumed that construction of all phases would start in 2040, which is the first year in which construction of the first actions could begin.

The conceptual engineering data provided by USACE for the 10 phases cover a 5-year period. Engineering assumptions beyond these initial 5 years of construction are not available. For the purposes of this analysis, the activity estimates provided by USACE for the first 5-year period were assumed to repeat for the subsequent 5 years, covering the entire 10-year construction period for the first actions.

The following emissions sources were included in the modeling. The first six bullets describe the modeling approach for all phases except utilities. The modeling approach for utility construction is separately discussed in the seventh bullet. Refer to Annex D.2.1 for model outputs and calculations.

- **Off-road construction equipment**. USACE estimated the number of pieces of equipment and total operating hours. These assumptions were input into CalEEMod. Model defaults were used to define the equipment horsepower and load factors. All equipment was conservatively assumed to be diesel-fueled. State regulatory mandates for zero-emissions vehicles (ZEVs) and additional electrification of the off-road equipment sector are likely to increase the future use of electric and alternatively fueled equipment and vehicles during construction.
- **Marine vessels**: Specific marine vessel information was not provided by USACE other than the known use of vessels during bayfill operations. For the purposes of this analysis, bayfill activities were assumed to occur during the earth fill and bedding and riprap phases. Two tugboats and two workboats were assumed to operate, requiring 16 operating hours per day of each vessel type. This analysis also accounts for the potential use of barges for piledriving. Two barges and two tugboats were assumed to operate during the sheet pile, H-pile, and steel pile phases. Emissions factors for marine vessel operation were obtained from California Air Resource Board (CARB)'s Off-Road Web Tool.

- **Construction workers' vehicle trips**. The number of construction employees was estimated from the number of onsite off-road equipment using an industry-standard 1.25 workers per equipment. This analysis assumes two vehicle trips per employee. The resulting vehicle trips were input into CalEEMod. Model defaults were used to define the trip length (11.7 miles one way) and vehicle fleet mix.
- **Construction haul truck trips.** USACE estimated the total number of haul trucks needed for the raise, bedding and riprap, sheet pile, H-pile, steel pile, and concrete truck phases. CalEEMod defaults were used to define hauling trips for the demo structures, ground improvement, and earth fill phases. Defaults were also used for the trip lengths and fleet mix.
- **Earthmoving**. USACE estimated expected earthmoving activities, which includes grading 128 acres during the earth fill phase. Additionally, 11,263,064 cubic yards and 614,900 cubic yards of soil would be exported and imported during the ground improvement and earth fill phases, respectively. These assumptions were input into CalEEMod.
- **Demolition**. USACE estimated expected demolition activities, which includes demolition of 122,360 square feet during the demo structures phase. These assumptions were input into CalEEMod.
- **Utilities**. USACE estimated the total utility length to be 8.4 miles. Construction activity estimates (e.g., equipment operating hours) were scaled from similar projects that included installation of fiber optics, sewer, and water infrastructure. CalEEMod was used to model emissions.

The activity assumptions described above are based on a preliminary and conceptual level of design detail for the first actions. While general activities expected for construction can be defined based on common techniques and known quantities, specific details will be informed by conditions at the time of construction in 2040. The activity assumptions are considered reasonably representative of the first actions based on currently available information, but this analysis recognizes that industry-standard construction practices, as well as available equipment and control technologies, will change over the next 15 years. Accordingly, this analysis incorporates a 100 percent contingency on the activity assumptions provided by USACE to account for the project's distant timeline, inherent uncertainties, and preliminary estimations which results in an estimate that is double the calculated emissions using the assumptions noted above.

4.2 Subsequent Actions (2090)

The subsequent actions are evaluated through a qualitative analysis due to USACE's determination that making engineering assumptions for activities that would begin in 2090 would be too speculative. Additionally, current air quality models do not include emissions projections beyond 2050.

5.0 Preliminary Results

5.1 First Actions (2040)

Estimated construction emissions for the first actions are summarized in **Table D.2-3**. As stated previously, the results provide a rough order of magnitude to the potential emissions that may result from construction of the first actions. They are considered preliminary and should not be used in any regulatory compliance document. The results are provided to support ongoing project planning and provide information on the potential conformity outcome for the Recommended Plan.

Table D.2-3: Preliminary Emissions Estimate for the Recommended Plan First Actions

(tons per year) [a,b]

Construction Year	VOC	NO_X	SO_2	PM2.5
2040	2	53	<1	4
2041	2	50	<1	4
2042	2	38	<1	3
2043	1	9	<1	<1
2044	<1	1	<1	<1
2045	2	53	<1	4
2046	2	50	<1	4
2047	2	38	<1	3
2048	1	9	<1	<1
2049	<1	1	<1	<1
Current *de minimis* level	100	100	100	100
Exceeds *de minimis* level?	No	No	No	No

Note: The results presented provide a rough order of magnitude to the potential emissions that may result from construction of the first actions. They are considered preliminary and should not be used in any regulatory compliance document.

[a] Emissions are rounded to the nearest whole number.

[b] The modeling output files are included in Annex A of this report.

Preliminary analysis of the first actions indicates that emissions may not exceed the *de minimis* levels that are currently applicable to the action area. As noted previously, this result does not mean that conformity requirements have been satisfied and that compliance with the CAA has been achieved. CAA compliance is formally assessed when more realistic emissions estimates are available. This is necessary due to the potential for both over- or underestimating emissions given the analysis uncertainties and limitations, as discussed in Section 5.1.1, *Analysis Uncertainty and Limitations*.

5.1.1 Analysis Uncertainty and Limitations

The preliminary emissions analysis of the first actions includes substantial uncertainty and thus, any material conclusions drawn from the results are limited. This is because the information and models used to estimate emissions lack the necessary precision and reliability required to make a conclusive assessment of air quality impacts occurring between 2040 and 2050. Specific limitations include the following.

- **Construction Details**: The analysis relies on assumptions about specific equipment and methods that would be used almost 20 years in the future. These details are not known with certainty and may vary depending on evolving construction technologies and methods, such as fuel and equipment types.
- **Construction durations.** The duration of construction activities was provided; however, data only for the initial 5 years of the 10-year construction period were available. This partial information indicates a potential gap in the understanding of the long-term construction timeline.
- **Construction costs.** Construction costs, like fuel price, are estimated based on certain assumptions, and cost overruns or other changes could affect final construction activities.
- **State and local regulations.** The effectiveness of state and local regulations in mitigating emissions is assumed but not guaranteed. Changes in regulations or their enforcement may affect actual emissions.
- **Future technological advancements.** The first actions analysis does not consider the potential for future technological advancements that could reduce emissions or improve construction efficiency, like advancements in zero-emissions construction equipment and vehicles.
- **Mitigation measures.** Emissions modeling does not account for implementation of avoidance and minimization measures or mitigation measures described in Appendix D-1-1, *Air Quality and Greenhouse Gases* (AMM-AQ-1, AMM-AQ-2, AMM-AQ-3, MM-AQ-1, MM-AQ-2). These measures may affect the project in the future differently than they would today, indicating the extent to which they can reduce impacts is speculative.
- **Future air quality conditions.** Nonattainment and maintenance designations for the action area are likely to change in the next 20 years, influencing the determination of applicable *de minimis* levels for CAA compliance.

5.2 Subsequent Actions (2090)

Construction of the subsequent actions would not begin until 2090. It is impossible to predict industry, economic, and technological conditions that will influence project actions occurring 50 years in the future. Thus, even a preliminary estimate of emissions for the subsequent actions cannot be reasonably generated. It would also be

inappropriate to presume the current *de minimis* levels would apply to the action area in 2090 (or even in 2050 when a more reasonable estimate of emissions could be generated). As noted previously, *de minimis* levels are informed by the area attainment designations for the NAAQS. SIPs for the San Francisco Bay Area describe how the region will attain the current (2008 and 2015) ozone standards and PM2.5 (2006) standard in the coming decades. If the action area reaches attainment for the ozone and PM2.5 NAAQS, general conformity requirements would not apply to future federal actions. However, while the current NAAQS may be achieved in the near future, USEPA regularly reviews and adopts new (lower) NAAQS in accordance with evolving scientific and health information. Thus, it is likely the nonattainment and maintenance designations for the action area in 2090 will differ from what they are today, influencing the determination of applicable *de minimis* levels for CAA compliance.

An emissions analysis for the subsequent actions cannot be performed; however, it is known that the emissions intensity of future construction equipment and vehicles will decline over time. This is due, in part, to the state's regulatory framework for achieving carbon neutrality by 2045. For example, the Advanced Clean Cars II regulations identify ZEV sales requirements starting with the 2026 model year through 2035, after which all new passenger cars, trucks, and utility vehicles sold in California will be zero emissions. CARB is also developing ZEV requirements for medium- and heavy-duty drayage, high-priority, and government fleets through the Advanced Clean Fleets regulation, which is still in draft form. While regulatory mandates for zero-emissions construction equipment have not yet been proposed, Executive Order N-79-20 establishes a goal for full electrification by 2035. These regulatory mandates and other technological advancements will minimize equipment and vehicle combustion emissions, although dust emissions from earthmoving and demolition would still occur. However, based on the results for the first actions (**Table D.2-3**), it is anticipated that dust (PM2.5) emissions would be minimal.

6.0 Next Steps for Project-Level Analysis

Once more realistic project assumptions are known, a general conformity applicability analysis would need to be completed to assess CAA compliance and the need for a GCD. The preliminary analysis conducted for the first actions indicates that a GCD may not be required (**Table D.2-3**). However, as discussed previously, the reliability of this conclusion is limited given the analysis uncertainties. If the revised project analysis indicates that emissions from first actions or subsequent actions exceed the *de minimis* levels, a GCD would be required. Section 3.2, *Action Area Attainment Status and GCR Applicability*, summarizes the primary methods for satisfying general conformity requirements through a GCD. Once a draft GCD is made it must be circulated for a minimum 30-day public review period in accordance with 40 CFR Sections 93.155 and 93.156. Following public review, USACE would issue a Final GCD and publish notice in the *Federal Register*.

7.0 Conclusion

The quantitative and qualitative analyses presented for the first and subsequent actions of the Recommended Plan indicate that construction emissions may not exceed the de minimis levels that currently apply to the action area. However, given that construction would not begin until 2040 for the first actions and 2090 for the subsequent actions, the information currently available to support the emissions analysis lacks the necessary precision to make a reliable and defensible conclusion with respect to CAA consistency. A comprehensive emissions analysis will be conducted when more accurate information and data are available to define expected construction activities and project conditions. Based on the results of that analysis, a GCD may be required to satisfy general conformity.

8.0 References

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ANNEX D.2.1
AIR QUALITY AND GREENHOUSE GAS ANALYSIS CALCULATIONS

Model Output: Off-Road Web Query (v1.1.0) Emissions Inventory
Region Type: Sub-Area
Region: San Francisco (SF)
Calendar Year: 2040, 2041, 2042, 2043, 2044
Scenario: All Adopted Rules - Exhaust
Vehicle Classification: Off-Road Web Query Equipment Types
Units: tons/day for Emissions, gallons/year for Fuel, hours/year for Activity, Horsepower-hours/year for Horsepower-hours

Region	Calendar	Vehicle Category	Model Year	Horsepower Bin	Fuel	HC_tpd	ROG_tpd	TOG_tpd	CO_tpd	NOx_tpd	CO2_tpd	PM10_tpd	PM2.5_tpd	SOx_tpd	NH3_tpd	Fuel Consum	Total_Activity	Total_Popula	Horsepower_Hours_hhpy
San Francisco (SI	2040	Commercial Harbor Craft - AE - Barge-Other	Aggregate	Aggregate	Diesel	0.000343	0.00041498	0.00049	0.0021	0.00832	1.46507	3.93E-05	3.759E-05	0	0	48132.4847	17558.41	41.8000002	874232.957
San Francisco (SI	2040	Commercial Harbor Craft - AE - Tugboat-Push/To	Aggregate	Aggregate	Diesel	0.001233	0.00149147	0.00177	0.0069	0.02734	4.50459	0.000132	0.00012645	0	0	147700.003	82287.9052	63.2083325	2567697.83
San Francisco (SI	2040	Commercial Harbor Craft - AE - Work Boat	Aggregate	Aggregate	Diesel	0.000436	0.00052722	0.00063	0.0026	0.01015	1.51872	9.62E-05	9.1946E-05	0	0	55709.3089	24160.4644	33.74825	1002884.24
San Francisco (SI	2040	Commercial Harbor Craft - ME - Tugboat-Push/To	Aggregate	Aggregate	Diesel	0.003927	0.00475224	0.00566	0.0355	0.09363	32.7173	0.000429	0.00040988	0	0	1074231.72	76708.8648	69.374997	20390843.1
San Francisco (SI	2040	Commercial Harbor Craft - ME - Work Boat	Aggregate	Aggregate	Diesel	0.001953	0.0023627	0.00281	0.009	0.0441	6.4832	0.000338	0.00032266	0	0	237903.862	37246.5458	58.2924291	4446184.92

		HC_tpd	ROG_tpd	TOG_tpd	CO_tpd	NOx_tpd	CO2_tpd	PM10_tpd	PM2.5_tpd	SOx_tpd	NH3_tpd
Commercial Harbor Craft - Tugboat-Push/Tow	Tons/year	0.28	0.34	0.41	1.72	6.74	1089.08	0.05	0.05	0.00	0.00
Commercial Harbor Craft - Work Boat	Tons/year	1.88	2.28	2.71	15.45	44.15	13586.00	0.20	0.20	0.00	0.00
Commercial Harbor Craft - Barge-Other	Tons/year	0.71	0.86	1.03	3.30	16.09	2366.37	0.12	0.12	0.00	0.00
Commercial Harbor Craft - Tugboat-Push/Tow	Tons/hour	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Commercial Harbor Craft - Work Boat	Tons/hour	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00
Commercial Harbor Craft - Barge-Other	Tons/hour	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00

	hrs/day
Commercial Harbor Craft - Tugboat-Push/Tow	16
Commercial Harbor Craft - Work Boat	16
Commercial Harbor Craft - Barge-Other	16

CalEEMod Schedule					Tons (2040)						Tons (2041)						Tons (2042)						Tons (2043)						Tons (2044)					
CalEEMod Schedule					ROG	NOx	CO	PM10	PM2.5	SO2	ROG	NOx	CO	PM10	PM2.5	SO2	ROG	NOx	CO	PM10	PM2.5	SO2	ROG	NOx	CO	PM10	PM2.5	SO2	ROG	NOx	CO	PM10	PM2.5	SO2
Phase	Type	Start	End	Days																														
Demo Structures	Demolition	1/3/2040	4/18/2040	77																														
Raise	Building Construction	1/3/2040	8/22/2041	428																														
Ground Improvement	Grading	1/3/2040	9/12/2042	704																														
Earthfill	Grading	1/3/2040	1/27/2043	801	0.09	1.83	0.58	0.01	0.01	0.00	0.09	1.83	0.58	0.01	0.01	0.00	0.09	1.83	0.58	0.01	0.01	0.00	0.01	0.13	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bedding & Riprap	Site Preparation	1/3/2040	10/25/2040	213	0.08	1.50	0.47	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sheetpile Driving	Building Construction	1/3/2040	2/23/2044	1081	0.19	3.63	0.94	0.02	0.02	0.00	0.19	3.64	0.95	0.02	0.02	0.00	0.19	3.64	0.95	0.02	0.02	0.00	0.19	3.64	0.95	0.02	0.02	0.00	0.03	0.53	0.14	0.00	0.00	0.00
H-Pile	Building Construction	1/3/2040	2/29/2040	42	0.03	0.59	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steel Pile	Building Construction	1/3/2040	2/8/2044	1070	0.19	3.63	0.94	0.02	0.02	0.00	0.19	3.64	0.95	0.02	0.02	0.00	0.19	3.64	0.95	0.02	0.02	0.00	0.19	3.64	0.95	0.02	0.02	0.00	0.02	0.38	0.10	0.00	0.00	0.00
Concrete Truck	Building Construction	1/3/2040	12/1/2044	1283																														

1/3/2040	12/31/2040	260	
1/1/2041	12/31/2041	261	
1/1/2042	12/31/2042	261	
1/1/2043	12/31/2043	261	
1/1/2044	12/1/2044	240	

Working Days	2040	2041	2042	2043	2044
Earthfill	260	261	261	19	0
Bedding & Riprap	213	0	0	0	0
Sheetpile Driving	260	261	261	261	38
H-Pile	42	0	0	0	0
Steel Pile	260	261	261	261	27

Total Emissions - CalEEMod Outputs with 100% Contingency + Marine Vessels + Utilities

	VOC	NO_x	CO	SO2	PM_{10}	$PM_{2.5}$
2040	2	53	57	0	19	4
2041	2	50	55	0	19	4
2042	2	38	38	0	16	3
2043	1	9	5	0	1	0
2044	0	1	1	0	0	0
2045	2	53	57	0	19	4
2046	2	50	55	0	19	4
2047	2	38	38	0	16	3
2048	1	9	5	0	1	0
2049	0	1	1	0	0	0

2.2. CalEEMod Outputs - Construction Emissions by Year, Unmitigated (Does not include 100% contingency)

Year	TOG	ROG	NOx	CO	SO_2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T
Annual											
2040	2.15765583	0.554748414	18.63045232	24.33034	0.130351	0.185329	9.317462	9.502791	0.180298	1.840322	2.02062
2041	1.93234957	0.49109861	17.28225647	22.64914	0.127004	0.169012	9.176467	9.34548	0.165137	1.808492	1.973629
2042	1.4194602	0.393205383	12.15037018	16.13657	0.091466	0.125648	7.622706	7.748354	0.122471	1.399976	1.522447
2043	0.20618764	0.168683161	0.958798698	1.672815	0.00522	0.027926	0.347891	0.375817	0.025729	0.045409	0.071139
2044	0.04529998	0.037664653	0.220410878	0.312958	0.000855	0.007528	0.01926	0.026787	0.006926	0.004524	0.01145

Marine Vessels (Calculated from "RecPlan_OFFROAD Marine Analysis_2040.xlsx")

				Tons (2040)						Tons (2041)						Tons (2042)						Tons (2043)						Tons (2044)					
CalEEMod Schedule				ROG	NOx	CO	PM10	PM2.5	SO2	ROG	NOx	CO	PM10	PM2.5	SO2	ROG	NOx	CO	PM10	PM2.5	SO2	ROG	NOx	CO	PM10	PM2.5	SO2	ROG	NOx	CO	PM10	PM2.5	SO2
Phase	Start	End	Days																														
Demo Structures	1/3/2040	4/18/2040	77																														
Raise	1/3/2040	8/22/2041	428																														
Ground Improvement	1/3/2040	9/12/2042	704																														
Earthfill	1/3/2040	1/27/2043	801	0.1	1.8	0.6	0.0	0.0	0.0	0.1	1.8	0.6	0.0	0.0	0.0	0.1	1.8	0.6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bedding & Riprap	1/3/2040	10/25/2040	213	0.1	1.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sheetpile Driving	1/3/2040	2/23/2044	1081	0.2	3.6	0.9	0.0	0.0	0.0	0.2	3.6	0.9	0.0	0.0	0.0	0.190969	3.6	0.94796	0.024141	0.023079	0	0.190969	3.639109	0.94796	0.024141	0.023079	0	0.027804	0.529832	0.138017	0.003515	0.00336	0
H-Pile	1/3/2040	2/29/2040	42	0.0	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel Pile	1/3/2040	2/8/2044	1070	0.2	3.6	0.9	0.0	0.0	0.0	0.2	3.6	0.9	0.0	0.0	0.0	0.190969	3.6	0.94796	0.024141	0.023079	0	0.190969	3.639109	0.94796	0.024141	0.023079	0	0.019755	0.37646	0.098065	0.002497	0.002387	0
Concrete Truck	1/3/2040	12/1/2044	1283																														
			TOTAL	0.6	11.2	3.1	0.1	0.1	0.0	0.5	9.1	2.5	0.1	0.1	0.0	0.5	9.1	2.5	0.1	0.1	0.0	0.4	7.4	1.9	0.0	0.0	0.0	0.0	0.9	0.2	0.0	0.0	0.0

Utilities

Fiber Optics

	VOC	NO_X	CO	SO2	PM_{10}	$PM_{2.5}$
Year 1	0.017078	0.156633	0.165557	0.000324	0.097425	0.05038

100% Contingency

VOC	NO_X	CO	SO2	PM_{10}	$PM_{2.5}$
0.034156	0.313267	0.331115	0.000648	0.194849	0.100759

Sewer-Water

	VOC	NO_X	CO	SO2	PM_{10}	$PM_{2.5}$
Year 1	0.231297	1.899051	2.241754	0.004096	0.10142	0.072171
Year 2	0.400196	3.240497	3.756903	0.006906	0.173532	0.120624
Year 3	0.286854	2.34647	2.849076	0.005532	0.120477	0.083572

100% Contingency

VOC	NO_X	CO	SO2	PM_{10}	$PM_{2.5}$
0.462595	3.798102	4.483509	0.008191	0.202841	0.144342
0.800391	6.480995	7.513805	0.013812	0.347063	0.241249
0.573707	4.69294	5.698153	0.011064	0.240954	0.167144

Seawall RecPlan 2040 04032025 Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Seawall RecPlan 2040 04032025
Construction Start Date	1/3/2040
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	3.90
Precipitation (days)	2.60
Location	37.795670987249224, -122.3925256780877
County	San Francisco
City	San Francisco
Air District	Bay Area AQMD
Air Basin	San Francisco Bay Area
TAZ	1072
EDFZ	1
Electric Utility	Pacific Gas & Electric Company
Gas Utility	—
App Version	2022.1.1.29

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
User Defined Industrial	601,330	User Defined Unit	14.0	0.00	0.00	0.00	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Construction	C-10-A	Water Exposed Surfaces
Construction	C-10-B	Water Active Demolition Sites

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	16.9	4.45	141	191	1.01	1.45	73.5	74.9	1.41	14.5	15.9	—	117,060	117,060	12.1	17.8	53.6	122,718
Mit.	16.9	4.45	141	191	1.01	1.45	71.8	73.2	1.41	14.2	15.6	—	117,060	117,060	12.1	17.8	53.6	122,718
% Reduced	—	—	—	—	—	—	2%	2%	—	2%	2%	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	17.2	4.69	151	195	1.03	1.52	73.6	75.1	1.48	14.5	16.0	—	118,252	118,252	12.2	17.8	1.40	123,864
Mit.	17.2	4.69	151	195	1.03	1.52	71.8	73.4	1.48	14.2	15.7	—	118,252	118,252	12.2	17.8	1.40	123,864
% Reduced	—	—	—	—	—	—	2%	2%	—	2%	2%	—	—	—	—	—	—	—
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	11.8	3.04	102	133	0.71	1.02	51.1	52.1	0.99	10.1	11.1	—	82,379	82,379	8.54	12.6	16.3	86,350
Mit.	11.8	3.04	102	133	0.71	1.02	50.1	51.1	0.99	9.95	10.9	—	82,379	82,379	8.54	12.6	16.3	86,350
% Reduced	—	—	—	—	—	—	2%	2%	—	1%	1%	—	—	—	—	—	—	—

Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	0.55	18.6	24.3	0.13	0.19	9.32	9.50	0.18	1.84	2.02	—	13,639	13,639	1.41	2.08	2.71	14,296
Mit.	2.16	0.55	18.6	24.3	0.13	0.19	9.15	9.33	0.18	1.82	2.00	—	13,639	13,639	1.41	2.08	2.71	14,296
% Reduced	—	—	—	—	—	—	2%	2%	—	1%	1%	—	—	—	—	—	—	—

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2040	16.9	4.45	141	191	1.01	1.45	73.5	74.9	1.41	14.5	15.9	—	117,060	117,060	12.1	17.8	53.6	122,718
2041	15.0	3.96	129	175	0.98	1.32	70.7	72.0	1.29	13.9	15.2	—	109,964	109,964	10.8	17.3	45.0	115,433
2042	14.6	3.68	122	168	0.97	1.25	70.6	71.9	1.22	13.9	15.1	—	106,505	106,505	9.76	17.3	39.1	111,941
2043	1.52	1.27	6.87	12.2	0.04	0.21	0.42	0.62	0.19	0.10	0.29	—	4,229	4,229	0.16	0.04	0.13	4,245
2044	0.19	0.16	1.05	1.10	< 0.005	0.04	0.12	0.16	0.04	0.03	0.07	—	251	251	0.01	< 0.005	0.03	252
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2040	17.2	4.69	151	195	1.03	1.52	73.6	75.1	1.48	14.5	16.0	—	118,252	118,252	12.2	17.8	1.40	123,864
2041	14.8	3.82	136	175	0.98	1.32	70.7	72.0	1.29	13.9	15.2	—	109,961	109,961	10.8	17.3	1.17	115,387
2042	14.5	3.54	129	168	0.97	1.25	70.6	71.9	1.22	13.9	15.1	—	106,505	106,505	9.76	17.3	1.02	111,903
2043	2.31	1.57	13.5	22.1	0.08	0.29	31.1	31.4	0.27	3.50	3.77	—	9,426	9,426	0.63	0.80	0.05	9,681
2044	1.50	1.25	6.72	12.0	0.04	0.20	0.42	0.61	0.18	0.10	0.28	—	4,207	4,207	0.16	0.04	< 0.005	4,224
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2040	11.8	3.04	102	133	0.71	1.02	51.1	52.1	0.99	10.1	11.1	—	82,379	82,379	8.54	12.6	16.3	86,350
2041	10.6	2.69	94.7	124	0.70	0.93	50.3	51.2	0.90	9.91	10.8	—	78,271	78,271	7.69	12.4	13.9	82,159
2042	7.78	2.15	66.6	88.4	0.50	0.69	41.8	42.5	0.67	7.67	8.34	—	55,191	55,191	5.01	8.81	8.63	57,950

2043	1.13	0.92	5.25	9.17	0.03	0.15	1.91	2.06	0.14	0.25	0.39	—	3,283	3,283	0.14	0.07	0.08	3,307
2044	0.25	0.21	1.21	1.71	< 0.005	0.04	0.11	0.15	0.04	0.02	0.06	—	537	537	0.02	0.01	0.01	539
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2040	2.16	0.55	18.6	24.3	0.13	0.19	9.32	9.50	0.18	1.84	2.02	—	13,639	13,639	1.41	2.08	2.71	14,296
2041	1.93	0.49	17.3	22.6	0.13	0.17	9.18	9.35	0.17	1.81	1.97	—	12,959	12,959	1.27	2.05	2.30	13,602
2042	1.42	0.39	12.2	16.1	0.09	0.13	7.62	7.75	0.12	1.40	1.52	—	9,137	9,137	0.83	1.46	1.43	9,594
2043	0.21	0.17	0.96	1.67	0.01	0.03	0.35	0.38	0.03	0.05	0.07	—	543	543	0.02	0.01	0.01	548
2044	0.05	0.04	0.22	0.31	< 0.005	0.01	0.02	0.03	0.01	< 0.005	0.01	—	89.0	89.0	< 0.005	< 0.005	< 0.005	89.3

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2040	16.9	4.45	141	191	1.01	1.45	71.8	73.2	1.41	14.2	15.6	—	117,060	117,060	12.1	17.8	53.6	122,718
2041	15.0	3.96	129	175	0.98	1.32	69.5	70.9	1.29	13.7	15.0	—	109,964	109,964	10.8	17.3	45.0	115,433
2042	14.6	3.68	122	168	0.97	1.25	69.5	70.8	1.22	13.7	15.0	—	106,505	106,505	9.76	17.3	39.1	111,941
2043	1.52	1.27	6.87	12.2	0.04	0.21	0.42	0.62	0.19	0.10	0.29	—	4,229	4,229	0.16	0.04	0.13	4,245
2044	0.19	0.16	1.05	1.10	< 0.005	0.04	0.12	0.16	0.04	0.03	0.07	—	251	251	0.01	< 0.005	0.03	252
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2040	17.2	4.69	151	195	1.03	1.52	71.8	73.4	1.48	14.2	15.7	—	118,252	118,252	12.2	17.8	1.40	123,864
2041	14.8	3.82	136	175	0.98	1.32	69.5	70.9	1.29	13.7	15.0	—	109,961	109,961	10.8	17.3	1.17	115,387
2042	14.5	3.54	129	168	0.97	1.25	69.5	70.8	1.22	13.7	15.0	—	106,505	106,505	9.76	17.3	1.02	111,903
2043	2.31	1.57	13.5	22.1	0.08	0.29	30.9	31.2	0.27	3.48	3.75	—	9,426	9,426	0.63	0.80	0.05	9,681
2044	1.50	1.25	6.72	12.0	0.04	0.20	0.42	0.61	0.18	0.10	0.28	—	4,207	4,207	0.16	0.04	< 0.005	4,224
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

2040	11.8	3.04	102	133	0.71	1.02	50.1	51.1	0.99	9.95	10.9	—	82,379	82,379	8.54	12.6	16.3	86,350
2041	10.6	2.69	94.7	124	0.70	0.93	49.5	50.4	0.90	9.79	10.7	—	78,271	78,271	7.69	12.4	13.9	82,159
2042	7.78	2.15	66.6	88.4	0.50	0.69	41.2	41.9	0.67	7.58	8.26	—	55,191	55,191	5.01	8.81	8.63	57,950
2043	1.13	0.92	5.25	9.17	0.03	0.15	1.90	2.05	0.14	0.25	0.39	—	3,283	3,283	0.14	0.07	0.08	3,307
2044	0.25	0.21	1.21	1.71	< 0.005	0.04	0.11	0.15	0.04	0.02	0.06	—	537	537	0.02	0.01	0.01	539
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2040	2.16	0.55	18.6	24.3	0.13	0.19	9.15	9.33	0.18	1.82	2.00	—	13,639	13,639	1.41	2.08	2.71	14,296
2041	1.93	0.49	17.3	22.6	0.13	0.17	9.03	9.20	0.17	1.79	1.95	—	12,959	12,959	1.27	2.05	2.30	13,602
2042	1.42	0.39	12.2	16.1	0.09	0.13	7.51	7.64	0.12	1.38	1.51	—	9,137	9,137	0.83	1.46	1.43	9,594
2043	0.21	0.17	0.96	1.67	0.01	0.03	0.35	0.37	0.03	0.05	0.07	—	543	543	0.02	0.01	0.01	548
2044	0.05	0.04	0.22	0.31	< 0.005	0.01	0.02	0.03	0.01	< 0.005	0.01	—	89.0	89.0	< 0.005	< 0.005	< 0.005	89.3

3. Construction Emissions Details

3.1. Demo Structures (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.61	3.83	0.01	0.02	—	0.02	0.02	—	0.02	—	580	580	0.02	< 0.005	—	582
Demolition	—	—	—	—	—	—	1.65	1.65	—	0.25	0.25	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.61	3.83	0.01	0.02	—	0.02	0.02	—	0.02	—	580	580	0.02	< 0.005	—	582
Demolition	—	—	—	—	—	—	1.65	1.65	—	0.25	0.25	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.34	0.81	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	122	122	< 0.005	< 0.005	—	123
Demolition	—	—	—	—	—	—	0.35	0.35	—	0.05	0.05	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	20.3	20.3	< 0.005	< 0.005	—	20.3
Demolition	—	—	—	—	—	—	0.06	0.06	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.11	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	37.5	37.5	< 0.005	< 0.005	0.02	37.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.12	0.02	1.07	1.40	0.01	0.01	0.35	0.36	0.01	0.09	0.10	—	930	930	0.10	0.15	0.45	977
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.5	35.5	< 0.005	< 0.005	< 0.005	35.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.12	0.02	1.12	1.40	0.01	0.01	0.35	0.36	0.01	0.09	0.10	—	930	930	0.10	0.15	0.01	977
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	7.50	7.50	< 0.005	< 0.005	< 0.005	7.52
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.02	< 0.005	0.23	0.30	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	196	196	0.02	0.03	0.04	206
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.24	1.24	< 0.005	< 0.005	< 0.005	1.25
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	32.5	32.5	< 0.005	0.01	0.01	34.1

3.2. Demo Structures (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.61	3.83	0.01	0.02	—	0.02	0.02	—	0.02	—	580	580	0.02	< 0.005	—	582
Demolition	—	—	—	—	—	—	1.06	1.06	—	0.16	0.16	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.61	3.83	0.01	0.02	—	0.02	0.02	—	0.02	—	580	580	0.02	< 0.005	—	582
Demolition	—	—	—	—	—	—	1.06	1.06	—	0.16	0.16	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.34	0.81	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	122	122	< 0.005	< 0.005	—	123
Demolition	—	—	—	—	—	—	0.22	0.22	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	20.3	20.3	< 0.005	< 0.005	—	20.3
Demolition	—	—	—	—	—	—	0.04	0.04	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.11	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	37.5	37.5	< 0.005	< 0.005	0.02	37.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.12	0.02	1.07	1.40	0.01	0.01	0.35	0.36	0.01	0.09	0.10	—	930	930	0.10	0.15	0.45	977
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.5	35.5	< 0.005	< 0.005	< 0.005	35.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.12	0.02	1.12	1.40	0.01	0.01	0.35	0.36	0.01	0.09	0.10	—	930	930	0.10	0.15	0.01	977
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	7.50	7.50	< 0.005	< 0.005	< 0.005	7.52
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.02	< 0.005	0.23	0.30	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	196	196	0.02	0.03	0.04	206
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.24	1.24	< 0.005	< 0.005	< 0.005	1.25
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	32.5	32.5	< 0.005	0.01	0.01	34.1

3.3. Bedding & Riprap (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.35	0.29	2.33	2.52	0.01	0.07	—	0.07	0.07	—	0.07	—	659	659	0.03	0.01	—	661
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.35	0.29	2.33	2.52	0.01	0.07	—	0.07	0.07	—	0.07	—	659	659	0.03	0.01	—	661
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.20	0.17	1.36	1.47	< 0.005	0.04	—	0.04	0.04	—	0.04	—	384	384	0.02	< 0.005	—	386
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.25	0.27	< 0.005	0.01	—	0.01	0.01	—	0.01	—	63.6	63.6	< 0.005	< 0.005	—	63.9
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.11	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	37.5	37.5	< 0.005	< 0.005	0.02	37.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.26	0.04	2.33	3.06	0.02	0.02	0.76	0.78	0.02	0.20	0.22	—	2,033	2,033	0.22	0.33	0.99	2,138
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.5	35.5	< 0.005	< 0.005	< 0.005	35.6

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.26	0.03	2.46	3.07	0.02	0.02	0.76	0.78	0.02	0.20	0.22	—	2,034	2,034	0.22	0.33	0.03	2,137
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.05	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	20.7	20.7	< 0.005	< 0.005	0.01	20.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.15	0.02	1.41	1.79	0.01	0.01	0.44	0.45	0.01	0.12	0.13	—	1,187	1,187	0.13	0.19	0.25	1,247
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.43	3.43	< 0.005	< 0.005	< 0.005	3.45
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.03	< 0.005	0.26	0.33	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	196	196	0.02	0.03	0.04	207

3.4. Bedding & Riprap (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.35	0.29	2.33	2.52	0.01	0.07	—	0.07	0.07	—	0.07	—	659	659	0.03	0.01	—	661
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.35	0.29	2.33	2.52	0.01	0.07	—	0.07	0.07	—	0.07	—	659	659	0.03	0.01	—	661

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.20	0.17	1.36	1.47	< 0.005	0.04	—	0.04	0.04	—	0.04	—	384	384	0.02	< 0.005	—	386
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.25	0.27	< 0.005	0.01	—	0.01	0.01	—	0.01	—	63.6	63.6	< 0.005	< 0.005	—	63.9
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.11	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	37.5	37.5	< 0.005	< 0.005	0.02	37.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.26	0.04	2.33	3.06	0.02	0.02	0.76	0.78	0.02	0.20	0.22	—	2,033	2,033	0.22	0.33	0.99	2,138
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.5	35.5	< 0.005	< 0.005	< 0.005	35.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.26	0.03	2.46	3.07	0.02	0.02	0.76	0.78	0.02	0.20	0.22	—	2,034	2,034	0.22	0.33	0.03	2,137
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.05	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	20.7	20.7	< 0.005	< 0.005	0.01	20.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.15	0.02	1.41	1.79	0.01	0.01	0.44	0.45	0.01	0.12	0.13	—	1,187	1,187	0.13	0.19	0.25	1,247
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.43	3.43	< 0.005	< 0.005	< 0.005	3.45
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.03	< 0.005	0.26	0.33	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	196	196	0.02	0.03	0.04	207

3.5. Ground Improvement (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	1.50	1.50	—	0.23	0.23	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	1.50	1.50	—	0.23	0.23	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.18	0.92	< 0.005	0.05	—	0.05	0.04	—	0.04	—	160	160	0.01	< 0.005	—	161
Dust From Material Movement	—	—	—	—	—	—	1.07	1.07	—	0.16	0.16	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.22	0.17	< 0.005	0.01	—	0.01	0.01	—	0.01	—	26.6	26.6	< 0.005	< 0.005	—	26.6
Dust From Material Movement	—	—	—	—	—	—	0.20	0.20	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.21	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	75.0	75.0	< 0.005	< 0.005	0.04	75.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	12.9	1.81	117	153	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	101,656	101,656	11.0	16.4	49.3	106,880
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	71.0	71.0	< 0.005	< 0.005	< 0.005	71.2

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	12.8	1.72	123	154	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	101,686	101,686	11.0	16.4	1.29	106,863
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.13	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	50.6	50.6	< 0.005	< 0.005	0.01	50.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	9.17	1.26	85.9	109	0.63	0.63	27.0	27.6	0.63	7.22	7.85	—	72,422	72,422	7.82	11.7	15.2	76,123
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	8.38	8.38	< 0.005	< 0.005	< 0.005	8.41
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	1.67	0.23	15.7	19.9	0.11	0.11	4.93	5.04	0.11	1.32	1.43	—	11,990	11,990	1.29	1.94	2.51	12,603

3.6. Ground Improvement (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	0.59	0.59	—	0.09	0.09	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Roa Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	0.59	0.59	—	0.09	0.09	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.18	0.92	< 0.005	0.05	—	0.05	0.04	—	0.04	—	160	160	0.01	< 0.005	—	161
Dust From Material Movement	—	—	—	—	—	—	0.42	0.42	—	0.06	0.06	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.22	0.17	< 0.005	0.01	—	0.01	0.01	—	0.01	—	26.6	26.6	< 0.005	< 0.005	—	26.6
Dust From Material Movement	—	—	—	—	—	—	0.08	0.08	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.21	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	75.0	75.0	< 0.005	< 0.005	0.04	75.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	12.9	1.81	117	153	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	101,656	101,656	11.0	16.4	49.3	106,880
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	71.0	71.0	< 0.005	< 0.005	< 0.005	71.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	12.8	1.72	123	154	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	101,686	101,686	11.0	16.4	1.29	106,863
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.13	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	50.6	50.6	< 0.005	< 0.005	0.01	50.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	9.17	1.26	85.9	109	0.63	0.63	27.0	27.6	0.63	7.22	7.85	—	72,422	72,422	7.82	11.7	15.2	76,123
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	8.38	8.38	< 0.005	< 0.005	< 0.005	8.41
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	1.67	0.23	15.7	19.9	0.11	0.11	4.93	5.04	0.11	1.32	1.43	—	11,990	11,990	1.29	1.94	2.51	12,603

3.7. Ground Improvement (2041) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	1.50	1.50	—	0.23	0.23	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	1.50	1.50	—	0.23	0.23	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.18	0.92	< 0.005	0.05	—	0.05	0.04	—	0.04	—	161	161	0.01	< 0.005	—	161
Dust From Material Movement	—	—	—	—	—	—	1.07	1.07	—	0.16	0.16	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.22	0.17	< 0.005	0.01	—	0.01	0.01	—	0.01	—	26.6	26.6	< 0.005	< 0.005	—	26.7
Dust From Material Movement	—	—	—	—	—	—	0.20	0.20	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.21	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	74.6	74.6	< 0.005	< 0.005	0.03	74.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	12.0	1.85	112	148	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	98,971	98,971	10.1	16.4	42.6	104,166
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	70.6	70.6	< 0.005	< 0.005	< 0.005	70.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	11.9	1.72	118	148	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	99,003	99,003	10.1	16.4	1.11	104,157
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.13	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	50.5	50.5	< 0.005	< 0.005	0.01	50.7
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	8.53	1.26	82.8	106	0.63	0.63	27.1	27.7	0.63	7.24	7.87	—	70,703	70,703	7.18	11.7	13.1	74,396
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	8.36	8.36	< 0.005	< 0.005	< 0.005	8.39
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	1.56	0.23	15.1	19.3	0.11	0.11	4.94	5.06	0.11	1.32	1.44	—	11,706	11,706	1.19	1.94	2.18	12,317

3.8. Ground Improvement (2041) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	0.59	0.59	—	0.09	0.09	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	0.59	0.59	—	0.09	0.09	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.18	0.92	< 0.005	0.05	—	0.05	0.04	—	0.04	—	161	161	0.01	< 0.005	—	161
Dust From Material Movement	—	—	—	—	—	—	0.42	0.42	—	0.06	0.06	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.22	0.17	< 0.005	0.01	—	0.01	0.01	—	0.01	—	26.6	26.6	< 0.005	< 0.005	—	26.7

Dust From Material Movement	—	—	—	—	—	—	0.08	0.08	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.21	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	74.6	74.6	< 0.005	< 0.005	0.03	74.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	12.0	1.85	112	148	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	98,971	98,971	10.1	16.4	42.6	104,166
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	70.6	70.6	< 0.005	< 0.005	< 0.005	70.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	11.9	1.72	118	148	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	99,003	99,003	10.1	16.4	1.11	104,157
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.13	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	50.5	50.5	< 0.005	< 0.005	0.01	50.7
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	8.53	1.26	82.8	106	0.63	0.63	27.1	27.7	0.63	7.24	7.87	—	70,703	70,703	7.18	11.7	13.1	74,396
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	8.36	8.36	< 0.005	< 0.005	< 0.005	8.39
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	1.56	0.23	15.1	19.3	0.11	0.11	4.94	5.06	0.11	1.32	1.44	—	11,706	11,706	1.19	1.94	2.18	12,317

3.9. Ground Improvement (2042) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	1.50	1.50	—	0.23	0.23	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	1.50	1.50	—	0.23	0.23	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.13	0.11	0.83	0.64	< 0.005	0.03	—	0.03	0.03	—	0.03	—	112	112	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.75	0.75	—	0.11	0.11	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.15	0.12	< 0.005	0.01	—	0.01	0.01	—	0.01	—	18.6	18.6	< 0.005	< 0.005	—	18.7
Dust From Material Movement	—	—	—	—	—	—	0.14	0.14	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.20	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	74.3	74.3	< 0.005	< 0.005	0.03	74.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	11.9	1.85	107	143	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	96,642	96,642	9.13	16.4	37.1	101,808
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.18	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	70.3	70.3	< 0.005	< 0.005	< 0.005	70.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	11.8	1.72	113	144	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	96,676	96,676	9.13	16.4	0.96	101,806
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.09	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.1	35.1	< 0.005	< 0.005	0.01	35.3
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	5.94	0.90	55.9	71.7	0.44	0.44	18.9	19.4	0.44	5.06	5.50	—	48,234	48,234	4.55	8.21	7.99	50,801
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.82	5.82	< 0.005	< 0.005	< 0.005	5.84

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	1.08	0.16	10.2	13.1	0.08	0.08	3.45	3.53	0.08	0.92	1.00	—	7,986	7,986	0.75	1.36	1.32	8,411

3.10. Ground Improvement (2042) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	0.59	0.59	—	0.09	0.09	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.26	0.22	1.66	1.29	< 0.005	0.06	—	0.06	0.06	—	0.06	—	225	225	0.01	< 0.005	—	226
Dust From Material Movement	—	—	—	—	—	—	0.59	0.59	—	0.09	0.09	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Roa Equipment	0.13	0.11	0.83	0.64	< 0.005	0.03	—	0.03	0.03	—	0.03	—	112	112	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.29	0.29	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Roa d Equipm ent	0.02	0.02	0.15	0.12	< 0.005	0.01	—	0.01	0.01	—	0.01	—	18.6	18.6	< 0.005	< 0.005	—	18.7
Dust From Material Movement	—	—	—	—	—	—	0.05	0.05	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.20	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	74.3	74.3	< 0.005	< 0.005	0.03	74.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	11.9	1.85	107	143	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	96,642	96,642	9.13	16.4	37.1	101,808
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.18	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	70.3	70.3	< 0.005	< 0.005	< 0.005	70.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	11.8	1.72	113	144	0.88	0.88	38.0	38.8	0.88	10.2	11.0	—	96,676	96,676	9.13	16.4	0.96	101,806
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.09	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.1	35.1	< 0.005	< 0.005	0.01	35.3

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	5.94	0.90	55.9	71.7	0.44	0.44	18.9	19.4	0.44	5.06	5.50	—	48,234	48,234	4.55	8.21	7.99	50,801
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.82	5.82	< 0.005	< 0.005	< 0.005	5.84
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	1.08	0.16	10.2	13.1	0.08	0.08	3.45	3.53	0.08	0.92	1.00	—	7,986	7,986	0.75	1.36	1.32	8,411

3.11. Earthfill (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	1.35	2.73	< 0.005	0.05	—	0.05	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.34	0.34	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	48.9	48.9	0.01	0.01	0.02	51.4
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	1.35	2.73	< 0.005	0.05	—	0.05	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427

Dust From Material Movement	—	—	—	—	—	—	0.34	0.34	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	48.9	48.9	0.01	0.01	< 0.005	51.4
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.96	1.95	< 0.005	0.03	—	0.03	0.03	—	0.03	—	303	303	0.01	< 0.005	—	304
Dust From Material Movement	—	—	—	—	—	—	0.24	0.24	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	20.0	20.0	< 0.005	2.00	2.00	—	34.8	34.8	< 0.005	0.01	0.01	36.6
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.18	0.36	< 0.005	0.01	—	0.01	0.01	—	0.01	—	50.2	50.2	< 0.005	< 0.005	—	50.4
Dust From Material Movement	—	—	—	—	—	—	0.04	0.04	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	3.65	3.65	< 0.005	0.36	0.36	—	5.76	5.76	< 0.005	< 0.005	< 0.005	6.06
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.63	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	225	225	< 0.005	< 0.005	0.13	226
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.62	0.09	5.60	7.34	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,878	4,878	0.53	0.79	2.37	5,128

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.04	0.57	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	213	213	< 0.005	< 0.005	< 0.005	214
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.61	0.08	5.90	7.37	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,879	4,879	0.53	0.79	0.06	5,128
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.39	0.00	0.00	0.18	0.18	0.00	0.04	0.04	—	152	152	< 0.005	< 0.005	0.04	152
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.44	0.06	4.12	5.24	0.03	0.03	1.30	1.33	0.03	0.35	0.38	—	3,475	3,475	0.38	0.56	0.73	3,653
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.07	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	25.2	25.2	< 0.005	< 0.005	0.01	25.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.08	0.01	0.75	0.96	0.01	0.01	0.24	0.24	0.01	0.06	0.07	—	575	575	0.06	0.09	0.12	605

3.12. Earthfill (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	1.35	2.73	< 0.005	0.05	—	0.05	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.13	0.13	—	0.02	0.02	—	—	—	—	—	—	—

Onsite truck	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	48.9	48.9	0.01	0.01	0.02	51.4
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	1.35	2.73	< 0.005	0.05	—	0.05	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.13	0.13	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	48.9	48.9	0.01	0.01	< 0.005	51.4
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.96	1.95	< 0.005	0.03	—	0.03	0.03	—	0.03	—	303	303	0.01	< 0.005	—	304
Dust From Material Movement	—	—	—	—	—	—	0.09	0.09	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	20.0	20.0	< 0.005	2.00	2.00	—	34.8	34.8	< 0.005	0.01	0.01	36.6
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.18	0.36	< 0.005	0.01	—	0.01	0.01	—	0.01	—	50.2	50.2	< 0.005	< 0.005	—	50.4
Dust From Material Movement	—	—	—	—	—	—	0.02	0.02	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	3.65	3.65	< 0.005	0.36	0.36	—	5.76	5.76	< 0.005	< 0.005	< 0.005	6.06

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.63	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	225	225	< 0.005	< 0.005	0.13	226
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.62	0.09	5.60	7.34	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,878	4,878	0.53	0.79	2.37	5,128
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.04	0.57	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	213	213	< 0.005	< 0.005	< 0.005	214
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.61	0.08	5.90	7.37	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,879	4,879	0.53	0.79	0.06	5,128
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.39	0.00	0.00	0.18	0.18	0.00	0.04	0.04	—	152	152	< 0.005	< 0.005	0.04	152
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.44	0.06	4.12	5.24	0.03	0.03	1.30	1.33	0.03	0.35	0.38	—	3,475	3,475	0.38	0.56	0.73	3,653
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.07	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	25.2	25.2	< 0.005	< 0.005	0.01	25.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.08	0.01	0.75	0.96	0.01	0.01	0.24	0.24	0.01	0.06	0.07	—	575	575	0.06	0.09	0.12	605

3.13. Earthfill (2041) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road	0.21	0.18	1.33	2.73	< 0.005	0.04	—	0.04	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.34	0.34	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	47.6	47.6	< 0.005	0.01	0.02	50.1
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	1.33	2.73	< 0.005	0.04	—	0.04	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.34	0.34	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	47.6	47.6	< 0.005	0.01	< 0.005	50.1
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.95	1.95	< 0.005	0.03	—	0.03	0.03	—	0.03	—	304	304	0.01	< 0.005	—	305
Dust From Material Movement	—	—	—	—	—	—	0.24	0.24	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	20.0	20.0	< 0.005	2.00	2.00	—	34.0	34.0	< 0.005	0.01	0.01	35.8
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.17	0.36	< 0.005	0.01	—	0.01	0.01	—	0.01	—	50.4	50.4	< 0.005	< 0.005	—	50.5

Dust From Material Movement	—	—	—	—	—	—	0.04	0.04	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	3.66	3.66	< 0.005	0.37	0.37	—	5.63	5.63	< 0.005	< 0.005	< 0.005	5.92
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.62	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	224	224	< 0.005	< 0.005	0.10	224
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.58	0.09	5.37	7.09	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,749	4,749	0.48	0.79	2.05	4,998
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.04	0.56	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	212	212	< 0.005	< 0.005	< 0.005	212
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.57	0.08	5.67	7.11	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,751	4,751	0.48	0.79	0.05	4,998
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.39	0.00	0.00	0.18	0.18	0.00	0.04	0.04	—	152	152	< 0.005	< 0.005	0.03	152
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.06	3.97	5.07	0.03	0.03	1.30	1.33	0.03	0.35	0.38	—	3,393	3,393	0.34	0.56	0.63	3,570
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.07	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	25.1	25.1	< 0.005	< 0.005	0.01	25.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.07	0.01	0.72	0.93	0.01	0.01	0.24	0.24	0.01	0.06	0.07	—	562	562	0.06	0.09	0.10	591

3.14. Earthfill (2041) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	1.33	2.73	< 0.005	0.04	—	0.04	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.13	0.13	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	47.6	47.6	< 0.005	0.01	0.02	50.1
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	1.33	2.73	< 0.005	0.04	—	0.04	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.13	0.13	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	47.6	47.6	< 0.005	0.01	< 0.005	50.1
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.95	1.95	< 0.005	0.03	—	0.03	0.03	—	0.03	—	304	304	0.01	< 0.005	—	305
Dust From Material Movement	—	—	—	—	—	—	0.09	0.09	—	0.01	0.01	—	—	—	—	—	—	—

Onsite truck	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	20.0	20.0	< 0.005	2.00	2.00	—	34.0	34.0	< 0.005	0.01	0.01	35.8
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.17	0.36	< 0.005	0.01	—	0.01	0.01	—	0.01	—	50.4	50.4	< 0.005	< 0.005	—	50.5
Dust From Material Movement	—	—	—	—	—	—	0.02	0.02	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	3.66	3.66	< 0.005	0.37	0.37	—	5.63	5.63	< 0.005	< 0.005	< 0.005	5.92
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.62	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	224	224	< 0.005	< 0.005	0.10	224
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.58	0.09	5.37	7.09	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,749	4,749	0.48	0.79	2.05	4,998
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.04	0.56	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	212	212	< 0.005	< 0.005	< 0.005	212
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.57	0.08	5.67	7.11	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,751	4,751	0.48	0.79	0.05	4,998
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.39	0.00	0.00	0.18	0.18	0.00	0.04	0.04	—	152	152	< 0.005	< 0.005	0.03	152
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.06	3.97	5.07	0.03	0.03	1.30	1.33	0.03	0.35	0.38	—	3,393	3,393	0.34	0.56	0.63	3,570
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.07	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	25.1	25.1	< 0.005	< 0.005	0.01	25.2

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.07	0.01	0.72	0.93	0.01	0.01	0.24	0.24	0.01	0.06	0.07	—	562	562	0.06	0.09	0.10	591

3.15. Earthfill (2042) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.17	1.30	2.73	< 0.005	0.04	—	0.04	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.34	0.34	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	46.5	46.5	< 0.005	0.01	0.02	48.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.17	1.30	2.73	< 0.005	0.04	—	0.04	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.34	0.34	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	46.5	46.5	< 0.005	0.01	< 0.005	48.9
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Roa Equipment	0.15	0.12	0.93	1.95	< 0.005	0.03	—	0.03	0.03	—	0.03	—	304	304	0.01	< 0.005	—	305
Dust From Material Movement	—	—	—	—	—	—	0.24	0.24	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	20.0	20.0	< 0.005	2.00	2.00	—	33.2	33.2	< 0.005	0.01	0.01	35.0
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Roa d Equipm ent	0.03	0.02	0.17	0.36	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	50.4	50.4	< 0.005	< 0.005	—	50.5
Dust From Material Movement	—	—	—	—	—	—	0.04	0.04	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	3.66	3.66	< 0.005	0.37	0.37	—	5.49	5.49	< 0.005	< 0.005	< 0.005	5.79
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.61	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	223	223	< 0.005	< 0.005	0.09	223
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.57	0.09	5.14	6.88	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,637	4,637	0.44	0.79	1.78	4,885
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.55	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	211	211	< 0.005	< 0.005	< 0.005	212
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.57	0.08	5.45	6.90	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,639	4,639	0.44	0.79	0.05	4,885
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.38	0.00	0.00	0.18	0.18	0.00	0.04	0.04	—	151	151	< 0.005	< 0.005	0.03	151

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.06	3.84	4.92	0.03	0.03	1.30	1.33	0.03	0.35	0.38	—	3,313	3,313	0.31	0.56	0.55	3,489
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.07	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	25.0	25.0	< 0.005	< 0.005	< 0.005	25.1
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.07	0.01	0.70	0.90	0.01	0.01	0.24	0.24	0.01	0.06	0.07	—	548	548	0.05	0.09	0.09	578

3.16. Earthfill (2042) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.17	1.30	2.73	< 0.005	0.04	—	0.04	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.13	0.13	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	46.5	46.5	< 0.005	0.01	0.02	48.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.17	1.30	2.73	< 0.005	0.04	—	0.04	0.04	—	0.04	—	426	426	0.02	< 0.005	—	427

Dust From Material Movement	—	—	—	—	—	—	0.13	0.13	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	46.5	46.5	< 0.005	0.01	< 0.005	48.9
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.12	0.93	1.95	< 0.005	0.03	—	0.03	0.03	—	0.03	—	304	304	0.01	< 0.005	—	305
Dust From Material Movement	—	—	—	—	—	—	0.09	0.09	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	20.0	20.0	< 0.005	2.00	2.00	—	33.2	33.2	< 0.005	0.01	0.01	35.0
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.17	0.36	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	50.4	50.4	< 0.005	< 0.005	—	50.5
Dust From Material Movement	—	—	—	—	—	—	0.02	0.02	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	3.66	3.66	< 0.005	0.37	0.37	—	5.49	5.49	< 0.005	< 0.005	< 0.005	5.79
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.61	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	223	223	< 0.005	< 0.005	0.09	223
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.57	0.09	5.14	6.88	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,637	4,637	0.44	0.79	1.78	4,885

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.55	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	211	211	< 0.005	< 0.005	< 0.005	212
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.57	0.08	5.45	6.90	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,639	4,639	0.44	0.79	0.05	4,885
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.38	0.00	0.00	0.18	0.18	0.00	0.04	0.04	—	151	151	< 0.005	< 0.005	0.03	151
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.06	3.84	4.92	0.03	0.03	1.30	1.33	0.03	0.35	0.38	—	3,313	3,313	0.31	0.56	0.55	3,489
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.07	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	25.0	25.0	< 0.005	< 0.005	< 0.005	25.1
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.07	0.01	0.70	0.90	0.01	0.01	0.24	0.24	0.01	0.06	0.07	—	548	548	0.05	0.09	0.09	578

3.17. Earthfill (2043) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.20	0.17	1.28	2.72	< 0.005	0.04	—	0.04	0.03	—	0.03	—	426	426	0.02	< 0.005	—	427

Dust From Material Movement	—	—	—	—	—	—	0.34	0.34	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	45.4	45.4	< 0.005	0.01	< 0.005	47.8
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.07	0.14	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	22.5	22.5	< 0.005	< 0.005	—	22.6
Dust From Material Movement	—	—	—	—	—	—	0.02	0.02	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	1.48	1.48	< 0.005	0.15	0.15	—	2.40	2.40	< 0.005	< 0.005	< 0.005	2.52
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.73	3.73	< 0.005	< 0.005	—	3.74
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.27	0.27	< 0.005	0.03	0.03	—	0.40	0.40	< 0.005	< 0.005	< 0.005	0.42
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.54	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	210	210	< 0.005	< 0.005	< 0.005	211

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.52	0.08	5.22	6.69	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,536	4,536	0.44	0.75	0.04	4,769
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	< 0.005	11.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.03	< 0.005	0.27	0.35	< 0.005	< 0.005	0.10	0.10	< 0.005	0.03	0.03	—	240	240	0.02	0.04	0.04	252
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.84	1.84	< 0.005	< 0.005	< 0.005	1.85
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.06	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	39.7	39.7	< 0.005	0.01	0.01	41.7

3.18. Earthfill (2043) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.20	0.17	1.28	2.72	< 0.005	0.04	—	0.04	0.03	—	0.03	—	426	426	0.02	< 0.005	—	427
Dust From Material Movement	—	—	—	—	—	—	0.13	0.13	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	28.3	28.3	< 0.005	2.82	2.82	—	45.4	45.4	< 0.005	0.01	< 0.005	47.8

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.07	0.14	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	22.5	22.5	< 0.005	< 0.005	—	22.6
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	1.48	1.48	< 0.005	0.15	0.15	—	2.40	2.40	< 0.005	< 0.005	< 0.005	2.52
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.73	3.73	< 0.005	< 0.005	—	3.74
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.27	0.27	< 0.005	0.03	0.03	—	0.40	0.40	< 0.005	< 0.005	< 0.005	0.42
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.54	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	210	210	< 0.005	< 0.005	< 0.005	211
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.52	0.08	5.22	6.69	0.04	0.04	1.82	1.86	0.04	0.49	0.53	—	4,536	4,536	0.44	0.75	0.04	4,769
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	< 0.005	11.2

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.03	< 0.005	0.27	0.35	< 0.005	< 0.005	0.10	0.10	< 0.005	0.03	0.03	—	240	240	0.02	0.04	0.04	252
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.84	1.84	< 0.005	< 0.005	< 0.005	1.85
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.06	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	39.7	39.7	< 0.005	0.01	0.01	41.7

3.19. Raise (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.31	0.26	1.53	2.50	0.01	0.07	—	0.07	0.06	—	0.06	—	990	990	0.04	0.01	—	994
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.31	0.26	1.53	2.50	0.01	0.07	—	0.07	0.06	—	0.06	—	990	990	0.04	0.01	—	994
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.22	0.19	1.09	1.78	0.01	0.05	—	0.05	0.04	—	0.04	—	705	705	0.03	0.01	—	708
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.20	0.33	< 0.005	0.01	—	0.01	0.01	—	0.01	—	117	117	< 0.005	< 0.005	—	117
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	22.5	22.5	< 0.005	< 0.005	0.01	22.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	21.3	21.3	< 0.005	< 0.005	< 0.005	21.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	15.2	15.2	< 0.005	< 0.005	< 0.005	15.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.52	2.52	< 0.005	< 0.005	< 0.005	2.52

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.20. Raise (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.31	0.26	1.53	2.50	0.01	0.07	—	0.07	0.06	—	0.06	—	990	990	0.04	0.01	—	994
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.31	0.26	1.53	2.50	0.01	0.07	—	0.07	0.06	—	0.06	—	990	990	0.04	0.01	—	994
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.22	0.19	1.09	1.78	0.01	0.05	—	0.05	0.04	—	0.04	—	705	705	0.03	0.01	—	708
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Roa Equipment	0.04	0.03	0.20	0.33	< 0.005	0.01	—	0.01	0.01	—	0.01	—	117	117	< 0.005	< 0.005	—	117
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	22.5	22.5	< 0.005	< 0.005	0.01	22.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	21.3	21.3	< 0.005	< 0.005	< 0.005	21.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	15.2	15.2	< 0.005	< 0.005	< 0.005	15.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.52	2.52	< 0.005	< 0.005	< 0.005	2.52
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.21. Raise (2041) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.31	0.26	1.50	2.45	0.01	0.06	—	0.06	0.06	—	0.06	—	990	990	0.04	0.01	—	994
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.31	0.26	1.50	2.45	0.01	0.06	—	0.06	0.06	—	0.06	—	990	990	0.04	0.01	—	994
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.12	0.68	1.12	< 0.005	0.03	—	0.03	0.03	—	0.03	—	454	454	0.02	< 0.005	—	455
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.12	0.20	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	75.1	75.1	< 0.005	< 0.005	—	75.3
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	22.4	22.4	< 0.005	< 0.005	0.01	22.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	21.2	21.2	< 0.005	< 0.005	< 0.005	21.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	9.72	9.72	< 0.005	< 0.005	< 0.005	9.75
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.61	1.61	< 0.005	< 0.005	< 0.005	1.61
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.22. Raise (2041) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.31	0.26	1.50	2.45	0.01	0.06	—	0.06	0.06	—	0.06	—	990	990	0.04	0.01	—	994

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.31	0.26	1.50	2.45	0.01	0.06	—	0.06	0.06	—	0.06	—	990	990	0.04	0.01	—	994
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.12	0.68	1.12	< 0.005	0.03	—	0.03	0.03	—	0.03	—	454	454	0.02	< 0.005	—	455
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.02	0.12	0.20	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	75.1	75.1	< 0.005	< 0.005	—	75.3
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	22.4	22.4	< 0.005	< 0.005	0.01	22.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.02	0.02	0.00	0.01	0.01	—	21.2	21.2	< 0.005	< 0.005	< 0.005	21.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	9.72	9.72	< 0.005	< 0.005	< 0.005	9.75
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.61	1.61	< 0.005	< 0.005	< 0.005	1.61
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.23. Sheetpile Driving (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.85	0.71	3.25	6.28	0.02	0.11	—	0.11	0.11	—	0.11	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.85	0.71	3.25	6.28	0.02	0.11	—	0.11	0.11	—	0.11	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.60	0.51	2.31	4.47	0.02	0.08	—	0.08	0.07	—	0.07	—	1,744	1,744	0.07	0.01	—	1,750
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.42	0.82	< 0.005	0.01	—	0.01	0.01	—	0.01	—	289	289	0.01	< 0.005	—	290
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.17	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	60.0	60.0	< 0.005	< 0.005	0.03	60.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.15	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	56.8	56.8	< 0.005	< 0.005	< 0.005	56.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	40.5	40.5	< 0.005	< 0.005	0.01	40.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.71	6.71	< 0.005	< 0.005	< 0.005	6.73
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.24. Sheetpile Driving (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.85	0.71	3.25	6.28	0.02	0.11	—	0.11	0.11	—	0.11	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.85	0.71	3.25	6.28	0.02	0.11	—	0.11	0.11	—	0.11	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.60	0.51	2.31	4.47	0.02	0.08	—	0.08	0.07	—	0.07	—	1,744	1,744	0.07	0.01	—	1,750
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.42	0.82	< 0.005	0.01	—	0.01	0.01	—	0.01	—	289	289	0.01	< 0.005	—	290
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.17	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	60.0	60.0	< 0.005	< 0.005	0.03	60.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.15	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	56.8	56.8	< 0.005	< 0.005	< 0.005	56.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	40.5	40.5	< 0.005	< 0.005	0.01	40.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.71	6.71	< 0.005	< 0.005	< 0.005	6.73
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.25. Sheetpile Driving (2041) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.84	0.71	3.17	6.22	0.02	0.11	—	0.11	0.10	—	0.10	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.84	0.71	3.17	6.22	0.02	0.11	—	0.11	0.10	—	0.10	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.60	0.50	2.26	4.44	0.02	0.08	—	0.08	0.07	—	0.07	—	1,749	1,749	0.07	0.01	—	1,755
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.41	0.81	< 0.005	0.01	—	0.01	0.01	—	0.01	—	290	290	0.01	< 0.005	—	291
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.17	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	59.7	59.7	< 0.005	< 0.005	0.03	59.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.15	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	56.5	56.5	< 0.005	< 0.005	< 0.005	56.7
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	40.4	40.4	< 0.005	< 0.005	0.01	40.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.69	6.69	< 0.005	< 0.005	< 0.005	6.71
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.26. Sheetpile Driving (2041) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.84	0.71	3.17	6.22	0.02	0.11	—	0.11	0.10	—	0.10	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.84	0.71	3.17	6.22	0.02	0.11	—	0.11	0.10	—	0.10	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.60	0.50	2.26	4.44	0.02	0.08	—	0.08	0.07	—	0.07	—	1,749	1,749	0.07	0.01	—	1,755
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.41	0.81	< 0.005	0.01	—	0.01	0.01	—	0.01	—	290	290	0.01	< 0.005	—	291
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.17	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	59.7	59.7	< 0.005	< 0.005	0.03	59.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.15	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	56.5	56.5	< 0.005	< 0.005	< 0.005	56.7
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	40.4	40.4	< 0.005	< 0.005	0.01	40.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.69	6.69	< 0.005	< 0.005	< 0.005	6.71
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.27. Sheetpile Driving (2042) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road	0.84	0.70	3.11	6.21	0.02	0.11	—	0.11	0.10	—	0.10	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.84	0.70	3.11	6.21	0.02	0.11	—	0.11	0.10	—	0.10	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.60	0.50	2.22	4.43	0.02	0.08	—	0.08	0.07	—	0.07	—	1,749	1,749	0.07	0.01	—	1,755
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.40	0.81	< 0.005	0.01	—	0.01	0.01	—	0.01	—	290	290	0.01	< 0.005	—	291
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.16	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	59.5	59.5	< 0.005	< 0.005	0.02	59.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.15	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	56.2	56.2	< 0.005	< 0.005	< 0.005	56.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	40.2	40.2	< 0.005	< 0.005	0.01	40.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.66	6.66	< 0.005	< 0.005	< 0.005	6.68
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.28. Sheetpile Driving (2042) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.84	0.70	3.11	6.21	0.02	0.11	—	0.11	0.10	—	0.10	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Roa Equipment	0.84	0.70	3.11	6.21	0.02	0.11	—	0.11	0.10	—	0.10	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Roa d Equipm ent	0.60	0.50	2.22	4.43	0.02	0.08	—	0.08	0.07	—	0.07	—	1,749	1,749	0.07	0.01	—	1,755
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Roa d Equipm ent	0.11	0.09	0.40	0.81	< 0.005	0.01	—	0.01	0.01	—	0.01	—	290	290	0.01	< 0.005	—	291
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.16	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	59.5	59.5	< 0.005	< 0.005	0.02	59.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.15	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	56.2	56.2	< 0.005	< 0.005	< 0.005	56.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	40.2	40.2	< 0.005	< 0.005	0.01	40.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.66	6.66	< 0.005	< 0.005	< 0.005	6.68
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.29. Sheetpile Driving (2043) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.69	3.01	6.14	0.02	0.10	—	0.10	0.09	—	0.09	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.69	3.01	6.14	0.02	0.10	—	0.10	0.09	—	0.09	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road	0.59	0.49	2.15	4.39	0.02	0.07	—	0.07	0.07	—	0.07	—	1,749	1,749	0.07	0.01	—	1,755
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.39	0.80	< 0.005	0.01	—	0.01	0.01	—	0.01	—	290	290	0.01	< 0.005	—	291
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.16	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	59.2	59.2	< 0.005	< 0.005	0.02	59.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.14	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	56.0	56.0	< 0.005	< 0.005	< 0.005	56.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	40.1	40.1	< 0.005	< 0.005	0.01	40.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.64	6.64	< 0.005	< 0.005	< 0.005	6.66
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.30. Sheetpile Driving (2043) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.69	3.01	6.14	0.02	0.10	—	0.10	0.09	—	0.09	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.69	3.01	6.14	0.02	0.10	—	0.10	0.09	—	0.09	—	2,448	2,448	0.10	0.02	—	2,456
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.59	0.49	2.15	4.39	0.02	0.07	—	0.07	0.07	—	0.07	—	1,749	1,749	0.07	0.01	—	1,755
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipm	0.11	0.09	0.39	0.80	< 0.005	0.01	—	0.01	0.01	—	0.01	—	290	290	0.01	< 0.005	—	291
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.16	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	59.2	59.2	< 0.005	< 0.005	0.02	59.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.14	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	56.0	56.0	< 0.005	< 0.005	< 0.005	56.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	40.1	40.1	< 0.005	< 0.005	0.01	40.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.64	6.64	< 0.005	< 0.005	< 0.005	6.66
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.31. Sheetpile Driving (2044) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.81	0.68	2.92	6.09	0.02	0.09	—	0.09	0.09	—	0.09	—	2,448	2,448	0.10	0.02	—	2,457
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.07	0.31	0.64	< 0.005	0.01	—	0.01	0.01	—	0.01	—	259	259	0.01	< 0.005	—	260
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.06	0.12	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	42.8	42.8	< 0.005	< 0.005	—	43.0
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.14	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	55.8	55.8	< 0.005	< 0.005	< 0.005	56.0

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.91	5.91	< 0.005	< 0.005	< 0.005	5.93
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.98	0.98	< 0.005	< 0.005	< 0.005	0.98
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.32. Sheetpile Driving (2044) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.81	0.68	2.92	6.09	0.02	0.09	—	0.09	0.09	—	0.09	—	2,448	2,448	0.10	0.02	—	2,457
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipm	0.09	0.07	0.31	0.64	< 0.005	0.01	—	0.01	0.01	—	0.01	—	259	259	0.01	< 0.005	—	260
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.06	0.12	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	42.8	42.8	< 0.005	< 0.005	—	43.0
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.14	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	55.8	55.8	< 0.005	< 0.005	< 0.005	56.0
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.91	5.91	< 0.005	< 0.005	< 0.005	5.93
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.98	0.98	< 0.005	< 0.005	< 0.005	0.98
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.33. H-pile (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.20	3.43	0.01	0.07	—	0.07	0.07	—	0.07	—	1,114	1,114	0.05	0.01	—	1,118
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.25	0.40	< 0.005	0.01	—	0.01	0.01	—	0.01	—	128	128	0.01	< 0.005	—	129
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	21.2	21.2	< 0.005	< 0.005	—	21.3
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.5	35.5	< 0.005	< 0.005	< 0.005	35.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.08	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	50.8	50.8	0.01	0.01	< 0.005	53.4
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.09	4.09	< 0.005	< 0.005	< 0.005	4.10
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	5.85	5.85	< 0.005	< 0.005	< 0.005	6.15
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.68	0.68	< 0.005	< 0.005	< 0.005	0.68
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.97	0.97	< 0.005	< 0.005	< 0.005	1.02

3.34. H-pile (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.20	3.43	0.01	0.07	—	0.07	0.07	—	0.07	—	1,114	1,114	0.05	0.01	—	1,118
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.25	0.40	< 0.005	0.01	—	0.01	0.01	—	0.01	—	128	128	0.01	< 0.005	—	129
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	21.2	21.2	< 0.005	< 0.005	—	21.3
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	35.5	35.5	< 0.005	< 0.005	< 0.005	35.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.08	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	50.8	50.8	0.01	0.01	< 0.005	53.4
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.09	4.09	< 0.005	< 0.005	< 0.005	4.10
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	5.85	5.85	< 0.005	< 0.005	< 0.005	6.15
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.68	0.68	< 0.005	< 0.005	< 0.005	0.68
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.97	0.97	< 0.005	< 0.005	< 0.005	1.02

3.35. Steel Pile (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.47	0.39	2.86	4.37	0.01	0.08	—	0.08	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.47	0.39	2.86	4.37	0.01	0.08	—	0.08	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.33	0.28	2.03	3.11	0.01	0.05	—	0.05	0.05	—	0.05	—	881	881	0.04	0.01	—	884
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.37	0.57	< 0.005	0.01	—	0.01	0.01	—	0.01	—	146	146	0.01	< 0.005	—	146

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.02	0.53	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	188	188	< 0.005	< 0.005	0.10	188
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.08	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	50.8	50.8	0.01	0.01	0.02	53.4
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.47	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	177	177	< 0.005	< 0.005	< 0.005	178
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.08	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	50.8	50.8	0.01	0.01	< 0.005	53.4
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.33	0.00	0.00	0.15	0.15	0.00	0.03	0.03	—	127	127	< 0.005	< 0.005	0.03	127
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	36.2	36.2	< 0.005	0.01	0.01	38.1
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	21.0	21.0	< 0.005	< 0.005	0.01	21.0
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	6.00	6.00	< 0.005	< 0.005	< 0.005	6.30

3.36. Steel Pile (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.47	0.39	2.86	4.37	0.01	0.08	—	0.08	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.47	0.39	2.86	4.37	0.01	0.08	—	0.08	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.33	0.28	2.03	3.11	0.01	0.05	—	0.05	0.05	—	0.05	—	881	881	0.04	0.01	—	884
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.37	0.57	< 0.005	0.01	—	0.01	0.01	—	0.01	—	146	146	0.01	< 0.005	—	146
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.04	0.04	0.02	0.53	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	188	188	< 0.005	< 0.005	0.10	188
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.08	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	50.8	50.8	0.01	0.01	0.02	53.4
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.47	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	177	177	< 0.005	< 0.005	< 0.005	178
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.08	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	50.8	50.8	0.01	0.01	< 0.005	53.4
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.33	0.00	0.00	0.15	0.15	0.00	0.03	0.03	—	127	127	< 0.005	< 0.005	0.03	127
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	36.2	36.2	< 0.005	0.01	0.01	38.1
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	21.0	21.0	< 0.005	< 0.005	0.01	21.0
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	6.00	6.00	< 0.005	< 0.005	< 0.005	6.30

3.37. Steel Pile (2041) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	2.81	4.31	0.01	0.07	—	0.07	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	2.81	4.31	0.01	0.07	—	0.07	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.33	0.28	2.01	3.08	0.01	0.05	—	0.05	0.05	—	0.05	—	884	884	0.04	0.01	—	887
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.37	0.56	< 0.005	0.01	—	0.01	0.01	—	0.01	—	146	146	0.01	< 0.005	—	147
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.02	0.52	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	187	187	< 0.005	< 0.005	0.09	187
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	49.5	49.5	0.01	0.01	0.02	52.1
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.04	0.04	0.03	0.47	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	176	176	< 0.005	< 0.005	< 0.005	177
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	49.5	49.5	0.01	0.01	< 0.005	52.1
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.32	0.00	0.00	0.15	0.15	0.00	0.03	0.03	—	126	126	< 0.005	< 0.005	0.03	127
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	35.4	35.4	< 0.005	0.01	0.01	37.2
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	20.9	20.9	< 0.005	< 0.005	< 0.005	21.0
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	5.85	5.85	< 0.005	< 0.005	< 0.005	6.16

3.38. Steel Pile (2041) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	2.81	4.31	0.01	0.07	—	0.07	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.46	0.39	2.81	4.31	0.01	0.07	—	0.07	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.33	0.28	2.01	3.08	0.01	0.05	—	0.05	0.05	—	0.05	—	884	884	0.04	0.01	—	887
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.37	0.56	< 0.005	0.01	—	0.01	0.01	—	0.01	—	146	146	0.01	< 0.005	—	147
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.02	0.52	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	187	187	< 0.005	< 0.005	0.09	187
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	49.5	49.5	0.01	0.01	0.02	52.1
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.47	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	176	176	< 0.005	< 0.005	< 0.005	177
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	49.5	49.5	0.01	0.01	< 0.005	52.1

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.32	0.00	0.00	0.15	0.15	0.00	0.03	0.03	—	126	126	< 0.005	< 0.005	0.03	127
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	35.4	35.4	< 0.005	0.01	0.01	37.2
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	20.9	20.9	< 0.005	< 0.005	< 0.005	21.0
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	5.85	5.85	< 0.005	< 0.005	< 0.005	6.16

3.39. Steel Pile (2042) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	2.78	4.30	0.01	0.07	—	0.07	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	2.78	4.30	0.01	0.07	—	0.07	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.33	0.28	1.98	3.07	0.01	0.05	—	0.05	0.05	—	0.05	—	884	884	0.04	0.01	—	887
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.36	0.56	< 0.005	0.01	—	0.01	0.01	—	0.01	—	146	146	0.01	< 0.005	—	147
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.51	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	186	186	< 0.005	< 0.005	0.07	186
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	48.3	48.3	< 0.005	0.01	0.02	50.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.46	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	176	176	< 0.005	< 0.005	< 0.005	176
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	48.3	48.3	< 0.005	0.01	< 0.005	50.9
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.32	0.00	0.00	0.15	0.15	0.00	0.03	0.03	—	126	126	< 0.005	< 0.005	0.02	126
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	34.5	34.5	< 0.005	0.01	0.01	36.4
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	20.8	20.8	< 0.005	< 0.005	< 0.005	20.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	5.72	5.72	< 0.005	< 0.005	< 0.005	6.02

3.40. Steel Pile (2042) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	2.78	4.30	0.01	0.07	—	0.07	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	2.78	4.30	0.01	0.07	—	0.07	0.07	—	0.07	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.33	0.28	1.98	3.07	0.01	0.05	—	0.05	0.05	—	0.05	—	884	884	0.04	0.01	—	887
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.36	0.56	< 0.005	0.01	—	0.01	0.01	—	0.01	—	146	146	0.01	< 0.005	—	147
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.51	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	186	186	< 0.005	< 0.005	0.07	186
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	48.3	48.3	< 0.005	0.01	0.02	50.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.46	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	176	176	< 0.005	< 0.005	< 0.005	176
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.06	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	48.3	48.3	< 0.005	0.01	< 0.005	50.9
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.32	0.00	0.00	0.15	0.15	0.00	0.03	0.03	—	126	126	< 0.005	< 0.005	0.02	126
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	34.5	34.5	< 0.005	0.01	0.01	36.4
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	20.8	20.8	< 0.005	< 0.005	< 0.005	20.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	5.72	5.72	< 0.005	< 0.005	< 0.005	6.02

3.41. Steel Pile (2043) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.45	0.38	2.73	4.23	0.01	0.07	—	0.07	0.06	—	0.06	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.45	0.38	2.73	4.23	0.01	0.07	—	0.07	0.06	—	0.06	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.32	0.27	1.95	3.02	0.01	0.05	—	0.05	0.04	—	0.04	—	884	884	0.04	0.01	—	887
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.36	0.55	< 0.005	0.01	—	0.01	0.01	—	0.01	—	146	146	0.01	< 0.005	—	147
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.50	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	185	185	< 0.005	< 0.005	0.06	186
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	47.2	47.2	< 0.005	0.01	0.02	49.7
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.45	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	175	175	< 0.005	< 0.005	< 0.005	176
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	47.3	47.3	< 0.005	0.01	< 0.005	49.7
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.31	0.00	0.00	0.15	0.15	0.00	0.03	0.03	—	125	125	< 0.005	< 0.005	0.02	126
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	33.8	33.8	< 0.005	0.01	0.01	35.5
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	20.7	20.7	< 0.005	< 0.005	< 0.005	20.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	5.59	5.59	< 0.005	< 0.005	< 0.005	5.88

3.42. Steel Pile (2043) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road	0.45	0.38	2.73	4.23	0.01	0.07	—	0.07	0.06	—	0.06	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.45	0.38	2.73	4.23	0.01	0.07	—	0.07	0.06	—	0.06	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.32	0.27	1.95	3.02	0.01	0.05	—	0.05	0.04	—	0.04	—	884	884	0.04	0.01	—	887
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.36	0.55	< 0.005	0.01	—	0.01	0.01	—	0.01	—	146	146	0.01	< 0.005	—	147
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.50	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	185	185	< 0.005	< 0.005	0.06	186
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	47.2	47.2	< 0.005	0.01	0.02	49.7

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.45	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	175	175	< 0.005	< 0.005	< 0.005	176
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	47.3	47.3	< 0.005	0.01	< 0.005	49.7
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.31	0.00	0.00	0.15	0.15	0.00	0.03	0.03	—	125	125	< 0.005	< 0.005	0.02	126
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.05	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	33.8	33.8	< 0.005	0.01	0.01	35.5
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.06	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	20.7	20.7	< 0.005	< 0.005	< 0.005	20.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	5.59	5.59	< 0.005	< 0.005	< 0.005	5.88

3.43. Steel Pile (2044) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.45	0.37	2.66	4.19	0.01	0.06	—	0.06	0.06	—	0.06	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.20	0.32	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	94.4	94.4	< 0.005	< 0.005	—	94.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.04	0.06	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	15.6	15.6	< 0.005	< 0.005	—	15.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.45	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	174	174	< 0.005	< 0.005	< 0.005	175
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	46.3	46.3	< 0.005	0.01	< 0.005	48.7
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	13.3	13.3	< 0.005	< 0.005	< 0.005	13.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	3.53	3.53	< 0.005	< 0.005	< 0.005	3.72
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.21	2.21	< 0.005	< 0.005	< 0.005	2.22
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.58	0.58	< 0.005	< 0.005	< 0.005	0.62

3.44. Steel Pile (2044) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.45	0.37	2.66	4.19	0.01	0.06	—	0.06	0.06	—	0.06	—	1,237	1,237	0.05	0.01	—	1,241
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.20	0.32	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	94.4	94.4	< 0.005	< 0.005	—	94.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.04	0.06	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	15.6	15.6	< 0.005	< 0.005	—	15.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.03	0.02	0.45	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	174	174	< 0.005	< 0.005	< 0.005	175
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.05	0.07	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	46.3	46.3	< 0.005	0.01	< 0.005	48.7
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	13.3	13.3	< 0.005	< 0.005	< 0.005	13.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	3.53	3.53	< 0.005	< 0.005	< 0.005	3.72
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.21	2.21	< 0.005	< 0.005	< 0.005	2.22
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.58	0.58	< 0.005	< 0.005	< 0.005	0.62

3.45. Concrete Truck (2040) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Roa Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Roa d Equipm ent	0.12	0.10	0.74	0.57	< 0.005	0.03	—	0.03	0.03	—	0.03	—	100	100	< 0.005	< 0.005	—	101
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Roa d Equipm ent	0.02	0.02	0.13	0.10	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	16.6	16.6	< 0.005	< 0.005	—	16.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.01	0.32	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	113	113	< 0.005	< 0.005	0.06	113
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.28	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	106	106	< 0.005	< 0.005	< 0.005	107
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.02	0.02	0.01	0.20	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	76.0	76.0	< 0.005	< 0.005	0.02	76.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	12.6	12.6	< 0.005	< 0.005	< 0.005	12.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.46. Concrete Truck (2040) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road	0.12	0.10	0.74	0.57	< 0.005	0.03	—	0.03	0.03	—	0.03	—	100	100	< 0.005	< 0.005	—	101
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.10	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	16.6	16.6	< 0.005	< 0.005	—	16.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.01	0.32	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	113	113	< 0.005	< 0.005	0.06	113
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.28	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	106	106	< 0.005	< 0.005	< 0.005	107
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.20	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	76.0	76.0	< 0.005	< 0.005	0.02	76.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	12.6	12.6	< 0.005	< 0.005	< 0.005	12.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.47. Concrete Truck (2041) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.12	0.10	0.74	0.57	< 0.005	0.03	—	0.03	0.03	—	0.03	—	101	101	< 0.005	< 0.005	—	101
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipm	0.02	0.02	0.13	0.10	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	16.6	16.6	< 0.005	< 0.005	—	16.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.01	0.31	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	112	112	< 0.005	< 0.005	0.05	112
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.28	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	106	106	< 0.005	< 0.005	< 0.005	106
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	75.8	75.8	< 0.005	< 0.005	0.02	76.0
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	12.5	12.5	< 0.005	< 0.005	< 0.005	12.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.48. Concrete Truck (2041) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.12	0.10	0.74	0.57	< 0.005	0.03	—	0.03	0.03	—	0.03	—	101	101	< 0.005	< 0.005	—	101
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.10	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	16.6	16.6	< 0.005	< 0.005	—	16.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.01	0.31	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	112	112	< 0.005	< 0.005	0.05	112
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.28	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	106	106	< 0.005	< 0.005	< 0.005	106
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	75.8	75.8	< 0.005	< 0.005	0.02	76.0
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	12.5	12.5	< 0.005	< 0.005	< 0.005	12.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.49. Concrete Truck (2042) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipm	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.12	0.10	0.74	0.57	< 0.005	0.03	—	0.03	0.03	—	0.03	—	101	101	< 0.005	< 0.005	—	101
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.10	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	16.6	16.6	< 0.005	< 0.005	—	16.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.31	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.04	112
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.27	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	105	105	< 0.005	< 0.005	< 0.005	106
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	75.4	75.4	< 0.005	< 0.005	0.01	75.7
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	12.5	12.5	< 0.005	< 0.005	< 0.005	12.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.50. Concrete Truck (2042) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Roa Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Roa d Equipm ent	0.12	0.10	0.74	0.57	< 0.005	0.03	—	0.03	0.03	—	0.03	—	101	101	< 0.005	< 0.005	—	101
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Roa d Equipm ent	0.02	0.02	0.13	0.10	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	16.6	16.6	< 0.005	< 0.005	—	16.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.31	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.04	112
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.27	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	105	105	< 0.005	< 0.005	< 0.005	106
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	75.4	75.4	< 0.005	< 0.005	0.01	75.7
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	12.5	12.5	< 0.005	< 0.005	< 0.005	12.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.51. Concrete Truck (2043) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road	0.12	0.10	0.74	0.57	< 0.005	0.03	—	0.03	0.03	—	0.03	—	101	101	< 0.005	< 0.005	—	101
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.10	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	16.6	16.6	< 0.005	< 0.005	—	16.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.30	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.04	111
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.27	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	105	105	< 0.005	< 0.005	< 0.005	105
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	75.2	75.2	< 0.005	< 0.005	0.01	75.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	12.4	12.4	< 0.005	< 0.005	< 0.005	12.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.52. Concrete Truck (2043) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.12	0.10	0.74	0.57	< 0.005	0.03	—	0.03	0.03	—	0.03	—	101	101	< 0.005	< 0.005	—	101
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipm	0.02	0.02	0.13	0.10	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	16.6	16.6	< 0.005	< 0.005	—	16.7
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.30	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.04	111
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.27	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	105	105	< 0.005	< 0.005	< 0.005	105
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.19	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	75.2	75.2	< 0.005	< 0.005	0.01	75.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	12.4	12.4	< 0.005	< 0.005	< 0.005	12.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.53. Concrete Truck (2044) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.68	0.53	< 0.005	0.03	—	0.03	0.02	—	0.02	—	92.5	92.5	< 0.005	< 0.005	—	92.8
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.12	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	15.3	15.3	< 0.005	< 0.005	—	15.4
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.30	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.03	111
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.27	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	105	105	< 0.005	< 0.005	< 0.005	105
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.17	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	69.0	69.0	< 0.005	< 0.005	0.01	69.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.4	11.4	< 0.005	< 0.005	< 0.005	11.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.54. Concrete Truck (2044) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipm	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.16	0.14	1.04	0.80	< 0.005	0.04	—	0.04	0.04	—	0.04	—	141	141	0.01	< 0.005	—	141
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.68	0.53	< 0.005	0.03	—	0.03	0.02	—	0.02	—	92.5	92.5	< 0.005	< 0.005	—	92.8
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.12	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	15.3	15.3	< 0.005	< 0.005	—	15.4
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.30	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.03	111
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.27	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	105	105	< 0.005	< 0.005	< 0.005	105
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.17	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	69.0	69.0	< 0.005	< 0.005	0.01	69.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.4	11.4	< 0.005	< 0.005	< 0.005	11.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Demo Structures	Demolition	1/3/2040	4/18/2040	5.00	77.0	—
Bedding & Riprap	Site Preparation	1/3/2040	10/25/2040	5.00	213	—
Ground Improvement	Grading	1/3/2040	9/12/2042	5.00	704	—
Earthfill	Grading	1/3/2040	1/27/2043	5.00	801	—
Raise	Building Construction	1/3/2040	8/22/2041	5.00	428	—
Sheetpile Driving	Building Construction	1/3/2040	2/23/2044	5.00	1,081	—
H-pile	Building Construction	1/3/2040	2/29/2040	5.00	42.0	—
Steel Pile	Building Construction	1/3/2040	2/8/2044	5.00	1,070	—
Concrete Truck	Building Construction	1/3/2040	12/1/2044	5.00	1,283	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Demo Structures	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Demo Structures	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Bedding & Riprap	Rubber Tired Dozers	Diesel	Average	1.00	3.00	367	0.40
Bedding & Riprap	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Ground Improvement	Cement and Mortar Mixers	Diesel	Average	4.00	8.00	10.0	0.56
Earthfill	Graders	Diesel	Average	1.00	4.00	148	0.41
Earthfill	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Raise	Cranes	Diesel	Average	1.00	8.00	367	0.29

Sheetpile Driving	Other General Industrial Equipment	Diesel	Average	1.00	8.00	35.0	0.34
Sheetpile Driving	Cranes	Diesel	Average	1.00	8.00	367	0.29
Sheetpile Driving	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
H-pile	Other General Industrial Equipment	Diesel	Average	1.00	8.00	35.0	0.34
H-pile	Cranes	Diesel	Average	1.00	8.00	367	0.29
Steel Pile	Other General Industrial Equipment	Diesel	Average	1.00	16.0	35.0	0.34
Steel Pile	Cranes	Diesel	Average	1.00	8.00	367	0.29
Concrete Truck	Cement and Mortar Mixers	Diesel	Average	1.00	20.0	10.0	0.56

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Demo Structures	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Demo Structures	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Bedding & Riprap	Rubber Tired Dozers	Diesel	Average	1.00	3.00	367	0.40
Bedding & Riprap	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Ground Improvement	Cement and Mortar Mixers	Diesel	Average	4.00	8.00	10.0	0.56
Earthfill	Graders	Diesel	Average	1.00	4.00	148	0.41
Earthfill	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Raise	Cranes	Diesel	Average	1.00	8.00	367	0.29
Sheetpile Driving	Other General Industrial Equipment	Diesel	Average	1.00	8.00	35.0	0.34
Sheetpile Driving	Cranes	Diesel	Average	1.00	8.00	367	0.29
Sheetpile Driving	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38

H-pile	Other General Industrial Equipment	Diesel	Average	1.00	8.00	35.0	0.34
H-pile	Cranes	Diesel	Average	1.00	8.00	367	0.29
Steel Pile	Other General Industrial Equipment	Diesel	Average	1.00	16.0	35.0	0.34
Steel Pile	Cranes	Diesel	Average	1.00	8.00	367	0.29
Concrete Truck	Cement and Mortar Mixers	Diesel	Average	1.00	20.0	10.0	0.56

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demo Structures	—	—	—	—
Demo Structures	Worker	5.00	11.7	LDA,LDT1,LDT2
Demo Structures	Vendor	0.00	8.40	HHDT,MHDT
Demo Structures	Hauling	18.3	20.0	HHDT
Demo Structures	Onsite truck	0.00	—	HHDT
Bedding & Riprap	—	—	—	—
Bedding & Riprap	Worker	5.00	11.7	LDA,LDT1,LDT2
Bedding & Riprap	Vendor	0.00	8.40	HHDT,MHDT
Bedding & Riprap	Hauling	40.0	20.0	HHDT
Bedding & Riprap	Onsite truck	0.00	—	HHDT
Ground Improvement	—	—	—	—
Ground Improvement	Worker	10.0	11.7	LDA,LDT1,LDT2
Ground Improvement	Vendor	0.00	8.40	HHDT,MHDT
Ground Improvement	Hauling	2,000	20.0	HHDT
Ground Improvement	Onsite truck	0.00	—	HHDT
Earthfill	—	—	—	—

Earthfill	Worker	30.0	11.7	LDA,LDT1,LDT2
Earthfill	Vendor	0.00	8.40	HHDT,MHDT
Earthfill	Hauling	96.0	20.0	HHDT
Earthfill	Onsite truck	1.00	19.2	HHDT
Raise	—	—	—	—
Raise	Worker	3.00	11.7	LDA,LDT1,LDT2
Raise	Vendor	0.00	8.40	HHDT,MHDT
Raise	Hauling	0.00	20.0	HHDT
Raise	Onsite truck	0.00	—	HHDT
Sheetpile Driving	—	—	—	—
Sheetpile Driving	Worker	8.00	11.7	LDA,LDT1,LDT2
Sheetpile Driving	Vendor	0.00	8.40	HHDT,MHDT
Sheetpile Driving	Hauling	0.00	20.0	HHDT
Sheetpile Driving	Onsite truck	0.00	—	HHDT
H-pile	—	—	—	—
H-pile	Worker	5.00	11.7	LDA,LDT1,LDT2
H-pile	Vendor	0.00	8.40	HHDT,MHDT
H-pile	Hauling	1.00	20.0	HHDT
H-pile	Onsite truck	0.00	—	HHDT
Steel Pile	—	—	—	—
Steel Pile	Worker	25.0	11.7	LDA,LDT1,LDT2
Steel Pile	Vendor	0.00	8.40	HHDT,MHDT
Steel Pile	Hauling	1.00	20.0	HHDT
Steel Pile	Onsite truck	0.00	—	HHDT
Concrete Truck	—	—	—	—
Concrete Truck	Worker	15.0	11.7	LDA,LDT1,LDT2
Concrete Truck	Vendor	0.00	8.40	HHDT,MHDT
Concrete Truck	Hauling	0.00	20.0	HHDT

Concrete Truck	Onsite truck	0.00	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demo Structures	—	—	—	—
Demo Structures	Worker	5.00	11.7	LDA,LDT1,LDT2
Demo Structures	Vendor	0.00	8.40	HHDT,MHDT
Demo Structures	Hauling	18.3	20.0	HHDT
Demo Structures	Onsite truck	0.00	—	HHDT
Bedding & Riprap	—	—	—	—
Bedding & Riprap	Worker	5.00	11.7	LDA,LDT1,LDT2
Bedding & Riprap	Vendor	0.00	8.40	HHDT,MHDT
Bedding & Riprap	Hauling	40.0	20.0	HHDT
Bedding & Riprap	Onsite truck	0.00	—	HHDT
Ground Improvement	—	—	—	—
Ground Improvement	Worker	10.0	11.7	LDA,LDT1,LDT2
Ground Improvement	Vendor	0.00	8.40	HHDT,MHDT
Ground Improvement	Hauling	2,000	20.0	HHDT
Ground Improvement	Onsite truck	0.00	—	HHDT
Earthfill	—	—	—	—
Earthfill	Worker	30.0	11.7	LDA,LDT1,LDT2
Earthfill	Vendor	0.00	8.40	HHDT,MHDT
Earthfill	Hauling	96.0	20.0	HHDT
Earthfill	Onsite truck	1.00	19.2	HHDT
Raise	—	—	—	—
Raise	Worker	3.00	11.7	LDA,LDT1,LDT2
Raise	Vendor	0.00	8.40	HHDT,MHDT
Raise	Hauling	0.00	20.0	HHDT

Raise	Onsite truck	0.00	—	HHDT
Sheetpile Driving	—	—	—	—
Sheetpile Driving	Worker	8.00	11.7	LDA,LDT1,LDT2
Sheetpile Driving	Vendor	0.00	8.40	HHDT,MHDT
Sheetpile Driving	Hauling	0.00	20.0	HHDT
Sheetpile Driving	Onsite truck	0.00	—	HHDT
H-pile	—	—	—	—
H-pile	Worker	5.00	11.7	LDA,LDT1,LDT2
H-pile	Vendor	0.00	8.40	HHDT,MHDT
H-pile	Hauling	1.00	20.0	HHDT
H-pile	Onsite truck	0.00	—	HHDT
Steel Pile	—	—	—	—
Steel Pile	Worker	25.0	11.7	LDA,LDT1,LDT2
Steel Pile	Vendor	0.00	8.40	HHDT,MHDT
Steel Pile	Hauling	1.00	20.0	HHDT
Steel Pile	Onsite truck	0.00	—	HHDT
Concrete Truck	—	—	—	—
Concrete Truck	Worker	15.0	11.7	LDA,LDT1,LDT2
Concrete Truck	Vendor	0.00	8.40	HHDT,MHDT
Concrete Truck	Hauling	0.00	20.0	HHDT
Concrete Truck	Onsite truck	0.00	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Building Square Footage)	Acres Paved (acres)
Demo Structures	0.00	0.00	0.00	122,360	—
Ground Improvement	5,631,532	5,631,532	0.00	0.00	—
Earthfill	307,450	307,450	128	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Non-applicable. No control strategies activated by user.

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Industrial	0.00	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2040	0.00	204	0.03	< 0.005
2041	0.00	204	0.03	< 0.005
2042	0.00	204	0.03	< 0.005
2043	0.00	204	0.03	< 0.005
2044	0.00	204	0.03	< 0.005

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	5.86	annual days of extreme heat
Extreme Precipitation	7.45	annual days with precipitation above 20 mm
Sea Level Rise	2.64	meters of inundation depth
Wildfire	4.41	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (Radke et al., 2017, CEC-500-2017-008), and consider inundation location and depth for the San Francisco Bay, the Sacramento-San Joaquin River Delta and California coast resulting different increments of sea level rise coupled with extreme storm events. Users may select from four scenarios to view the range in potential inundation depth for the grid cell. The four scenarios are: No rise, 0.5 meter, 1.0 meter, 1.41 meters
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	3.12

AQ-PM	30.9
AQ-DPM	99.7
Drinking Water	15.0
Lead Risk Housing	21.4
Pesticides	0.00
Toxic Releases	48.9
Traffic	32.1
Effect Indicators	—
CleanUp Sites	37.6
Groundwater	36.9
Haz Waste Facilities/Generators	97.3
Impaired Water Bodies	83.0
Solid Waste	0.00
Sensitive Population	—
Asthma	57.6
Cardio-vascular	7.14
Low Birth Weights	56.6
Socioeconomic Factor Indicators	—
Education	6.95
Housing	36.2
Linguistic	46.0
Poverty	40.6
Unemployment	21.1

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—

Above Poverty	67.48363916
Employed	68.92082638
Median HI	87.87373284
Education	—
Bachelor's or higher	96.41986398
High school enrollment	100
Preschool enrollment	74.06646991
Transportation	—
Auto Access	1.488515334
Active commuting	98.87078147
Social	—
2-parent households	70.81996664
Voting	73.24522007
Neighborhood	—
Alcohol availability	4.516874118
Park access	81.35506224
Retail density	99.79468754
Supermarket access	94.25125112
Tree canopy	67.58629539
Housing	—
Homeownership	12.42140382
Housing habitability	64.54510458
Low-inc homeowner severe housing cost burden	96.71500064
Low-inc renter severe housing cost burden	75.56781727
Uncrowded housing	83.16437829
Health Outcomes	—
Insured adults	93.81496215
Arthritis	27.4

Asthma ER Admissions	54.6
High Blood Pressure	22.4
Cancer (excluding skin)	7.2
Asthma	95.7
Coronary Heart Disease	34.0
Chronic Obstructive Pulmonary Disease	81.8
Diagnosed Diabetes	73.9
Life Expectancy at Birth	99.6
Cognitively Disabled	56.3
Physically Disabled	18.0
Heart Attack ER Admissions	84.9
Mental Health Not Good	98.3
Chronic Kidney Disease	55.3
Obesity	95.5
Pedestrian Injuries	95.5
Physical Health Not Good	91.4
Stroke	58.2
Health Risk Behaviors	—
Binge Drinking	65.1
Current Smoker	96.7
No Leisure Time for Physical Activity	90.8
Climate Change Exposures	—
Wildfire Risk	0.0
SLR Inundation Area	9.1
Children	84.0
Elderly	2.9
English Speaking	68.7
Foreign-born	69.6

Outdoor Workers	93.7
Climate Change Adaptive Capacity	—
Impervious Surface Cover	7.4
Traffic Density	45.8
Traffic Access	87.4
Other Indices	—
Hardship	7.5
Other Decision Support	—
2016 Voting	79.3

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	30.0
Healthy Places Index Score for Project Location (b)	91.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Schedule calculated from 2025.02.07_Rec Plan Quantities.xlsx
Land Use	Size of Wharf Area.
Construction: Off-Road Equipment	Pile drivers and hammers are categorized as "other industrial equipment."
Construction: Dust From Material Movement	Information calculated from 2025.02.07_Rec Plan Quantities.xlsx
Construction: Trips and VMT	Information calculated from 2025.02.07_Rec Plan Quantities.xlsx

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

SUB-APPENDIX D.3
NATIONAL HISTORIC PRESERVATION ACT COMPLIANCE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

List of Annexes

D.3.1: Programmatic Agreement

D.3.2: Agency and Tribal Coordination

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.3.1
PROGRAMMATIC AGREEMENT

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

PROGRAMMATIC AGREEMENT
BETWEEN
THE U.S. ARMY CORPS OF ENGINEERS, TULSA DISTRICT AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
REGARDING COMPLIANCE WITH SECTION 106 OF THE
NATIONAL HISTORIC PRESERVATION ACT FOR
PROPOSED IMPLEMENTATION OF THE SAN FRANCISCO WATERFRONT
COASTAL FLOOD STUDY RECOMMENDED PLAN

WHEREAS, the U.S. Army Corps of Engineers, Tulsa District, Southwestern Division (USACE) in partnership with the Port of San Francisco has proposed to design and implement a suite of coordinated, integrated, and interconnected Coastal Flood Risk Management (CFRM) measures (structural and nonstructural) and natural and nature-based features (NNBFs), to be constructed over time in response to increasing flood risk along 7.5 miles of the San Francisco Bay shoreline from Aquatic Park to just south of Heron's Head Park, in the City of San Francisco, San Francisco County, California; and

WHEREAS, the Corps has determined that the proposed project constitutes an undertaking, as defined in 36 CFR § 800.16(y), and therefore, is subject to Section 106 of the National Historic Preservation Act of 1966 (NHPA), 54 U.S.C. § 306108; and

WHEREAS, the CFRM measures and NNBF features will be constructed and implemented over time as designs are finalized, authorization by Congress and funding are acquired, and compliance is achieved, they are hereinafter referred to as *Project Components,* and cumulatively/collectively as the *project* or *undertaking*; and

WHEREAS, a Project Component refers to any CFRM measure or NNBF feature, or a group of measures and/or features planned for concurrent construction or implementation, together with all associated and/or supporting actions (e.g., utility relocation or removal, construction of access roads, staging or storage areas, trenching, scraping, vegetation clearing, etc.); and

WHEREAS, due to the scale, timing, and funding stream of the project, the USACE shall defer and phase the identification of historic properties, assessments of effects, and resolution of the project's adverse effects to historic properties pursuant to 36 CFR § 800.4(b)(2) and 800.5(a)(3), in accordance with this Programmatic Agreement (PA). This will be done in a manner that allows for investigations and reviews to be conducted for each Project Component as they are sequenced, as detailed herein; and

WHEREAS, the purpose of the undertaking is to reduce the risk of coastal flooding to industries and businesses critical to the Nation's economy, and to protect the health and safety of the coastal community, with anticipated long-term benefits to life safety, critical economic and industrial infrastructure, utilities, historic resources, historically disadvantaged communities, recreation, and the local economy, and help to maintain the integrity of San Francisco's historic districts through the management of coastal flooding and relative sea level change; and

WHEREAS, the dates of 2040 and 2090 have been established as milestones for evaluation of the success (or lack thereof) of flood management measures; and

WHEREAS, first actions are to be completed before 2040, at which time the success of the first actions will be evaluated for performance, and, if necessary, a second set of adaptative measures will be refined and implemented; and

WHEREAS, changing conditions may necessitate refinement of flood management measures prior to the target date of 2040, therefore, this PA applies to both first and second measures; and

WHEREAS, the Port of San Francisco (hereinafter "Port") is the Non-Federal Sponsor acting as lead agency for the City and County of San Francisco (CCSF); and

WHEREAS, the USACE has consulted with the Port pursuant to 36 CFR § 800.14 and has invited the Port to participate as an Invited Signatory to this PA and the Port has accepted; and

WHEREAS, USACE has prepared a Final Integrated Feasibility Report and Environmental Impact Statement (IFR-EIS) for the San Francisco Waterfront Coastal Flood Study (SFWCFS) in conjunction with the Port that presents the results of a feasibility study to recommend to Congress alternatives for CFRM; and

WHEREAS, the San Francisco Waterfront Coastal Flood Study is being conducted under the authority of Section 110 of Rivers and Harbors Act of 1950, Section 142 of Water Resources Development Act (WRDA) 1976 as amended by Section 705 of WRDA 1986 and Section 8325 of WRDA 2022, and Section 203 of WRDA 2020; and

WHEREAS, the Port oversees the administration of the public trust for the State of California under the Burton Act, ensuring that public trust uses such as maritime, public access, historic resources, visitor-serving uses, and water-related and dependent uses are preserved and maintained along the waterfront; and

WHEREAS, the Port will provide the necessary lands, easements, relocations, and rights-of-way; and

WHEREAS, the undertaking has the potential to affect historic districts, sites, buildings, structures, objects, and traditional cultural properties that are listed in or eligible for listing in the National Register of Historic Places (NRHP) (hereinafter, "historic properties") pursuant to Section 106 of the National Historic Preservation Act (54 U.S.C. § 306108) (NHPA), as amended, and its implementing regulations (36 CFR Part 800); and

WHEREAS, USACE recognizes that significant historic districts and properties in and around the Port of San Francisco are an integral part of the community's life and character, and preservation of this irreplaceable heritage is in the public interest; and

WHEREAS, USACE shall complete detailed analyses, including compliance with the NHPA and other cultural resources laws and regulations, in the Preconstruction, Engineering, and Design (PED) phase that will inform the final design and, ultimately, construction and implementation of the Project Components; and

WHEREAS, in accordance with section 101(b)(3) of the NHPA, the SHPO reflects the interests of the State and its citizens in the preservation of their cultural heritage and advises and assists Federal agencies in carrying out their section 106 responsibilities to ensure that historic properties are taken into consideration at all levels of planning and development (36 CFR § 800.2(c)(1); and

WHEREAS, while the USACE proposes to follow the *Secretary of the Interior's Standards for Rehabilitation & Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*, it is likely that the undertaking will cause effects to historic properties; and

WHEREAS, the features proposed for this project involve construction activities that have a potential to directly and indirectly affect historic properties in both terrestrial and submerged environments; and

WHEREAS, efforts to identify and evaluate historic properties, determine effects of the undertaking, identify appropriate avoidance, minimization or mitigation, and related consultation shall occur in accordance with this PA as the design for each Project Component is finalized and funded, which may occur over a period of multiple years; and

WHEREAS, for the purposes of this PA, a preliminary Area of Potential Effects (APE) has been established, and includes the project footprint; and

WHEREAS, once the project is authorized and funded, the APE shall be established by the USACE in consultation with the SHPO, Port, and consulting parties to include all areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE shall be reviewed, and if necessary, modified for each Project Component of the undertaking, in consultation, as designs are finalized; and

WHEREAS, the USACE and the SHPO agree that because effects on historic properties cannot be fully determined or resolved prior to the approval of the undertaking, it is necessary to develop this PA for the purpose of identifying and evaluating historic properties, assessing adverse effects, and resolving adverse effects on them accordance with 36 CFR § 800.6, 36 CFR § 800.14(b)(1)(ii), and 36 CFR § 800.14(b)(3); and

WHEREAS, prior to the execution of this PA, extensive research, outreach to potential consulting parties, and incorporation of San Francisco Planning Department data was undertaken to begin to identify historic properties located within the proposed project footprint; and

WHEREAS, based on records searches conducted July 17, 2020, and March 2, 2023, a total of 39 previously identified archaeological resources are located in or adjacent to the project area as

currently proposed. Of these, 32 are historic-age, four are precontact age, and three are multi-component with precontact and historic-age components. One historic site is listed on the NRHP. Two historic archaeological sites have been determined eligible for NRHP inclusion, and 3 have been determined not eligible. The remaining sites have yet to be evaluated for NRHP eligibility (undetermined). Aboveground historic properties include 9 historic districts and 32 individual historic properties listed on the NRHP, and an additional 6 individual properties and five districts that have been determined eligible for NRHP listing; and

WHEREAS, the USACE has invited the Advisory Council on Historic Preservation (Council) to participate as required by 36 CFR § 800.6(a)(1)(i)(C) and the Council, in a letter dated November 14, 2024, has declined to enter into the Section 106 process at this time; and

WHEREAS, there are no federally recognized Tribes within San Francisco County, California, and in accordance with 36 CFR § 800.2(a)(4), the USACE has invited nine non-federally recognized tribes, including the Amah Mutsun Tribal Band of Mission San Juan Bautista, Amah-Mutsun Tribal Band, Association of Ramaytush Ohlone, Costanoan-Rumsen Carmel Tribe, Indian Canyon Mutsun Band of Costanoan, Muwekma Ohlone Indian Tribe of the San Francisco Bay Area, The Ohlone Indian Tribe, Rumšen Am:a Tur:ataj Ohlone, and Wuksache Indian Tribe/Eshom Valley Band to be consulting parties in the Section 106 process and to participate in the development of this PA; and

WHEREAS, in accordance with 36 CFR § 800.2(a)(4), the USACE has invited the California Preservation Foundation, Dogpatch Neighborhood Association, National Park Service, National Trust for Historic Preservation, San Francisco Architectural Heritage, San Francisco Historic Preservation Commission, the San Francisco Planning Department, South Beach Rincon Mission Bay Neighborhood Association, Telegraph Hill Dwellers Neighborhood Association, and Ellen Johnck to participate as consulting parties in the Section 106 process and in the development of this PA; and

WHEREAS, any Federally recognized Tribe or non-Federally recognized Tribe or any party that has been invited to consult on this Undertaking may concur in this PA at any time after its execution, regardless of whether they participated in the development of this PA or whether they previously declined to be a Consulting Party or concur in this PA; and

WHEREAS, USACE shall continue to consult with any Federally recognized or non-Federally recognized Tribes throughout the implementation of this PA regarding effects to historic properties to which any such Tribe may attach religious and cultural significance, notwithstanding any decision by any such Tribe to decline to be a Consulting Party or to concur in the PA; and

WHEREAS, USACE shall consult with the SHPO to identify individuals or organizations to invite as consulting parties; and

WHEREAS, the USACE may identify and invite additional consulting parties as the Section 106 consultation progresses and after the execution of this PA, in which case USACE shall provide

them copies of documentation specified in 36 CFR § 800.11(a) and (e), 800.2(a)(4), 2(c)(5), and 800.6(a)(2), and subject to confidentiality provisions of 36 CFR § 800.11(c)(1); and

WHEREAS, the USACE and the Port have involved the public through two public scoping meetings, two public notices and open comment periods, six workshops, and multiple walking tours and will continue to involve the public through public notices and meetings in accordance with 36 CFR § 800.2(d)(3); and

WHEREAS, this PA shall be applicable to all actions and activities associated with and/or in support of the undertaking (all Project Components), and the USACE shall ensure compliance with Section 106 of the NHPA for the undertaking through the execution and implementation of this PA pursuant to 36 CFR § 800.14(b)(3);

WHEREAS, the Section 106 process is inherently governmental, and the USACE is stipulated herein as the responsible party for tasks identified in this PA, even when the stipulated work (i.e. field investigations) is conducted by others; and

NOW, THEREFORE, the USACE and the SHPO agree that the proposed undertaking shall be implemented and administered in accordance with the following Stipulations in order to take into account the effects of the undertaking on historic properties and to satisfy the USACE's Section 106 responsibilities for all individual aspects of the undertaking.

I. SCOPE OF UNDERTAKING

This PA shall be applicable to all actions and activities associated with and/or in support of the undertaking, including new construction and improvements, for the duration of this agreement. Due to the scale, timing, and funding stream of the project, the USACE shall defer and phase the identification of historic properties, assessments of effects, and resolution of the project's adverse effects to historic properties pursuant to 36 CFR § 800.4(b)(2) and 800.5(a)(4), in accordance with this PA.

II. QUALIFICATIONS AND STANDARDS

A. USACE shall ensure that all work carried out pursuant to this PA shall be done by or under the direct supervision of the appropriate professionals who meet or exceed the *Secretary of the Interior's Professional Qualifications Standards*, consistent with 36 CFR 800.2(a)(1) and 36 CFR § 61) for the associated discipline. The USACE shall ensure that consultants retained for services pursuant to this PA meet these standards.

B. The USACE shall ensure that all work conducted in conjunction with this PA is performed in a manner consistent with the Secretary of Interior's *Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716-44740; September 23, 1983), as amended, or the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (36 CFR § 68), as appropriate. This shall include, the identification of historic properties, assessment of effects, and

development of necessary historic properties treatment plans (HPTPs) for mitigation of adverse effects.

III. DEFINITIONS

A. Project-Specific Definitions: The definitions provided in Appendix C shall apply throughout this Programmatic Agreement (PA) and to all Historic Property Treatment Plans (HPTPs) developed under its authority.

B. Regulatory Definitions: In addition to the project-specific definitions in the Appendix, all definitions set forth in 36 CFR § 800.16 are incorporated herein by reference and apply throughout this PA.

C. Applicability: Pursuant to Stipulation XVIII, the terms and definitions contained in the referenced Appendix are an integral and binding part of this PA and have the same force and effect as if written directly into the body of this Agreement.

IV. REVIEW PROCEDURES

A. Deliverables and documents produced pursuant to the Stipulations of this PA will include, a Research Design, Work Plans, maps, data, images, and technical reports. It is anticipated that deliverables will be produced by consultants, on behalf of USACE. USACE shall review and coordinate deliverables with Signatories, Invited Signatories, and consulting parties in accordance with the following overarching procedures. More details regarding specific types of consultation (such as those regarding the APE, effect findings, and NRHP determinations) or differences in review times are more thoroughly addressed in their corresponding Stipulations.

(1) USACE shall review all preliminary draft documents and deliverables produced in accordance with the stipulations of this Agreement for technical accuracy and completeness and, within 30 calendar days beginning on the date received, except as expressly identified in this Agreement, provide written comments for revision to the consultant prior to external distribution.

(2) Once consultant revisions have adequately addressed USACE comments, USACE shall accept the draft deliverable.

(3) USACE will distribute copies of the draft deliverable to the Signatories, Invited Signatories, and consulting parties for review with a cover letter communicating USACE's conclusions, concurrence, or recommendations relevant to the type of deliverable (including, for example, USACE determinations of National Register eligibility and findings of effects, which are addressed specifically in Stipulations VII, VIII(D), VIII(E), and IX), and requesting comments from all parties and/or concurrence from the SHPO;

(4) The Signatories, Invited Signatories, and consulting parties shall have thirty (30) calendar days from receipt of the Draft and USACE communication to review the draft and submit written comments to the USACE. The USACE may extend this review and comment period up to an additional fifteen (15) calendar days, if requested in writing, unless a shorter extension period is expressly provided for in this Agreement.

(5) USACE shall provide to the SHPO any written comments on the draft received from Invited Signatories and consulting parties within their review timeframe (including any extension). The SHPO shall then have an additional ten (10) calendar days from receipt to review the comments and respond to the USACE's request for comments and/or concurrence.

(6) The USACE shall consider all written comments received from the SHPO, Invited Signatories, and consulting parties during the review period, including those submitted within any approved extension, in determining whether additional revisions of the document or deliverable are required.

a. Should USACE require revisions to a draft deliverable, the consultant will be required to make revisions.

b. Another iteration of the above steps will occur upon receipt of any subsequent draft with substantive changes.

c. Multiple iterations of revised draft reviews (as outlined above) may be necessary to resolve issues.

(7) Once any required revisions from the consultant adequately address requirements, USACE shall accept the draft deliverable as a Final Draft.

(8) USACE shall distribute the Final Draft to the SHPO, Invited Signatories, and consulting parties, together with documentation of all comments received on the draft deliverable(s) and how USACE addressed any issues. USACE determinations of eligibility or findings of effect shall be provided in a cover letter.

(9) Final Distribution of Informational Documents: For planning, administrative, or informational documents that do not require official SHPO concurrence under the procedures of this PA, USACE shall consider the initial distribution to be the final distribution. USACE will provide copies to the SHPO, Invited Signatories, and consulting parties consistent with the confidentiality requirements of 36 CFR § 800.11(c) and Section 304 of the NHPA. For the purposes of this PA, such documents are limited to:

a. Administrative and Project Management Updates: Changes to agency or consulting party Points of Contact (POCs), updates to project construction schedules, notices of project pauses or cancellations, and the addition of Concurring Parties.

b. Finalized Compliance Documentation: Final technical reports, Historic Property Treatment Plans (HPTPs), or Research Designs that have already completed the formal review and comment periods stipulated in this PA.

c. Project Status Notifications: Documentation of how USACE addressed consulting party comments on previous drafts, copies of public notices, curation disposition records, and notifications of minor reductions in the project scope or Area of Potential Effects (APE) that do not alter previous effect findings.

d. Statutory/Emergency Notifications: Initial notifications of unanticipated discoveries or human remains (prior to the formal consultation outlined in Stipulations XII and XIII), and information provided by Tribes (only when explicit permission for distribution is granted by the Tribe).

(10) Should the SHPO determine that a final document or deliverable is not sufficient as set forth in 36 CFR § 800.11(a), the SHPO shall notify the USACE and specify the information needed, and the Signatories shall continue to consult on the document or deliverable in accordance with the timeframes established herein.

(11) The SHPO shall have thirty (30) calendar days from receipt to provide responses to USACE determinations of NRHP eligibility or findings of effect. The USACE shall grant extensions of up to fifteen (15) calendar days upon written request from the SHPO.

(12) Upon SHPO concurrence (or lack of objection) with determinations of eligibility and/or agreement with findings of effects presented in the draft final document or deliverable, USACE shall provide final copies of the deliverable to the SHPO, Invited Signatories, and consulting parties consistent with the confidentiality requirements of 36 CFR 800.11(c) and Section 304 of the NHPA.

(13) If the SHPO, Invited Signatories, and consulting parties fail to respond within the thirty (30) calendar day review period, and do not request an extension, the deliverable and its recommendations shall be deemed adequate. The USACE may finalize the deliverable and proceed in accordance with this PA.

(14) USACE shall provide copies of the final reports of all investigations to PA Signatories, Invited Signatories, and consulting parties. If no historic properties are identified within the APE, the USACE shall document this finding pursuant to 36 CFR § 800.11(d) and distribute the documentation to the SHPO, Invited Signatories, and consulting parties.

B. In the event the SHPO does not concur with determinations of eligibility or disagrees with findings of effects submitted for review, the USACE and SHPO shall consult for a period not to exceed fifteen (15) calendar days (or other mutually agreed timeframe) following receipt of the SHPO's written objection to resolve the issues in dispute. Should the parties be unable to reach agreement, they shall proceed in accordance with 36 CFR 800.5(c)(2) and Stipulation XVI(C)

(Dispute Resolution). The consultation period for resolving disagreements may be extended by mutual consent of the USACE and SHPO.

V. AREA OF POTENTIAL EFFECTS AND PHASING OF INVESTIGATIONS

A. Due to the complexity of the project and yet to be determined sequencing of Project Components, decisions on more precise timing, confirmation of locations, and methods of construction and implementation of CFRM and NNBF cannot be made until designs are more finalized during PED. Therefore, USACE shall phase the identification of historic properties, assessment of effects, and resolution of adverse effects within the APE, pursuant to 36 CFR § 800.4(b)(2), 800.5(a)(3), and 800.14(b)(2), and in accordance with this PA.

B. For the purposes of this PA, USACE has determined a preliminary APE based on feasibility level design that encompasses an area sufficient to accommodate all of the proposed Project Components under consideration as of the date of the execution of this PA (Appendix A, figure 1).

C. As the project moves into PED, prior to finalization of engineering designs and refinement of locations, and prior to the initiation of Project related construction and/or implementation activities, USACE shall determine and document the APE for the Undertaking in consultation with the SHPO in accordance with 36 CFR § 800.4(a) and in coordination with the Port and other consulting parties (Stipulation IV).

D. As currently proposed, the project is anticipated to have adverse effects on historic properties, such as physical destruction of or damage to all or part of a property, alteration of a property, change in character of a property's use, removal of a property, or introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features (36 CFR § 800.5(a)(2)(i)-(vi)).

E. Once a Project Component is defined, USACE shall review the APE in consultation with the SHPO and in coordination with the Port and other consulting parties to determine whether designs for the Project Component may increase or decrease areas of direct and/or indirect effects, and shall modify the APE accordingly. Likewise, if USACE determines that changes to the undertaking require modifications to the currently defined APE, then USACE, in consultation with the SHPO and in coordination with the Port and other consulting parties, shall modify the APE using the following process:

(1) USACE shall notify the consulting parties of any proposed change in the APE by providing a map and a description of the change. These parties shall then have fifteen (15) calendar days, or as extended by the Signatories, to comment on the modified APE.

(2) If the Signatories and Invited Signatories agree to the proposal, or if no comments are received within the allotted review time, then USACE will notify the consulting parties of

the modified APE. USACE will keep copies of the description and the map on file for its administrative record and distribute copies of each to the consulting parties within thirty (30) calendar days of the day upon which agreement to modify the APE was reached, or as extended by the Signatories.

(3) If the Signatories and Invited Signatories cannot agree or USACE receives an objection from a consulting party to a proposal for the modification of the APE, then USACE shall attempt to resolve the dispute in accordance with Stipulation XVI, Dispute Resolution. USACE shall consult with the objecting party and the SHPO for no less than thirty (30) calendar days to resolve the dispute before determining and documenting the modified APE.

(4) The USACE will notify the SHPO, Invited Signatories, and consulting parties of the modified APE. USACE will keep copies of the description and the map on file for its administrative record and distribute copies of each to SHPO and consulting parties within fourteen (14) calendar days of the notification, or as extended by the Signatories.

F. The SHPO, Invited Signatories, or any other consulting party to this PA may propose in writing that the APE established herein be modified by submitting a written request to USACE accompanied by a figure of the proposed modified APE and the reason(s) for the modification. USACE will then notify the SHPO and other consulting parties within seven (7) calendar days that it has received a request for modification. The SHPO and other consulting parties shall then have fifteen (15) calendar days, or as extended by the Signatories, to comment on the proposed modified APE. If the USACE and SHPO agree with the proposal, or if no comments are received within the allotted review time, USACE will follow the steps outlined in Stipulation V(E)2. If the SHPO and USACE cannot come to agreement over the modification or USACE receives an objection from a consulting party, USACE will follow Stipulation XVI(C), Dispute Resolution.

G. Following any modification(s) to the APE that alters the geographic area, USACE shall follow the processes set forth in this PA to identify and evaluate historic properties in the revised APE (Stipulation VI(A) and VI(B)(2) and VII, respectively), assess the effects of the undertaking on same in the revised APE (Stipulation VIII), and provide for the resolution of any adverse effects to same, known or subsequently discovered, per Stipulation IX.

VI. IDENTIFICATION OF HISTORIC PROPERTIES.

A. Inventory. USACE shall make a reasonable and good faith effort to identify and inventory historic properties- defined as sites, buildings, structures, objects, districts, or contributing elements eligible for listing in the National Register of Historic Places (NRHP), within the APE during the PED phase in accordance with Stipulation V(A).

(1) Identification efforts shall commence as early as practicable following project authorization and receipt of funding to support project design refinement and facilitate the avoidance and minimization of adverse effects to historic properties.

(2) Efforts to identify historic properties shall include, at a minimum:

a. Archival and background research;

b. Consultation with consulting parties, Tribes, and other knowledgeable individuals or organizations;

c. Oral history interviews and ethnographic information gathering, where appropriate;

d. Field investigations, including pedestrian survey, subsurface testing, and documentation;

e. Re-recordation and condition assessments of previously identified historic properties, as appropriate; and

f. Monitoring where access or conditions (e.g. unsurveyable areas) require deferred investigation.

B. Research Design**.** Prior to initiating any field investigations, USACE shall prepare and submit a Research Design for review and comment in accordance with Stipulations IV(A) and IV(B) of this PA. The Research Design shall serve as the primary framework guiding all cultural resources investigations associated with the undertaking. USACE shall ensure that the Research Design defines methods appropriate for the identification of historic properties within the APE, taking into account the specific environmental and cultural context of the area. The document shall include sufficient background research and clearly articulated research questions to inform identification, testing, and data recovery efforts.

(1) The Research Design shall address the APE in its entirety and, at a minimum, include:

a. Results of previous cultural resources investigations relevant to the project;

b. Information on known and potential historic properties located within or adjacent to the APE;

c. Expectations for the types and distributions of historic properties that may be present;

d. Proposed field and laboratory methods and techniques;

e. Procedures for artifact, data, and records management;

f. Provisions for the curation of recovered materials and associated records in accordance with 36 CFR Part 79; and

g. Procedures for the treatment of post-review discoveries of historic properties.

(2) USACE shall submit the draft Research Design to the SHPO, Invited Signatories, and consulting parties for review and comment consistent with Stipulation IV(A), though with a difference in review durations. Due to the necessary comprehensiveness of the Research Design, parties shall have sixty (60) calendar days from receipt of the document to provide comments. Upon receipt of comments from consulting parties, USACE shall forward all comments received during this period to the SHPO, who will

have twenty (20) additional calendar days to complete their review. USACE shall consider and address all comments received during the comment period. Following the close of the comment period and resolution of any outstanding issues (Stipulation IV(B)), USACE shall finalize the Research Design and provide copies to all Invited Signatories and consulting parties.

C. Treatment Plans for Inadvertent or Post Review Discoveries

(1) Plan for Inadvertent Discoveries of Human Remains. USACE shall ensure that a Plan for the Treatment of Human Remains or Cultural Items inadvertently discovered during fieldwork, construction, or laboratory analysis is prepared as a stand-alone document per Stipulation XII and included as an Appendix to the Research Design.

(2) Treatment Plan for Post Review Discoveries. USACE shall ensure that a Treatment Plan for Post Review Discoveries of Cultural Resources or Unexpected Effects is prepared as a stand-alone document per Stipulation XIII and included as an Appendix to the Research Design.

D. Level of Effort. USACE shall determine level of effort for field investigations by taking into account past planning, research studies, and inventories presented in the Research Design, the details and magnitude of the Project Component, anticipated and potential effects to historic properties, and the types of historic properties likely to be identified, all of which will be presented in Work Plans per Project Component. The USACE will take local and state laws, standards, and/or guidelines into consideration.

E. Work Plan. Upon refinement of designs for a specific Project Component the USACE shall review the APE and make any necessary modifications (as outlined in Stipulations V(A) and (B)). Prior to initiating investigations to identify historic properties per Project Component, USACE shall submit a Work Plan proposing the appropriate level of effort for identification of historic properties by outlining the methods to be employed for the identification, documentation, and evaluation of historic properties within the refined APE, in accordance with the Stipulations of this PA. Work Plans shall be provided to all reviewing parties for review and comment prior to finalization, consistent with Stipulation IV(A) of this PA.

F. Monitoring. Due to the urban context of the Project, certain portions of the APE may not be fully surveyable prior to construction. Such areas shall be identified through background research and consultation, and described in the Research Design. USACE shall recommend appropriate locations and methods for archaeological monitoring during construction activities. Methods for monitoring within the refined APE shall be included in the Project Component Work Plans.

G. Implementation. Upon authorization and receipt of funding, and prior to initiating construction or any ground-disturbing activities associated with Project Components during the

PED phase, USACE shall ensure all applicable Work Plans and monitoring protocols are fulfilled and inventories/identifications are complete.

H. Documentation. USACE will prepare an inventory report of all identified resources for each Project Component, consistent with the *Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716-44740). Inventories shall include archaeological sites (surface, subsurface, or submerged), features, historical structures and buildings, historical engineering features, cemeteries, landscapes, viewsheds, and TCPs, and USACE shall record historic structures, buildings, objects, and sites using the California Department of Parks and Recreation (DPR) 523 Record forms.

(1) At a minimum, documentation of architectural properties shall include measured drawings, large-format photographs, written history and description, and field records. The documentation of above-ground historic and architectural resources shall follow the guidelines and standards provided in the *Secretary of the Interior's Guidelines for Architectural and Engineering Documentation; The Secretary of the Interior's Standards for Rehabilitation (36 CFR 67): Guidelines for Rehabilitating Historic Buildings, Guidelines on Flood Adaptation for Rehabilitating Historic Buildings, and Guidelines on Sustainability for Rehabilitating Historic Buildings; The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings (Part 1: Preservation and Rehabilitation, Part 2 - Reconstruction and Restoration); and Guidelines for the Treatment of Cultural Landscapes,* as well as those set forth in the California Historical Building Code (CHBC), defined in Sections 18950 to 18961 of Division 13, Part 2.7 of Health and Safety Code (H&SC).

(2) USACE shall submit each inventory to reviewing parties for review and comment in accordance with the process outlined in Stipulation IV(A).

VII. NRHP ELIGIBILITY DETERMINATIONS

A. If cultural resources are identified within the APE, the USACE shall determine their eligibility for inclusion in the NRHP in accordance with the process described in 36 CFR § 800.4(c), 36 CFR § 63, the criteria established in 36 CFR § 60.4, and *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*. NRHP evaluations of cultural resources shall be conducted by individuals who meet or exceed the *Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 Fed. Reg. 44738-44739). Per 36 CFR § 800.4(c)(1), USACE acknowledges that Federally recognized and Non-Federally recognized Tribes possess special expertise in assessing the eligibility of historic properties that may possess religious and cultural significance to them and may be important to their communities, and will consult accordingly. In accordance with Stipulation IV (Review Procedures), USACE shall submit to SHPO, Invited Signatories, and consulting parties a completed inventory and evaluation for each Project Component.

B. Should the USACE and SHPO agree that a cultural resource is or is not eligible, then such consensus shall be deemed conclusive for the purpose of this PA.

C. Should SHPO not concur with USACE's eligibility determinations, the dispute resolution process (Stipulation XVI(C)) below shall be followed. Should USACE and SHPO be unable to come to agreement regarding eligibility, the disagreement shall be resolved pursuant to the process in 36 CFR § 800.4(c)(2), wherein the USACE shall obtain a determination of eligibility from the Keeper of the National Register pursuant to 36 CFR § 63.2(c-e). For cultural resources found not eligible for inclusion in the NRHP, no further protection or consideration of the site will be afforded for NHPA compliance purposes.

VIII. ASSESSMENT OF EFFECTS

A. Effects of the Project Component. Pursuant to 36 CFR § 800.5, the USACE shall make a reasonable and good faith effort to assess effects, as defined in 36 CFR § 800.16(i), on historic properties within the APE per Project Component and will provide a detailed account of effects to the SHPO and consulting parties (Stipulations IV(A), IV(B), and V. The USACE shall apply the criteria of adverse effect, pursuant to 36 CFR § 800.5(a)(1), to all Historic Properties within the APE that will be affected by each Project Component and provide a single finding of effect for each Project Component to the Signatories, Invited Signatories, and consulting parties in accordance with Stipulation IV(A) and IV(B).

(1) If the SHPO determines the applicable documentation standards are not met, the SHPO shall notify the USACE and specify the information needed to meet the standard. At the request of the agency official or any of the consulting parties, the Council shall review any disputes over whether documentation standards are met and provide its views to the agency official and the consulting parties.

B. Finding of no historic properties affected. The USACE may conclude that no historic properties are affected by the Project Component if no historic properties are present in the APE, or the Project Component will have no effect as outlined in 36 CFR § 800.4(d)(1). The USACE shall document the finding in compliance with 36 CFR § 800.11(d) seek SHPO concurrence for its finding of *no historic properties affected* per 36 CFR § 800.4(d)(1) and provide to the Invited Signatories and consulting parties per Stipulations IV(A) and IV(B). The USACE shall make the documentation of the finding available to the public per 36 CFR § 800.4(d), consistent with the confidentiality requirements of 36 CFR § 800.11(c) and Section 304 of the NHPA.

C. Finding of historic properties affected. Should USACE determine that there are historic properties in the APE which may be affected by a Project Component, USACE shall notify all consulting parties and invite their views on the effects pursuant to Stipulation IV(A). USACE shall apply the criteria of adverse effect in accordance with 36 CFR 800.5(a)(1):

Criteria of adverse effect: An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

(1) Finding of no adverse effect. The USACE, in consultation, may propose a finding of no adverse effect if the Project Component's effects do not meet the criteria of 36 CFR § 800.5(a)(1) or if the Project Component is modified to avoid adverse effects (36 CFR § 800.5(b) and 800.6(a)). USACE will consult on the finding in accordance with Stipulation IV(A). The agency official shall maintain a record of the finding and provide information on the finding to the public on request, consistent with the confidentiality provisions of 36 CFR § 800.11(c). If the undertaking will not be conducted as proposed at the time of the finding, USACE shall reopen consultation.

(2) Finding of adverse effect. If USACE determines that a Project Component or feature cannot be modified to avoid or minimize adverse effects, the USACE will make a finding of adverse effect consistent with the criteria in 36 CFR § 800.5(a)(1), and provide for review in accordance with Stipulation IV(A).

D. Avoid, minimize, mitigate. To minimize harm to affected historic properties to the maximum extent possible USACE shall consult with the SHPO, Invited Signatories, and other consulting parties to identify possibilities to avoid, minimize, or mitigate the adverse effects. The USACE will consider redesign of elements of the Project Component in order to avoid and/or minimize adverse effects to historic properties. If it is possible to modify the Project Component to avoid effects to historic properties, a finding of no adverse effect may be made and provided to the consulting parties for review in accordance with Stipulation IV(A). If effects to historic properties are determined to be adverse they will be resolved in accordance with Stipulation IX below.

E. Disagreement with effect finding. If, within the review period as established in Stipulation IV(A), a Signatory or Invited Signatory notifies the USACE in writing that it disagrees with an adequately documented finding and specifies the reasons for the disagreement in the notification, the USACE shall consult with the party to resolve the disagreement. If a resolution cannot be reached, Stipulation XVI(C), Dispute Resolution, will be followed.

F. Cumulative Effects.

(1) USACE shall consider cumulative effects to historic properties as part of its findings of effect for each individual Project Component and will resolve any identified adverse cumulative effects through the procedures outlined in Stipulation IX (Resolution of Adverse Effects). To ensure that USACE has effectively addressed cumulative effects for

the entire undertaking, USACE shall conduct an assessment of cumulative effects on a yearly basis as part of the PA Annual Report (Stipulation XV) and shall include cumulative effects on the agenda for the annual meeting with consulting parties, pursuant to Stipulation XV(C).

(2) Within one (1) year prior to the expiration of this PA (Stipulation XVIII), USACE shall review all Project Components implemented under this Agreement, as well as any past, present, and reasonably foreseeable future actions along the San Francisco Waterfront within the APE. USACE shall determine if the undertaking has resulted in adverse cumulative effects on historic properties. If, through consultation, USACE finds that the undertaking has resulted in previously unmitigated adverse cumulative effects, USACE shall follow the procedures in Stipulation IX to resolve the residual adverse effects prior to the expiration of this PA.

IX. RESOLUTION OF ADVERSE EFFECTS.

A. Resolution of Adverse Effects. If the USACE determines that the undertaking will have an adverse effect on historic properties as measured by criteria in 36 CFR 800.5(a)(1), the USACE shall work with the SHPO, Invited Signatories, and consulting parties to resolve adverse effects in accordance with 36 CFR 800.6. For all historic properties that will be adversely affected, the USACE shall:

(1) Afford the public an opportunity to express their views on resolving adverse effects in a manner appropriate to the magnitude of the project and its likely effects on historic properties.

(2) Work with the SHPO, Invited Signatories, and consulting parties to develop and evaluate alternatives or modifications to the undertaking that could avoid, minimize, or mitigate adverse effects.

(3) Propose alternatives to mitigate unavoidable adverse effects, as outlined in Stipulation X below.

(4) If USACE, SHPO, Invited Signatories, and consulting parties fail to agree on how adverse effects will be resolved, the Dispute Resolution process (Stipulation XVI(C) will be followed.

X. MITIGATION MEASURES AND HISTORIC PROPERTIES TREATMENT PLAN

A. Mitigation If USACE determines that there are no viable plans that would avoid adversely affecting historic properties, the USACE shall work with the SHPO, Invited Signatories, and consulting parties to identify possible mitigation measures to resolve adverse effects. Creative

mitigation measures shall be considered in order to provide meaningful mitigation for the stakeholders and the public. Plans for mitigation will be detailed in a Historic Properties Treatment Plan (HPTP). The HPTP shall outline the minimization and mitigation measures necessary to resolve the adverse effects to historic properties. Development of appropriate measures shall include consideration of historic property types and provisions for avoidance or protection of historic properties where possible.

(1) Mitigation measures. Possible mitigation measures may include, , data recovery; HABS/HAER/HALS documentation; preservation of selected eligible archaeological sites and incorporating them into heritage tourism plans, burying sites under fill or incorporating them into the undertaking; syntheses of existing information of similar archaeological properties, periods, or types in a region or area; educational programs; virtual or web-based reports or educational media that otherwise would not be produced; preservation plans; public education and outreach, including signage and museum exhibits; interpretive documents; the use of digital and other media technologies including films and scanning of resources and artifacts; inclusion of cultural landscape perspectives; use of paleoenvironmental data to develop landscape evolution models for both scientific and public information and/or to inform native planting or landscape plans as part of the undertaking; new historical contexts, including indigenous perspectives, of areas or regions; combinations of these or other mitigations as agreed upon by the Signatories, Invited Signatories, and consulting parties.

(2) HPTPs. HPTPs may be developed per Project Component for individual or multiple historic properties and will include the agreed-upon methods for mitigating adverse effects. The use of a HPTP to resolve adverse effects shall not require the execution of an individual Memorandum of Agreement or PA. HPTPs will be provided for review and comment to reviewing parties in accordance with Stipulation IV(A). Once approved and signed by the USACE approving official, the SHPO, and Invited Signatories, the HPTP will be executed. Once the HPTP is fulfilled, all consulting parties will be provided the opportunity to provide comments on the resulting deliverable(s) in accordance with Stipulation IV(A). The HPTP shall be in effect before construction commences.

B. Statutory Compliance. The mitigation of adverse effects to historic properties shall be funded by USACE and the Port as part of the construction budget. No construction affecting a given historic property shall be allowed to commence until the mitigation for adverse effects to that property has been completed. Mitigation will follow the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; Secretary of the Interior's *Guidelines for Architectural and Engineering Documentation*; The Secretary of the Interior's *Standards for Rehabilitation* (36 CFR 67): Guidelines for Rehabilitating Historic Buildings, *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*, and *Guidelines on Sustainability for Rehabilitating Historic Buildings*; The Secretary of the Interior's *Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings (Part 1: Preservation and Rehabilitation, Part 2 - Reconstruction and Restoration)*; and *Guidelines for the Treatment of Cultural Landscapes*, as well as those set forth in the California Historical Building Code (CHBC), defined in Sections 18950 to 18961 of Division 13, Part 2.7 of

Health and Safety Code (H&SC).

XI. CURATION AND DISPOSITION OF RECOVERED MATERIALS, RECORDS, AND REPORTS

A. Curation. The USACE shall ensure that all archeological materials and associated records owned by the U.S Government, the State of California, or any non-federal sponsor, which result from identification, evaluation, and treatment efforts conducted under this PA, are accessioned into a curation facility in accordance with the standards of 36 CFR Part 79, except as specified in Stipulation XII for burials. USACE shall ensure that if any cultural materials unrelated to burials and associated records resulting from identification, evaluation, and treatment of historic properties conducted under this Agreement are to be curated, they shall be maintained in accordance with 36 CFR Part 79 as detailed in the Research Design. Objects or soils associated with a historic property of religious and cultural significance shall only be curated following consultation. Archaeological items and materials from privately owned lands shall be returned to their owners upon completion of analyses required for Section 106 compliance under this PA.

B. Reports. The USACE shall provide copies of final technical reports of investigations and mitigation to the Signatories, Invited Signatories, and Consulting Parties, as well as additional copies for public distribution. In cases where the release of location information may cause harm to the Historic Property, this information will be withheld from the public in accordance with Section 304 of the NHPA (54 U.S.C. § 307103).

C. Confidentiality. Information regarding the nature and location of sites and other data that may be of a confidential or sensitive nature pursuant to 36 CFR § 800.11(c) and Section 304 of the NHPA shall be limited to appropriate USACE personnel, USACE contractors, Indian tribes, the SHPO, and those parties involved in planning, reviewing and implementing this PA in accordance with Section 304 of the NHPA (54 U.S.C. § 307103).

XII. INADVERTENT DISCOVERY OF BURIALS AND/OR HUMAN REMAINS

A. Treatment Plan for Inadvertent Discovery of Human Remains. In consultation with tribes who have expressed interest in the APE and the SHPO, USACE shall develop a *Treatment Plan for Inadvertent Discovery of Human Remains* (Treatment Plan) prior to any cultural resources investigations or construction. The Treatment Plan will be included as an Appendix to the Research Design which, along with this PA, shall guide cultural resources investigations and Section 106 compliance for the entirety of the project as outlined in Stipulation VI(B). Treatment of human remains will comply with the Advisory Council's *Policy Statement on Burial Sites, Human Remains and Funerary Objects* (March 2023). The Port and San Francisco Planning cultural resources staff as well as professionals meeting the Secretary of the Interior's Standards who are familiar with the cultural heritage and burial practices of the region will be afforded an opportunity to comment.

The USACE shall treat human remains encountered during any activities of this undertaking on non-federal lands in accordance with the requirements of Section 7050.5 of the California State

Health and Human Safety Code, and Section 5097.98 of the Public Resources Code. If human remains and/or burials are discovered on federally owned land or in the context of laboratory analyses and/or preparation of the collections for curation associated with this federal action after having been removed from non-federal land, USACE will comply with the Native American Graves and Repatriation Act (25 USC § 3001 et seq.)(NAGPRA) and its implementing regulations as set forth in 43 CFR Part 10.

B. Definitions. For purposes of this project, this PA adopts the definitions of "human remains" and "funerary objects" found at 43 CFR § 10.2(d)(1-2) in the implementing regulations for the NAGPRA, and the term "burial" as presented in the Treatment Plan for all inadvertent discoveries on Federal lands or Tribal lands. Those definitions are as follows:

(1) Human remains means any physical part of the body of a Native American individual.

a. Human remains reasonably believed to be comingled with other materials (such as soil or faunal remains) may be treated as human remains.

b. Human remains incorporated into a funerary object, sacred object, or object of cultural patrimony are considered part of the cultural items rather than human remains.

c. Human remains incorporated into an object or item that is not a funerary object, sacred object, or object of cultural patrimony are considered human remains.

(2) A funerary object is any object connected, either at the time of death or later, to a death rite or ceremony of a Native American culture according to the Native American traditional knowledge of a lineal descendant, Indian Tribe, or Native Hawaiian organization. This term does not include any object returned or distributed to living persons according to traditional custom after a death rite or ceremony. Funerary objects are either associated funerary objects or unassociated funerary objects.

a. Associated funerary object means any funerary object related to human remains that were removed and the location of the human remains is known. Any object made exclusively for burial purposes or to contain human remains is always an associated funerary object regardless of the physical location or existence of any related human remains.

b. Unassociated funerary object means any funerary object that is not an associated funerary object and is identified by a preponderance of the evidence as one or more of the following:

(i) Related to human remains but the human remains were not removed, or the location of the human remains is unknown,

(ii) Related to specific individuals or families,
(iii) Removed from a specific burial site of an individual or individuals with cultural affiliation to an Indian Tribe or Native Hawaiian organization, or
(iv) Removed from a specific area where a burial site of an individual or individuals with cultural affiliation to an Indian Tribe or Native Hawaiian organization is known to have existed, but the burial site is no longer extant.

(3) A cultural item is defined as a funerary object, sacred object, or object of cultural patrimony according to the Native American traditional knowledge of a lineal descendant, Indian Tribe, or Native Hawaiian organization. The USACE shall treat Native American human remains, objects of cultural patrimony, and sacred objects encountered during any activities of this undertaking with utmost respect and dignity.

(4) Burials. While human remains may have been buried intentionally or unintentionally by natural forces, all human bone/remains will be treated as burials for the purposes of the Treatment Plan. Due to the fragile nature of human bone, burials may also be evidenced by a burial pit outline, coffin hardware, associated items which may indicate a burial house, a cluster of whole or broken pottery, a mound or cairn, or other evidence provided in consultation or through research.

C. Discovery. Should burials, evidence of burials, and/or human remains be encountered during historic properties investigations or construction activities conducted on federal or Tribal lands pursuant to this PA, the USACE shall:

(1) Ensure that all ground disturbing activities cease within 100 feet of the human remains and any funerary or suspected funerary objects;

(2) Cover and/or protect remains in place in such a way that minimizes further exposure of and damage to the remains;

(3) Ensure that the site is secured from further disturbance or vandalism;

(4) Immediately notify local law enforcement officials (Office of the Chief Medical Examiner);

(5) If the remains are determined to not be associated with a criminal case, but are historic or prehistoric, the USACE shall initiate consultation with the SHPO and Tribes within 48 hours to develop a Plan of Action (POA) as outlined in the *Treatment Plan for Inadvertent Discovery of Human Remains*.

(6) The USACE shall ensure that the POA is fully implemented. If the remains are not Native American, the appropriate local authority shall be consulted to determine final disposition of the remains.

(7) If the remains are most likely to be Native American, tribes with claimed interest in the area shall be contacted. Should preservation in place not be possible, an affiliated tribe or lineal descendent shall be identified, and consultation will determine the appropriate course of action for treatment and disposition of the ancestor.

XIII. POST REVIEW DISCOVERIES OF CULTURAL RESOURCES OR UNEXPECTED EFFECTS

A. Post Review Discovery. A post-review discovery is defined as the identification of previously unknown historic properties within the context of the undertaking other than those planned as archaeological excavations. Previously unidentified and unanticipated cultural resources discovered while conducting project activities shall be subject to the terms of the *Post Review Discovery Plan for Cultural Resources*, drafted in consultation and included with the Research Design (Stipulation VI(B)(2)), both of which will be initiated when the project is authorized and funding has been received, and executed prior to any project related activities. Pursuant to 36 CFR § 800.13(b)(3), if cultural resources are discovered or unanticipated effects to historic properties are found after construction has commenced, the USACE shall stop construction within 100 feet of the discovery in the affected area and implement the Post Review Discovery Plan.

XIV. COMMUNICATIONS

Postal (letters) or letters conveyed by electronic mail (email) may serve as the official correspondence method for all communications regarding this PA and its provisions. See Appendix C for a list of contacts and email addresses. Contact information in Appendix C may be updated as needed without an amendment to this PA. It is the responsibility of each party to the PA to immediately inform the USACE of any change in name, address, email address, or phone number of any point-of-contact. The USACE shall forward this information to the SHPO, Invited Signatories, consulting parties by email and will provide a hard copy via postal mail upon request.

XV. PA MONITORING AND REPORTING

A. The USACE shall prepare an Annual Report documenting actions carried out pursuant to this PA. The reporting period shall commence one year from the date of execution. The Annual Report shall be distributed to the SHPO, Invited Signatories, and consulting parties to this PA.

B. The Annual Report shall address issues and describe actions and accomplishments over the past year, including, as applicable:

(1) Historic property surveys and results;

(2) Status of treatment and mitigation activities;

(3) Ongoing and completed public education activities;

(4) Any issues that are affecting or may affect the ability of the federal agency to continue to meet the terms of this PA;

(5) Any disputes and objections received, and how they were resolved;

(6) Any additional parties who have become Signatory or concurring parties to this PA in the past year.

(7) Any cumulative effects, as described in Stipulation VIII(F).

C. The USACE shall coordinate a meeting of the Signatories, Invited Signatories, and consulting parties to be scheduled within ninety (90) calendar days of distribution of the Annual Report, or another mutually agreed upon date, to discuss activities carried out pursuant to this PA during the preceding year and activities scheduled for the upcoming year. This meeting, should it be deemed unnecessary, may be cancelled by mutual consent of the Signatory Parties.

D. All consulting parties shall withhold site location information or other data that may be of a confidential or sensitive nature pursuant to 36 CFR 800.11(c).

XVI. AMENDMENTS, DISPUTES, AND TERMINATION

A. Amendments. Any party to the PA may propose to the other parties that it be amended, whereupon the parties will consult in accordance with 36 CFR § 800.6(c)(7) and Stipulation IV(B) to consider such an amendment. This PA shall be considered amended only upon the written agreement of the Signatories and Invited Signatories, and the USACE shall file a copy of the amended PA with the ACHP, as required by 36 CFR § 800.6(c)(7). The amendment will be effective on the date the copy signed by the signatories is filed with the Council. If the PA is not amended, it may be terminated by a Signatory in accordance with Stipulation XVI(D) of this PA.

B. Changes in the Undertaking. If construction or implementation of the undertaking has not commenced, and the USACE determines that it will not conduct the undertaking as originally coordinated, the USACE shall notify the SHPO, Signatories, and all consulting parties to this PA in writing of the proposed change in scope, provide maps illustrating the proposed changes to the undertaking, and initiate coordination under the terms of this Agreement as outlined in Stipulation IV and thereafter.

C. Dispute resolution. Disputes regarding the completion of the terms of this agreement (any actions proposed or the manner in which the terms of this PA are implemented) shall be resolved by the signatories. If the signatories cannot come to an agreement regarding a dispute, any one of the signatories may request the participation of the Council in resolving the dispute in accordance with the procedures outlined in 36 CFR § 800.9. If USACE determines that such objection cannot be resolved, and further consultation will not yield further results, the USACE shall:

(1) Forward all documentation relevant to the dispute, including the USACE's proposed resolution, to the ACHP. The ACHP shall provide the USACE with its advice on the resolution of the objection within thirty (30) calendar days of receiving adequate documentation. Fifteen (15) day extensions of this timeframe shall be granted upon request. Prior to reaching a final decision on the dispute, the USACE shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP and/or consulting parties and provide them with a copy of this written response within fifteen (15) calendar days of receipt of the Council's comments.

(2) If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time-period, or within an extension of the review period, the USACE shall make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, within fifteen (15) calendar days after the end of the review period, USACE shall prepare a written response that takes into account any timely comments regarding the dispute from the consulting parties to the PA and provide them and the ACHP with a copy of such written response.

(3) The USACE's responsibilities to carry out all other actions subject to the terms of this PA that are not the subject of the dispute remain unchanged.

D. Termination of PA. If, within the review period, or extension of the review period, an amendment cannot be reached, or a Signatory or Invited Signatory proposes termination of this PA for other reasons, the Signatory proposing termination shall, in writing, notify the other parties to this PA, explain the reasons for proposing termination, and consult in accordance with Stipulation IV(B) to seek alternatives to termination.

(1) Should such consultation result in an agreement, the parties shall proceed in accordance with the terms of that agreement and shall prepare any amendment to the PA, if needed, in accordance with the terms of Stipulation XVI(A).

(2) Should no agreement be reached, and the PA not amended as provided for in Stipulation XVI(A), the PA may be terminated.

(3) If this PA is terminated, and prior to work continuing on the Undertaking, USACE must either (a) execute a new PA pursuant to 36 CFR § 800.6 or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. USACE shall notify the Signatories as to the course of action it will pursue.

(4) Consultation shall not be required if the USACE proposes termination because the Undertaking no longer meets the definition set forth at 36 CFR § 800.16(y).

XVII. ANTI-DEFICIENCY ACT

A. The USACE's obligations under this PA are subject to the availability of appropriated funds and the Stipulations of this PA are subject to the provisions of the Anti-Deficiency Act. The USACE shall make reasonable and good faith efforts to secure the necessary funds to implement this PA in its entirety. If compliance with the Anti-Deficiency Act alters or impairs the USACE's ability to implement the Stipulations of this agreement, the USACE shall consult in accordance with the amendment and termination procedures found at Stipulations XV(A) and XV(D) of this agreement.

XVIII. APPENDICES AND INCORPORATION BY REFERENCE

A. Incorporation by Reference: All appendices attached to this PA are hereby incorporated by reference and made an integral and binding part of this PA. The terms, conditions, definitions, and protocols contained within the appendices shall have the same force and effect as if they were written directly into the main body of this Agreement. A failure to comply with the requirements of any appendix shall be considered a failure to comply with this PA.

B. Modification of Appendices: The Signatories may revise or update the Appendices without a formal amendment to the PA itself. USACE shall notify all consulting parties of any proposed changes to an appendix in writing. The consulting parties shall have thirty (30) calendar days to review and concur with the proposed changes. If no consulting party objects within the review period, the revised appendix shall be considered adopted.

XIX. DURATION

A. This PA is in effect upon its execution and filing with the ACHP. Unless amended pursuant to Stipulation XVI(A), this Agreement shall remain in force for ten (10) years after the effective date.

B. If the terms of this PA are not carried out within ten (10) years following its date of execution by the Signatory Parties, the USACE will consult with the other parties to this PA to reconsider its terms at least sixty (60) calendar days prior to its expiration. Reconsideration may include the continuation of the PA as originally executed, amendment of the PA in accordance with Stipulation XVI(A) or termination (Stipulation XVI(D). In the event of termination, the USACE will notify the other PA parties in writing and, if it chooses to continue with the undertaking, shall reinitiate review of the undertaking in accordance with 36 CFR Part 800.

XX. Execution of this PA and implementation of its terms evidences that the USACE has afforded the Council an opportunity to comment on the undertaking and its effects on historic properties, and that the USACE has taken into account those effects and fulfilled Section 106 responsibilities regarding the undertaking.

XIXXXI. Authorizing Signatures

In witness hereof, the following authorized representatives of the Signatories have signed their names on the dates indicated using counterpart signature pages, thereby executing this Agreement. This Agreement may be signed by any Invited Signatories or Concurring Parties using counterpart signature pages. The USACE will distribute copies of all signed pages to the Signatories once this Agreement is fully executed.

Signature Page for the United States Army Corps of Engineers

PROGRAMMATIC AGREEMENT
BETWEEN
THE U.S. ARMY CORPS OF ENGINEERS, TULSA DISTRICT AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
REGARDING COMPLIANCE WITH SECTION 106 OF THE
NATIONAL HISTORIC PRESERVATION ACT FOR
PROPOSED IMPLEMENTATION OF THE SAN FRANCISCO WATERFRONT
COASTAL FLOOD STUDY RECOMMENDED PLAN

Signatory:

7/1/26

Colonel Jessica D. Goffena, District Commander **Date**

Signature Page for California State Historic Preservation Officer

PROGRAMMATIC AGREEMENT
BETWEEN
THE U.S. ARMY CORPS OF ENGINEERS, TULSA DISTRICT AND
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PROPOSED IMPLEMENTATION OF THE SAN FRANCISCO WATERFRONT
COASTAL FLOOD STUDY RECOMMENDED PLAN

Signatory:

Julianne Polanco, California SHPO **Date**

Signature Page for Port of San Francisco

PROGRAMMATIC AGREEMENT
BETWEEN
THE U.S. ARMY CORPS OF ENGINEERS, TULSA DISTRICT AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
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PROPOSED IMPLEMENTATION OF THE SAN FRANCISCO WATERFRONT
COASTAL FLOOD STUDY RECOMMENDED PLAN

Invited Signatory:

_____

Port of San Francisco **Date**

APPENDIX A
PROJECT SUMMARY

The U.S. Army Corps of Engineers (USACE) has prepared an Integrated Feasibility Report and Environmental Impact Statement for the San Francisco Waterfront Coastal Flood Study that presents the results of a study to recommend to Congress coastal flood risk management alternatives on the San Francisco Peninsula in the City and County of San Francisco, California. The study addresses the feasibility of alternatives that would reduce the risk of coastal flooding to industries and businesses critical to the Nation's economy and protect the health and safety of the coastal community.[1] The Recommended Plan measures have been developed to a feasibility level of design (i.e. estimates and design level that is not detailed enough for a construction-ready project) based on currently available data and information developed during plan formulation. Compliance with the National Historic Preservation Act (NRHP) will be guided by this Programmatic Agreement (PA) and will occur once the project is authorized and funded by Congress and as designs are refined. Appendix B "Culture History and Literature Review" details what is known to date regarding the project area.

Cultural resources investigations will be completed pursuant to the PA, in compliance with the NHPA Section 106, to identify and evaluate sites and structures. Should a property be determined eligible for listing in the National Register of Historic Places (NRHP), potential adverse effects, if any, will be identified. Adverse effects will be avoided and minimized to the extent possible, and mitigation of remaining adverse impacts will be conducted prior to implementation or construction of any of the project components. All mitigation will be conducted in accordance with Secretary of the Interior's guidance, including:

(1) *Standards and Guidelines for Archeology and Historic Preservation*;
(2) *Guidelines for Architectural and Engineering Documentation*;
(3) *Standards for Rehabilitation (36 CFR 67): Guidelines for Rehabilitating Historic Buildings, Guidelines on Flood Adaptation for Rehabilitating Historic Buildings, and Guidelines on Sustainability for Rehabilitating Historic Buildings;*
(4) *Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings (Part 1: Preservation and Rehabilitation, Part 2 - Reconstruction and Restoration);*
(5) *Guidelines for the Treatment of Cultural Landscapes*

[1] This study is being conducted under the authority of Section 110 of the Rivers and Harbors Act of 1950, Section 142 of Water Resources Development Act (WRDA) 1976 as amended by Section 705 of WRDA 1986 and Section 8325 of WRDA 2022, and Section 203 of WRDA 2020, which authorize an investigation of the feasibility of providing protection against tidal and fluvial flooding and measures to adapt to rising sea levels in the City and County of San Francisco.

Work will also comport with the *California Historical Building Code* (CHBC), defined in Sections 18950 to 18961 of Division 13, Part 2.7 of Health and Safety Code (H&SC).

The Recommended Plan adaptively manages coastal flood risk through a suite of structural and non-structural measures that function as a system and are implemented over time, based on the risk of rising sea levels along 7.5 miles of the San Francisco Waterfront extending from Aquatic Park in the northeast to Heron's Head Park in the south. The undertaking is proposed in response to increasing flood risk and will include coastal and combined flood risk management measures consisting of three basic types: structural measures, nonstructural measures, and nature and nature-based features (NNBF), defined below.

(1) Structural measures are physical modifications such as flood barriers, armoring, and pumping and draining designed to reduce the frequency of damaging levels of flood inundation. That is, they modify the characteristics of the floods. They may be used alone or in combination with other measures. In the context of coastal flooding, structural measures are often employed to defend against overtopping (seawalls and bulkhead walls, floodwalls, levees, deployable closure structures); reduce wave hazards (dissipation, breakwaters); reduce erosion (armoring); and facilitate the flow, storage, or removal of water that has overtopped the shoreline (pump stations and inland drainage infrastructure).

(2) Nonstructural measures reduce consequences of flooding and allow water to disperse naturally rather than constructing traditional structural solutions. Nonstructural measures are permanent or contingent measures applied to an existing structure and/or its contents to prevent or provide resistance to damage from flooding. Nonstructural measures differ from structural measures in that they focus on reducing the consequences of flooding instead of focusing on reducing the flow of water. Nonstructural measures include both physical and nonphysical measures. Since these apply to existing structures, they may be both potential flood mitigation measures and impacts to historic properties.

(a) Physical nonstructural measures include modifications to a property or structure such as raising of structures, dry and wet floodproofing, basement filling/removal, relocation, and acquisition.

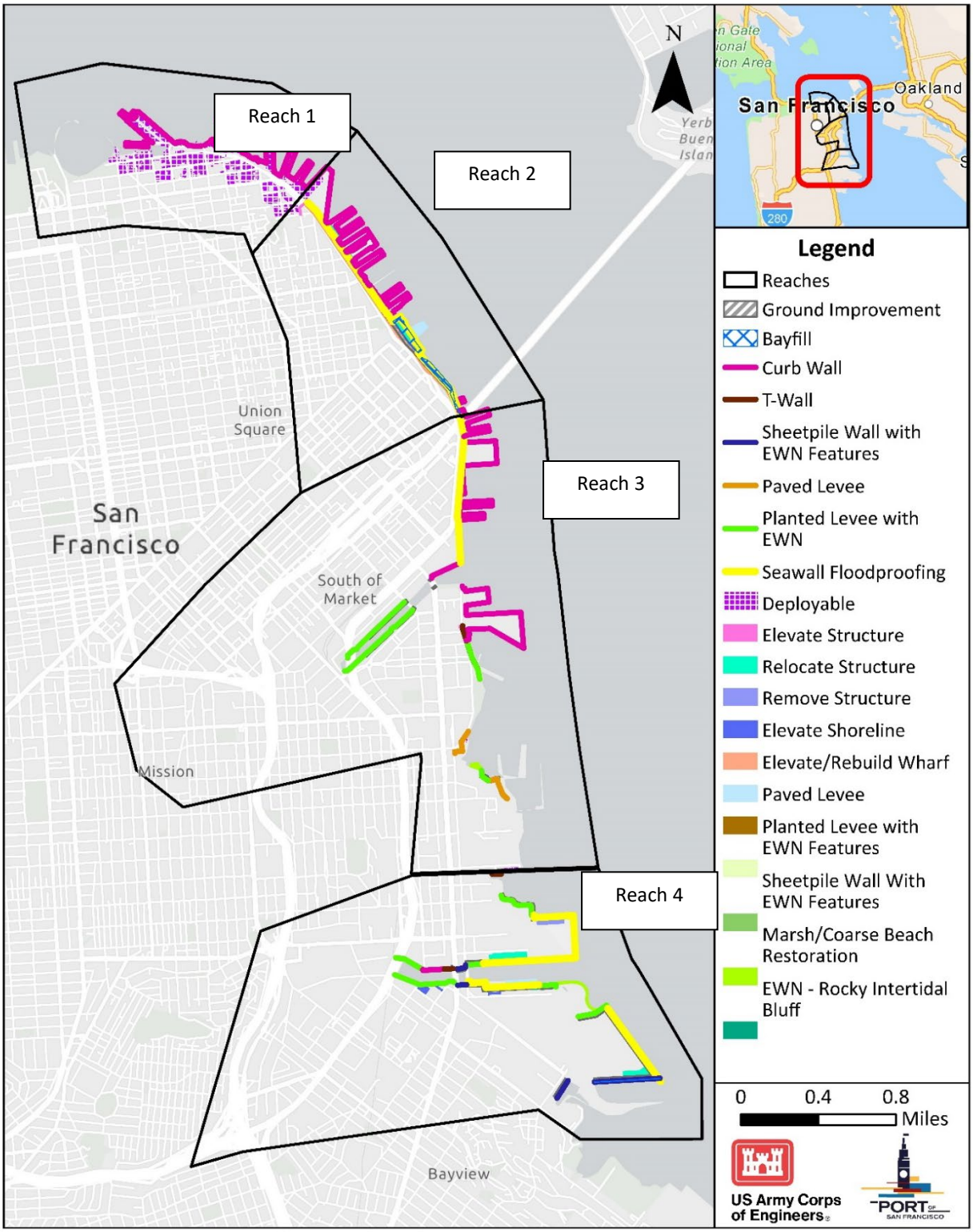
(b) Nonphysical nonstructural measures do not modify individual structures, but rather focus on behaviors and plans that reduce flood risk. They include evacuation plans, flood warning systems, flood insurance, floodplain mapping, emergency preparedness plans, risk communication, and land use regulations and zoning.

(3) NNBFs refer to the landscape features used to reduce flood risk while restoring natural processes and providing ecosystem benefits, by the intentional alignment of natural and engineering processes. These landscape features may be natural (produced

purely by natural processes) or nature-based (produced by a combination of natural processes and human engineering) and include such features as beaches, dunes, wetlands, reefs, and islands.

For planning purposes, the Recommended Plan, which is subject to Congressional authorization and funding, divides the system into four reaches based on hydrology and risk (Fig. 1) . Reach 1 relies primarily on non-structural measures such as floodproofing, retreat, and building demolition, while reaches 2, 3, and 4 each prioritize protection at the existing shoreline with several structural measures including raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, levees, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. Additionally, the system will be designed to comply with seismic standards and includes ground improvements for all structural measures. Since the Recommended Plan is adaptive to future conditions, a plan has been developed to monitor future conditions and provide thresholds for when adaptive measures of the system should be implemented.

Phased implementation and construction will be determined based on several factors including immediate risks, priorities of the NFS and communities benefitted, efficiencies in the construction and/or contracting, size and frequency of funding infusions, environmental clearance requirements and durations, and beneficial sequencing.



San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Figure 1. Overview of Preliminary Footprint for Recommended Plan First Actions

Descriptions of Measures

The following descriptions are provided in engineering and construction terms, and do not constitute impacts analysis. Identification and analyses of effects to historic properties will be conducted as stipulated in the body of this PA.

Floodproofing

There are two types of floodproofing – wet and dry floodproofing. As the name implies, wet floodproofing allows floodwaters to enter the structure, while, in contrast, dry floodproofing prevents the entry of floodwaters. Dry floodproofing is proposed for industrial and commercial properties and critical infrastructures and wet floodproofing is proposed for residential structures.

Wet floodproofing measures involve permanent or temporary measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure. Generally, this includes properly anchoring the structure, using flood resistant materials below the Base Flood Elevation, relocating and/or protecting mechanical and utility equipment, and use of openings or breakaway walls to avoid structural damage due to hydrostatic pressure and to allow flows to enter and exit the structure. Wet floodproofing is practical only for portions of a structure that are not used for living spaces, such as basements, elevated structures, crawlspaces, or attached garages.

Floodproofing activities would be completed in phases based on flooding frequency over a given period. Those with imminent risk would be completed first and properties where the risk rises as sea levels rise would be floodproofed when appropriate. They type of floodproofing would be structure dependent. Each structure would be evaluated independently of the others for what would be the most appropriate and least invasive method of flood protection possible that would still retain the integrity of the structure.

Many of the properties in the study area are considered historic and are eligible or listed on National Historic Register of Places under the National Historic Preservation Act. For these historic structures, the National Park Service's "Guidelines on Flood Adaptation" will be used to aid in identification of appropriate measures to increase flood resiliency while meeting the Secretary of the Interior's Standards for Rehabilitation and preserving the property's historic features, spaces, materials, site, and setting.

Deployables

Deployable gates would be used to close the openings at bridges and where additional tie into high ground is needed during high water events, while allowing continued vehicular, pedestrian, and rail access at all other times. A range of potential deployables may be used depending on the location, type of access needed, frequency of use, anticipated flooding

conditions, operation and maintenance needs, etc. and may include swing gates, roller gates, flip up barriers, or other removable deployables.

Permanent deployables are designed for temporary deployment during storm events or king tides. Typically, they are constructed of structural steel elements with a steel plate skin and tied into the adjacent flood protection measures (i.e., levee or vertical wall). Swing gates are attached to a reinforced column of a flood wall with hinges on one side, while rolling gates rest and roll on a ground wheel carrier or track along the gate sill.

When closed, compressible seals along the bottom and sides of the gate seal against the wall and sill to resist water infiltration. Depending on the height and width, additional bracing can be placed on the dry side of the gate to help it withstand the pressure of the water. Gates can have the option for a manual cranking system to close depending on size, but many times a motorized opening/closing device is required. Traffic control measures would be added to the bridges to warn of gate deployment when activated.



Swing Gate
Source: courtesy of Flood Control International

Roller Gate
Source: courtesy of Flood Control International

Flip Up Barrier
Source: courtesy of Flood Control International

FIGURE 2. EXAMPLE OF PERMANENT DEPLOYABLE FLOOD GATES.

Elevated Structures

Structure elevation involves raising each structure to a higher elevation to reduce the risk of flooding during high-water events. To do this, the structure is separated its foundation and temporarily raised in place with hydraulic jacks. The new foundation system, such as fill, columns, posts, piers, or raised foundation walls, would be constructed and then the structure lowered into place on the new foundation system. The goal is to ensure the lowest habitable floor is at or above the base of flood elevation or higher. Selection of proper elevation method depends on flood characteristics such as flood depth or velocity.

Relocate/Remove Structures

Structures may be removed from the existing location to eliminate the potential flood risk or to make room for the proposed flood protection system. Structures identified for relocation will be physically relocated or rebuilt in another location off-site to be determined during PED. Structures identified for removal will be permanently removed and not rebuilt in place or elsewhere.

For structures being relocated, the structure may be transported in whole or disassembled and then reassembled at the new location. For whole structure transport, the structure is typically

done by attaching a temporary steel framework under the structure to support it, then lifted off the foundation using a network of hydraulic jacks placed under the framework and controlled by a unified jacking system. Once the structure is at a sufficient height, hydraulic dollies or a flatbed trailer(s) are placed under the supporting framework. These are used to move the structure to the new location. After the move, the steps are reversed, and the structure is lowered.

In some instances, buildings being relocated would require modifications to allow for moving, and to make structural improvements to meet current building codes and standards once re-established on their new foundation. This is most likely to apply to historic bulkhead and shed building structures that are part of the Embarcadero Historic District.

For structures being permanently removed on-site, the material would need to be removed and disposed of. This will require heavy machinery such as wrecking balls, excavators, and bulldozers. Additionally, the building debris will need to be hauled off using large trucks or barges to an appropriate disposal facility.

Curb Wall

A curb wall is a short wall, approximately two feet tall and no more than one-foot wide, made of reinforced concrete that will be connected to existing gray infrastructure (e.g., wharfs, piers, seawalls) to minimize floodwater entry into adjacent structures (Figure 3). The curb wall will be fixed to a concrete deck or capping beam along the perimeter of the main structure. For the feasibility study, the curb wall was assumed to be constructed of either cast-in-place concrete or precast concrete elements which are attached mechanically, both of which would include some type of water stop integrated to ensure an acceptable seal against seepage. During the PED phase, other elements such as glass or clear polymer panel that would provide similar functionality may be considered to minimize visual impacts from the land or Bay.

If cast-in-place concrete is used it would be constructed by pouring concrete into removable forms (or castings) erected on site and cured in the structure's finished position. Temporary forms or castings would be constructed on site and would be reinforced with steel. Most formwork would be composed of steel, aluminum, and wood. Ready mixed concrete would be delivered via large cement trucks and poured into the castings with a truck chute, bucket, or pump. The concrete is left to cure in the castings before removal. Once cured, casting materials would be removed and reused for another location or measure or hauled off for disposal.

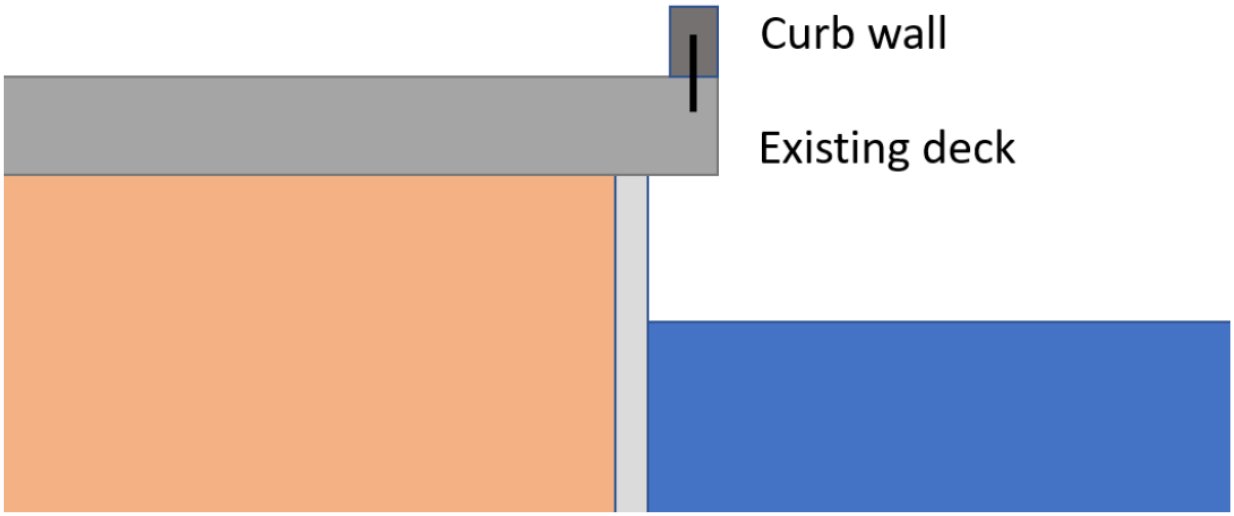


FIGURE 3. EXAMPLE CURB WALL

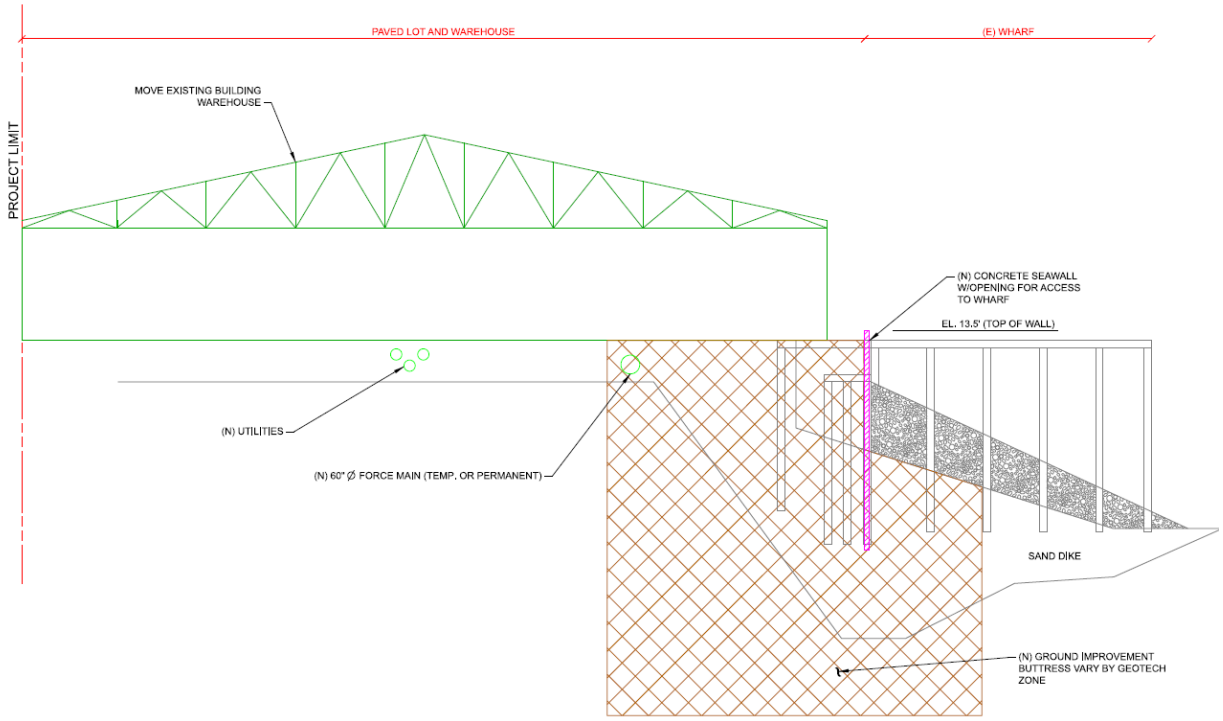
BULKHEAD SEAWALL

A seawall, synonymous with bulkhead wall, is a retaining wall structure that supports earthen fill on one side and protects against erosion caused by a waterbody on the other side. The seawall is the defined line of defense for the protection system. The design height of each seawall is the basis for how high the wharf or shoreline must be raised.

Seawalls are subdivided into two categories, 1) seawalls less than 30ft in vertical height from the seafloor, and 2) seawalls greater than 30ft in vertical height from the seafloor. The two different height groups roughly correspond to the anticipated maritime use along the wall, but also require different means of construction due to their scale and access for construction along the shoreline. Seawalls greater than 30 feet in height generally will require shoreline raises and/or wharf reconstruction and elevation if they are present, while seawalls less than 30 feet in height will typically only need the seawall itself to function as designed and not impeded the existing land uses (Figure 4 and 5). Shoreline elevation and wharf elevation and rebuilding is described in further detail in subsequent sections.

In general, it was assumed that all seawalls are constructed of concrete. The seawall is either constructed of precast concrete piles driven along the wall alignment at close spacing, then subsequently followed by driven square piles to fit within the interstitial space to fill the voids and create space for a grout pocket. Voids would be grouted to create a low permeability wall that would retain soils and resist erosion of the shoreline. The need for additional anchorage or tiebacks at the top of the wall using steel rods or soil anchors, as well as but the best technique for installation will be determined during the preconstruction, engineering, and design phase (PED).

Construction of the seawall is assumed to be completed from land by using secant pile or diaphragm wall designs. However, if other measures at the location require construction of a cofferdam and dewatering or construction in the “wet”, then the seawall may also employ similar techniques to avoid multiple moves of equipment or additional disruptions.



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FIGURE 4. EXAMPLE CROSS-SECTION OF A SEAWALL <30 FEET TALL WHERE NO WHARF OR SHORELINE ELEVATION IS NEEDED.

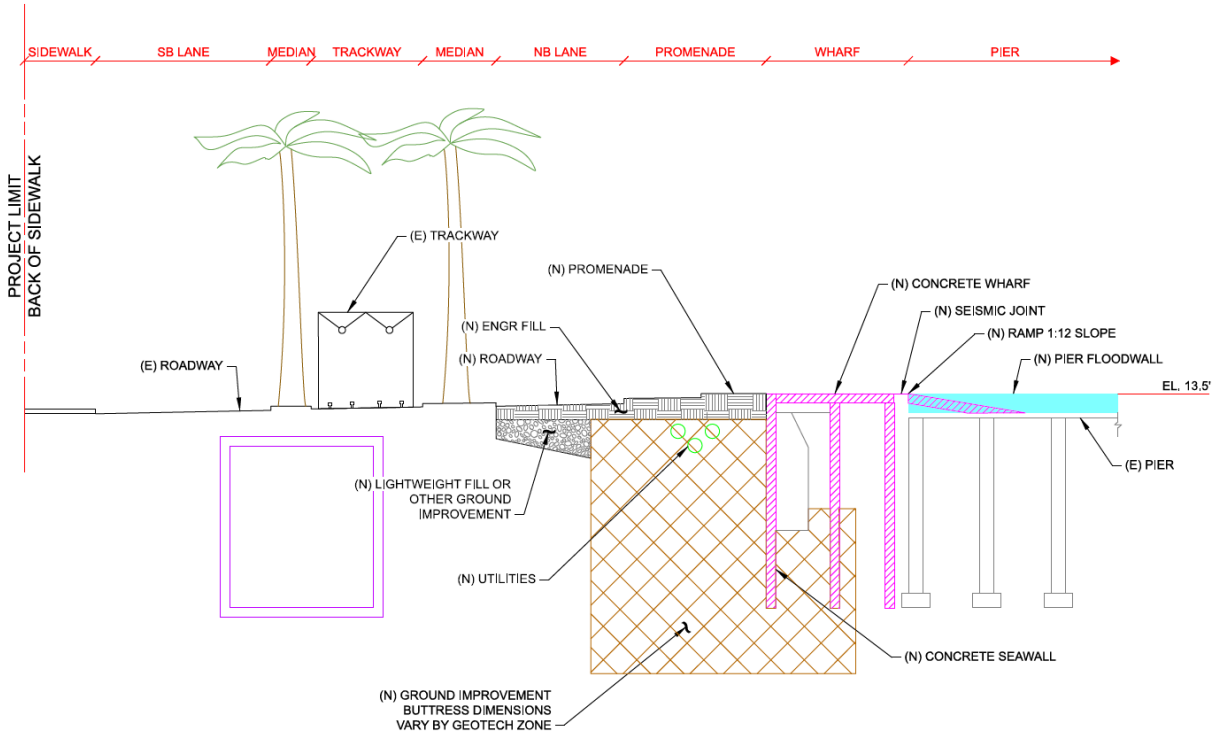


FIGURE 5. EXAMPLE CROSS-SECTION OF A SEAWALL >30 FEET TALL WHERE WHARF AND SHORELINE ELEVATION ARE NEEDED.

To construct the new seawalls, a cofferdam around the work area would be constructed and the area landward would be dewatered. Cofferdams are an enclosure that allows water to be pumped out to establish a dry working environment. A cofferdam would be constructed from steel sheet piles with interior bracing. Sheet piles would be driven into the sediment in the bay through hydraulic or pneumatic tools, braced internally with waler beams and compression struts to keep the wall from collapsing. Braces would be installed using heavy machinery from work barges in the bay. The area inside the cofferdam would be dewatered with a combination of surface pumps/sumps and deep wells as necessary to create a dry and stable work environment. Once construction is completed, the cofferdam would be disassembled and removed.

Additional EWN features have been added in front of the seawall to provide a natural solution to protecting the new seawall from high tidal energies at this location. The rocky intertidal bluff feature is described further below.

T-wall

A T-wall has a cross-section of an inverted “T”, and as designed for this project, is configured with a horizontal base (Figure 6) and is also the basis for the line of defense where this measure

is employed. In some areas, a new pile-supported T-wall would be constructed landside of the existing or integral to a new seawall. At this design level, the T-walls are assumed to be founded on deep foundations consisting of either steel H-piles or pipe piles which could be driven either vertically or battered depending on the design loads and underground site constraints. A steel sheet pile cutoff, extending 20-30 feet vertically beneath the wall base, will be installed to reduce under seepage and uplift pressures on the structure. The pile foundations are assumed to consist of two rows of piles which are 50 feet in length and placed on 5-foot centers along the wall length. The panel height of each t-wall is dependent upon the existing elevation. The base of each t-wall is constructed wider than typical for the designed panel height to accommodate anticipated adaptability for future height increase. These design estimates will be refined in the PED phase.

After the T-Wall is complete, the area landward of the t-wall would be regraded using imported fill material. After grading, the fill material would be paved to create sidewalks and landscaping added.

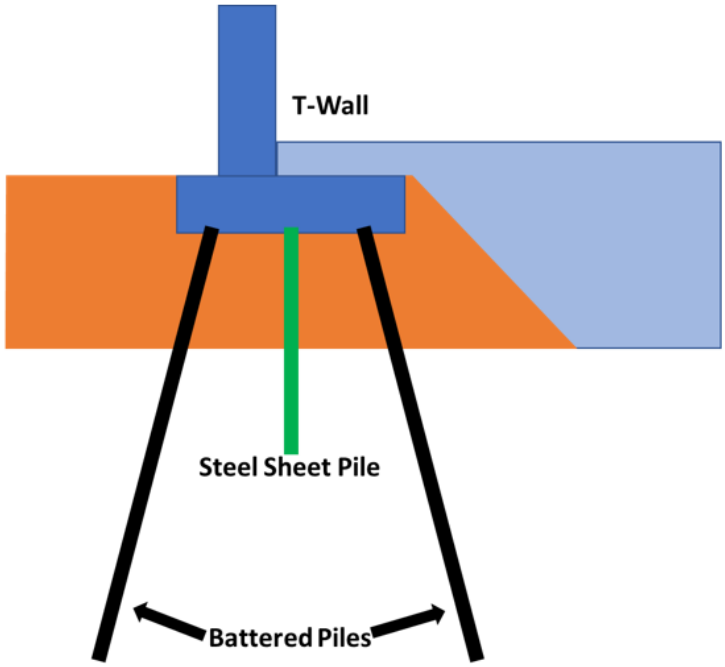


FIGURE 6. TYPICAL T-WALL CROSS-SECTION.

Elevated Shoreline

Where the existing shoreline elevation is lower than the top of design elevation of a new seawall or T-wall, the shoreline may need to be elevated or raised 3.5 to 7.5 feet to defend against 3.5 feet of sea level rise (13.5 or 15.5 feet NAVD88 top design elevation) (Figure 7). To raise the shoreline, the area landward of the seawall would be filled with imported material, compacted down, and regraded over sufficient space to facilitate grade transitions, transit,

vehicular and multi-modal access along the urban waterfront edge. Roadway, trackway, and promenade configurations are assumed to be generally the same as existing configuration; however, the exact surface configuration will be determined during PED.

Shoreline elevation would be constructed using standard earth moving equipment such as graders, bulldozers, dump trucks, etc. after all ground improvement measures have been completed. Any utilities that would be affected would also be relocated or modified to function with the new shoreline design.

Elevate/Rebuild Wharf

In places where the shoreline is being elevated, the existing bulkhead wharf, typically 50 feet wide running parallel to the shoreline, would also be elevated (Figure 7). The bulkhead wharf would be replaced with a new elevated reinforced concrete wharf structure with the top of the deck at specified flood defense design elevation.

To construct the new wharf, the existing wharf would be demolished, material removed, hauled away, and disposed of at an appropriate and approved facility. This would entail pulling out old pilings and existing concrete deck and surfacing (concrete or asphalt). The new wharf would then be constructed in the place of the old wharf.

Reinforced concrete ramps would be constructed to allow pedestrian and vehicular access from the elevated wharf to the finger piers, since the finger piers that stretch out into the bay would remain at the existing elevation, unless otherwise noted.

With the new wharf design, less bay fill from pile material is anticipated when compared to the existing bay fill from existing piles; however, the change cannot be quantified at this time due to uncertainty in the number and size of existing piles at each wharf.

Wharf raising may be constructed in the wet using marine or land-based equipment if the wharf raise is not being completed in conjunction with a measure that would require a temporary cofferdam. If a cofferdam is intended to construct other measures at the location, it is anticipated that the cofferdam would not be breached until after all construction is complete including the wharf elevation and rebuild.

For wharves that supports structures, each would be removed, relocated and/or replaced (see description for relocating/removing structures above). For buildings requiring relocation and replacement back on the wharf, it is assumed that these buildings would be either braced and moved to a temporary location (on land or to floating barge) or carefully dismantled and stored until the new wharf is constructed. Once the new wharf is constructed the structure(s) would be moved back or reassembled.

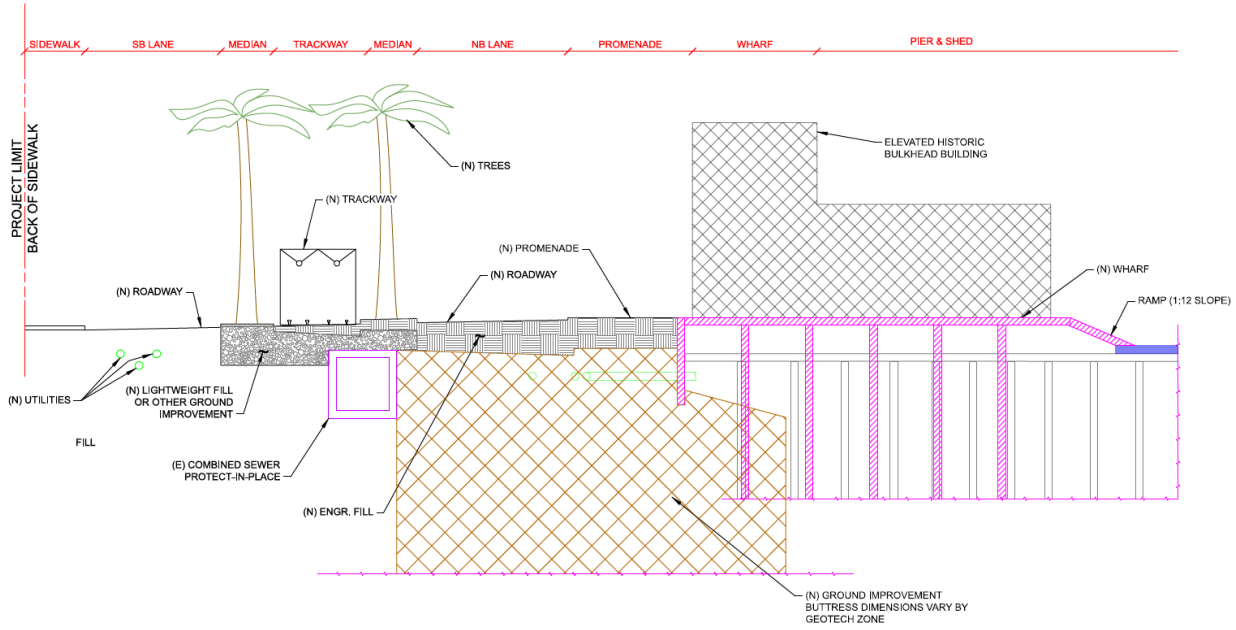


FIGURE 7. EXAMPLE CROSS-SECTION WITH AN ELEVATED SHORELINE, ELEVATED AND REBUILT WHARF, ELEVATED STRUCTURES, AND A RAMP DOWN TO THE EXISTING FINGER PIER.

Paved Levee

The levees would be designed as a raised earthen bank with a trapezoidal cross-section with a wider base that slopes up to a narrower crest to fortify against flooding risks (Figure 8). For this phase of the study, the side slopes were assumed to be no steeper than 3H:1V. It is likely that in locations where vehicle passage is necessary the slopes may range from 5H–10H:1V and on piers the slopes may be 12H:1V to accommodate Americans with Disabilities Act (ADA) accessibility requirements. The required levee height and width is dependent on local existing elevations and the final flood side design side slope and configuration. The height of the levee could range from one to 10 feet to achieve the target design elevation of 13.5 feet in reach 2 and 3 or 15.5 feet NAVD88 in reach 1. The crest width of the levee may range from 10 to 20 feet.

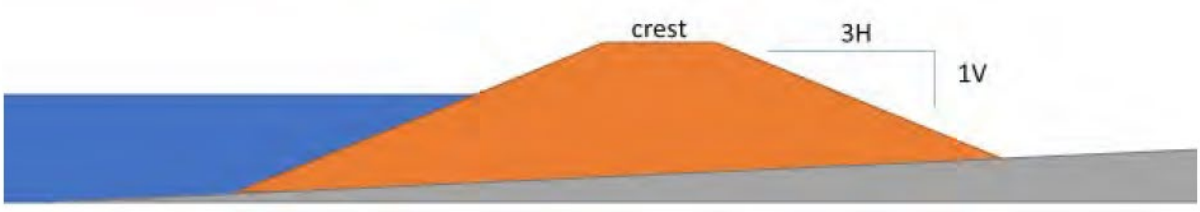


FIGURE 82. TYPICAL CROSS SECTION OF A LEVEE.

To construct the levees, first any existing vegetation, structures, roadways or parking lots along the proposed alignment would be removed and all material disposed of offsite. If utilities are within the alignment, they would need to be relocated prior to construction beginning. The project site would then be prepared for the levee foundation, which may include but is not limited to grading/stripping earthwork, adding or removing subgrade materials, drainage improvements, ground improvements, etc. The levees would be constructed of imported impervious earthen fill material, assumed to be procured from a commercial source near San Francisco and delivered to each site via dump truck. Fill would be placed in layers and compacted to reach the desired strength, width and height. For levees with a crest height ≥ 4 ft, a 20-foot-deep continuous vinyl sheet pile seepage barrier would be installed along the centerline of the structure using a vibratory or impact hammer to prevent undermining of the levee. Once complete, the levee would be dressed in a combination of commercially sourced bedding stones, rip rap/armoring stones, concrete, and/or pavement depending on the location of the structure and long-term use (Figure 9). Any existing bike lanes, bay trails, or roadways disrupted by the new structure would be relocated or built into the overall design of the structure (e.g. crest may be converted to a paved bike path or walking trail), which will be determined during PED (Figure 10).

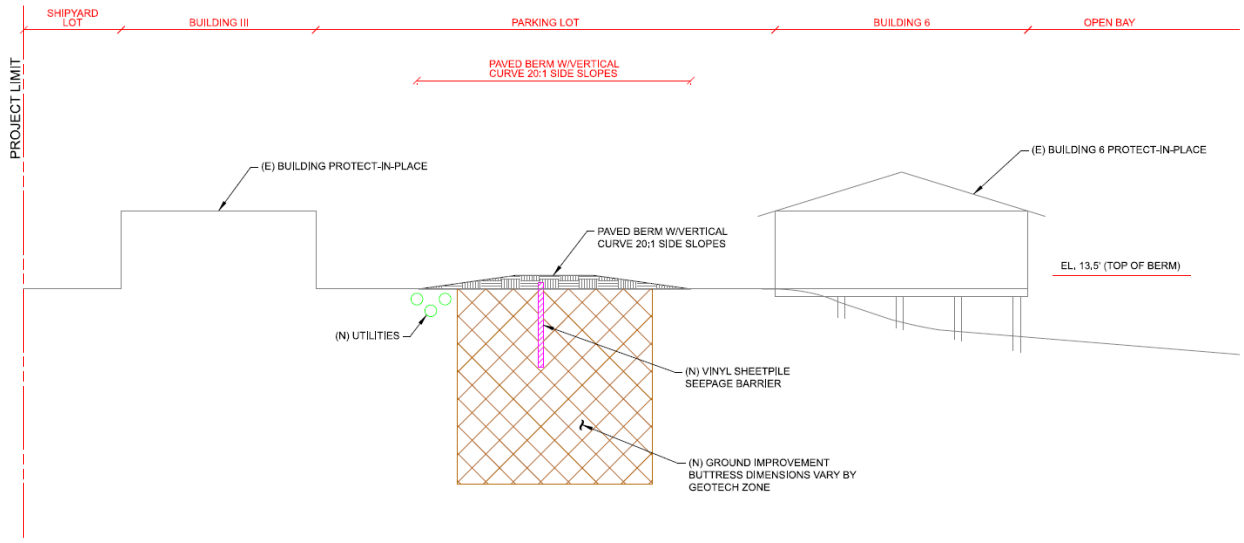


FIGURE 9. EXAMPLE CROSS-SECTION OF A ≥ 4 FT LEVEE WITH A PAVED SURFACE.

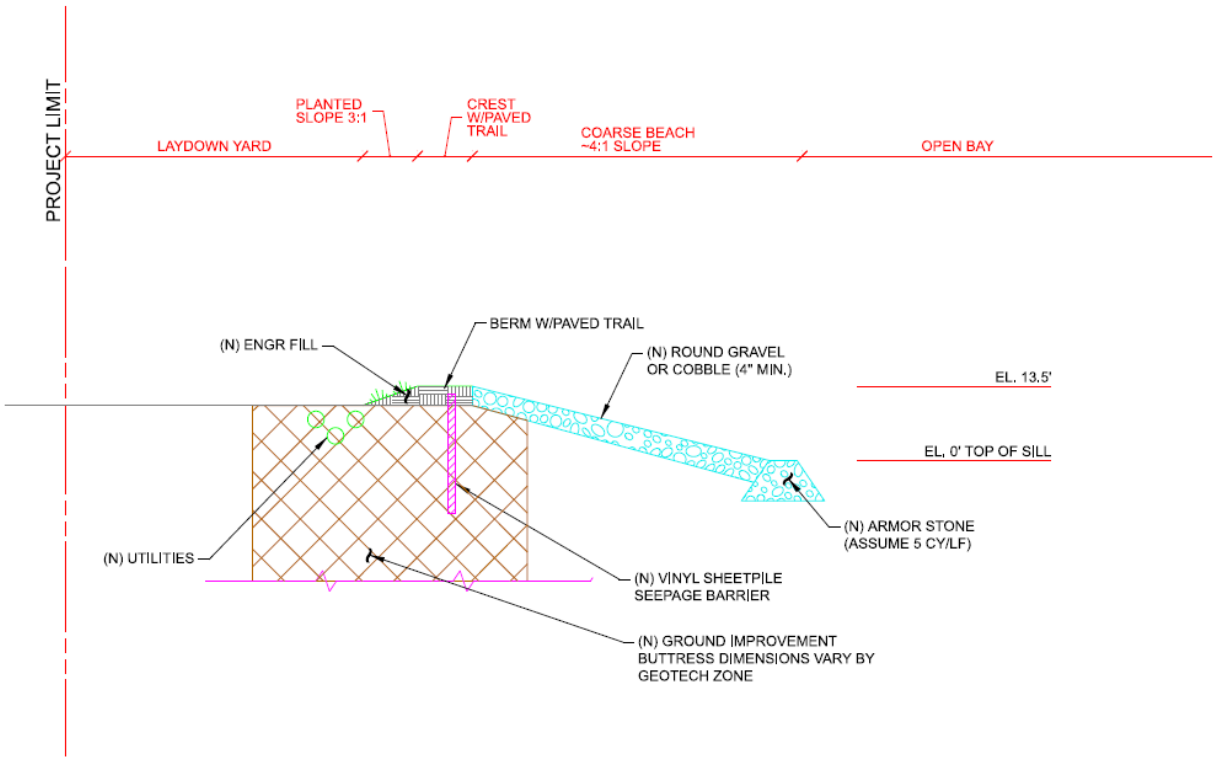


FIGURE 10. EXAMPLE CROSS-SECTION OF A ≥ 4 FT LEVEE WITH A PAVED TRAIL ON THE CREST AND ARMORING STONES ON THE BAYWARD SLOPE

Planted Levees with EWN Features

The planted levees would be constructed in the same manner as the Paved Levees measure except that the levee surface would be dressed in more native materials and pervious type surfaces and the side slopes may have gentler slopes to incorporate EWN features. This style levee typically connects the levee to terrestrial or aquatic habitat and can provide high quality transition zone habitat when vegetated with native plants. The slopes of these structures will typically vary between 10H:1V in space constrained areas to 30H:1V in isolated areas where real estate is not restrictive.

Each levee would be constructed of commercially sourced imported impervious earthen fill material same as the paved levee, but the topsoil would need to be specified based on the vegetation type anticipated to cover the slope. The final design of the planted levee and the type of EWN incorporated at each location will be dependent on site-specific conditions including real estate constraints, adjacent habitat types that can be connected, desired species composition and recruitment, and long-term use of the area. Each of the design would provide erosion control and stabilization of slopes using biological, mechanical and ecological concepts while providing floodable area in storms and extreme tides. The additional EWN features may be constructed of many different materials and textures to create a layered approach that can be refined to suit site and design needs. Additionally, each designs considered avoids

introducing material into open water areas to avoid bay fill, but over the long-term would increase available aquatic habitats as RSLC occurs.

For space constrained locations, creek enhancements can fit within the footprint of traditional levees and may include features such as habitat shelves or terraces, planted edges, live crib walls, and other measures that increase surface complexity (Figure 11).

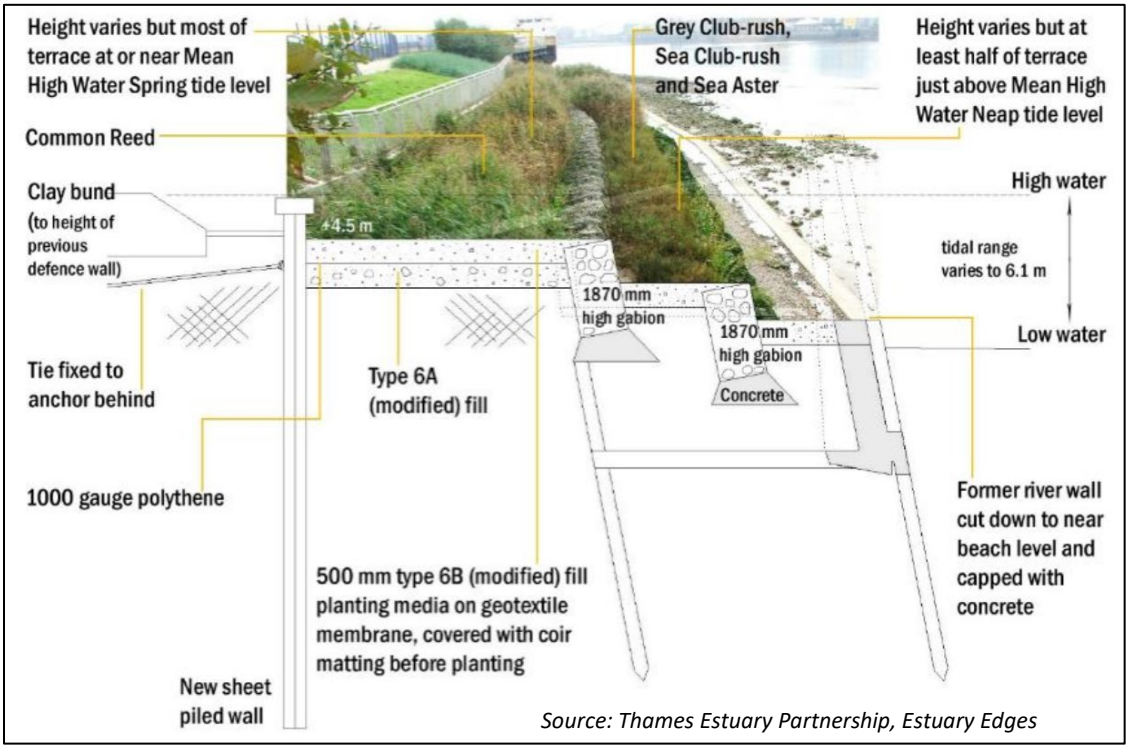


FIGURE 11. EXAMPLE CREEK ENHANCEMENTS ON THE THAMES ESTUARY.

Where space is available, a gentle slope may be graded to support multiple transition zones and may feature a levee with side slopes greater than 10H:1V. At the crest upland habitat would be created and transition to riparian, marsh and/or beach habitat to open water on the bayward side slope (Figure 12 and Figure 13). For a levee with a steeper grade slope, vegetated riprap may be incorporated while gentler slopes may rely entirely on native materials.

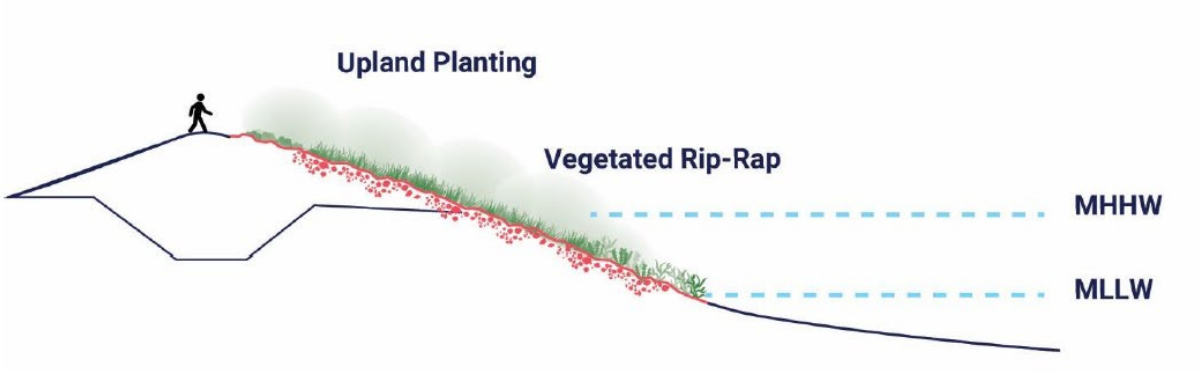


FIGURE 12. EXAMPLE CROSS-SECTION OF A PLANTED LEVEE WHERE A MODERATE AMOUNT OF SPACE IS AVAILABLE (~10H:1V SLOPE).



FIGURE 133. EXAMPLE CROSS-SECTION OF A PLANTED LEVEE WHERE CONSIDERABLE SPACE AVAILABLE (~ 30H:1V SLOPE).

Vegetated riprap, or ecological armoring, is armoring a direct replacement for traditional riprap that aims to replicate the natural processes and functions of rocky, intertidal habitat. Interlocking layered armored protection units or differently shaped riprap, sometimes with integrated tide pools, are designed to mimic natural intertidal conditions and create microhabitats, including vegetation establishment (Figure 14). Units can be stone (riprap), concrete, or other precast materials. In suitable environments, the units may be vegetated by filling in voids with soil and planted with upland, riparian or intertidal species.



FIGURE 14. EXAMPLE OF ECOLOGICALLY ENGINEERED ARTICULATED CONCRETE BLOCK MATTRESS USED AS ECOLOGICAL ARMORING (SOURCE: COURTESY OF ECOONCRETE TECH, LTD.)

Sheet Pile Wall with EWN Features

At locations identified for Sheet Pile Wall with EWN Features, a standalone sheet pile wall would be constructed as a floodwall, unlike in other measures where a sheet pile wall would be constructed in combination with another feature (e.g., levee or seawall). A sheet pile wall is a construction feature involving driving interlocking sheets of material into the ground to act as a barrier to contain water, for bank stabilization, and to prevent water from overflowing into vulnerable areas. The measure may be constructed using steel and/or cast-in place concrete materials using the same techniques described previously. The sheet pile wall would be constructed using land-based equipment.

As part of this measure, EWN features that would be used in space constrained locations would be incorporated into the overall design to provide additional protection to the floodwall (Figure 15). The EWN features would be constructed as described in the Planted Levees description.

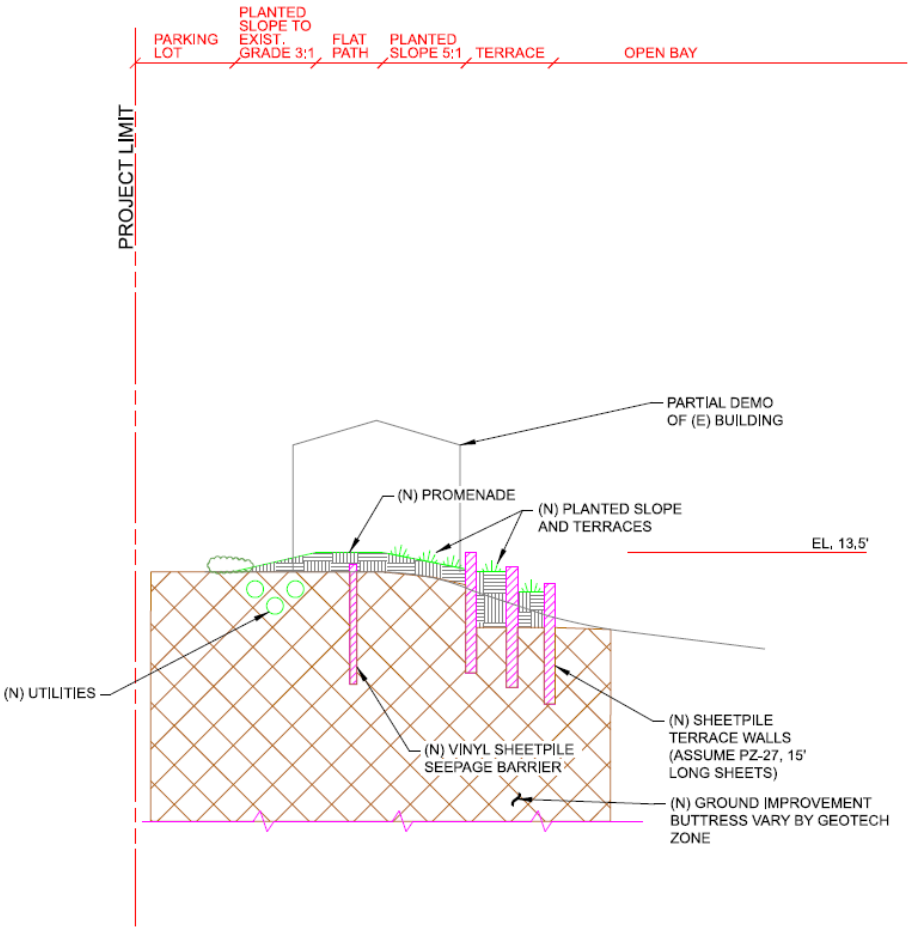


FIGURE 15. EXAMPLE CROSS-SECTION USING SHEET PILE WALLS AND EWN FEATURES

EWN - Marsh/Coarse Beach Restoration

Marsh and coarse beach restoration involves the restoration of degraded existing coastal wetlands (e.g., salt, brackish, and tidal freshwater marshes), mudflats, and/or coarse beach found in the proposed measure location. To restore the target habitat type at each location, sediment and other natural materials (cobble, gravel, larger rock size) would be introduced to the site to reach a target design elevation that will support the long-term viability of the desired habitat (Figure 16).

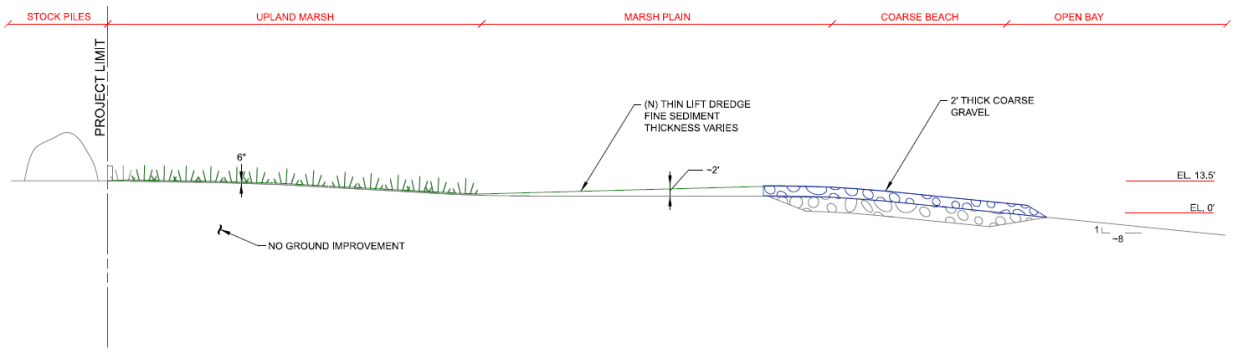


FIGURE 16. EXAMPLE CROSS-SECTION OF MARSH AND COARSE BEACH RESTORATION.

It is assumed material used to augment or nourish the marsh or beach would come from a commercially sourced material or from dredged material removed during normal operations and maintenance cycles (i.e. no new dredging would be pursued to implement this measure). The source of material would be determined during PED, but in any case, material placed at the site must have similar properties to the existing marsh or beach or meet the conditions of the target habitat type, if being created rather than restored.

To construct the marsh or beach, the material would be dumped in place (commercially sourced material) or pumped through a series of pipelines (dredged material) into the site until the surface profile is built up to the target elevations, which will be determined during PED and based on the target species, salinity and flooding regime and site conditions. Heavy machinery would be used to move sediment and facilitate construction which could include bulldozers, front-end loaders, track-hoes, marsh buggy, and backhoes. As necessary, temporary containment dikes would be constructed from in-situ material around the nourished areas to minimize material movement and to delineate work areas. The dikes would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages deemed appropriate for the site.

It is assumed that work would begin in an individual cell and continue until that cell is completed, with attempts made to not place material in more than one cell at a time to minimize the disturbance to existing marsh processes. Figure 17 shows an example of marsh restored at Heron's Head and Figure 18 shows an example of coarse beach restored in San Francisco that both would be suitable reference sites for restoration targets.

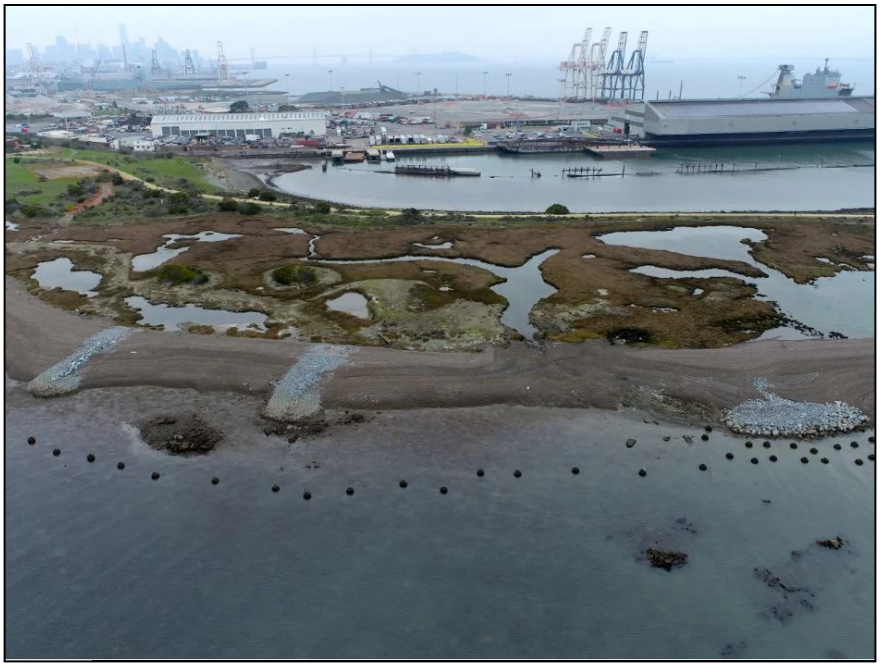


FIGURE 17. TIDAL MARSH AT HERON'S HEAD IN SAN FRANCISCO, CA. SOURCE: PORT OF SAN FRANCISCO.



Photo Credit: SFEI

FIGURE 18. EXAMPLE COARSE BEACH RESTORATION IN SAN FRANCISCO.

EWN- Rocky Intertidal Bluffs

This particular EWN feature integrates an engineered rocky tidal habitat into the shoreline elevation and bulkhead seawall design as a way to minimize wave runup and promote greater biodiversity along a steep shoreline rather than relying on traditional riprap or other engineered armoring to protect the new bulkhead seawall (Figure 19). Approximately 2.0 acres of new intertidal and subtidal habitat would be constructed bayward of the new seawall.

To construct the rocky intertidal bluff, a foundation of compacted sediment would be placed along the mudline/bay bottom and built up to achieve a target profile that slopes from the new seawall to the mudline. On top of this foundation, a combination of sand, gravel, rock, and/or pre-cast material like ecological armoring of varying sizes would be placed using cranes and heavy machinery to create tidepools and bluff areas to increase surface complexity (grooves, crevices, nooks, etc.). After construction is complete, the cofferdam would be removed, and the area would be subject to inundation. Minor refinements and adjustments to material in the rocky intertidal bluff post-construction, such as moving, replacing or adding more stone or other materials, may be needed to meet the design goals.

EWN - Living Seawalls

Living seawalls consist of structural elements combined with traditional seawalls that create varied micro-habitat conditions through surface relief and material composition (Figure 19). The introduction of surface complexity (e.g., surface texture, grooves, crevices, and nooks) to traditionally smooth surfaces promote vegetation growth, provides foraging habitat, and creates shelter from predation.

Living seawalls would be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design would incorporate textures to increase surface complexity). These elements would be incorporated as part of the pre-cast or cast-in-place forms used to construct the walls or piles. No additional specialized equipment or methodology is necessary to incorporate this added EWN feature and should not increase the construction duration.

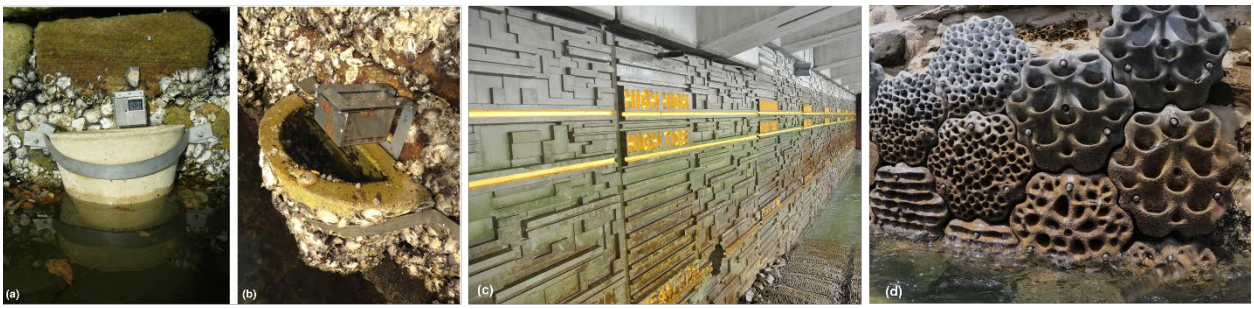


FIGURE19. EXAMPLES OF LIVING SEAWALL/VERTICAL ENHANCEMENTS THAT COULD BE INSTALLED ON VERTICAL SHORELINES. THESE COULD CONSIST OF PRE-CAST POTS AS SHOWN IN (A), (B), OR (D) AND PRE-CAST PANELS (C). SOURCE: MORRIS ET AL. 2017; WATERFRONT SEATTLE; VAN REMORTEL 2022.

Ground Improvements

Ground improvements are proposed to be incorporated into several of the structural measures to address both static and seismic loading conditions because of poor soil conditions and the increased weight of the new construction. A deep soil mixed (DSM) stabilization buttress with a

1:1 height to depth ratio (50 feet by 50 feet for Zone 1 and 100 feet by 100 feet for Zone 2) is currently assumed to be sufficient to stabilize the foundation and shoreline soil but will be further refined during PED when site-specific conditions are known. The DSM process forms columns of cemented material in the ground by mechanically mixing the in-situ soil with an introduced binder agent such as cement or lime. The binder can be introduced either by injection of a wet slurry or dry binder systems through the mechanical mixing tool. A grid of individual or overlapping soil mixed columns will make up the buttress.

The installation of DSM columns involves the introduction of a rotating auger into the subsoil which disrupts the existing soil structure and mixes it with the injected binder. Typically, one to six augers are mounted to a drilling rig and each auger consists of a drilling rod and cross bars. The soil mixing process is aided by injecting the cement binder through nozzles located at the end of the drilling rod. The column formation stage starts after reaching the target depth, which is usually divided into several stages where the auger is lifted and lowered to ensure adequate mixing of the soil with the binder and to form a homogeneous column. The width of the column is unknown at this time but could range from 2 to 9 feet wide.

APPENDIX B
CULTURE HISTORY

Culture History and Literature Review

1.0 Environmental Setting

The Study Area is at the northern margin of the San Francisco Peninsula, a landform that is composed primarily of uplifted marine sedimentary rock, with local accumulations of Holocene-age alluvial (i.e., transported by the movement of water) and aeolian (i.e., transported by wind) deposits. During the period for which there is scientific consensus regarding human occupation of North America, a period that roughly coincides with the Holocene epoch (around 12,000 years ago), the area underwent a series of geomorphic changes with the potential to affect archaeological resource preservation and visibility.

These changes were induced by sea-level rise, intertidal oscillation, wind movement of sand, and anthropogenic filling, as briefly discussed below.

At the beginning of the Holocene epoch (around 12,000 years ago), when local sea levels were significantly lower, the San Francisco Bay Area (Bay Area), including the Study Area, was a large valley with stands of trees and grassy meadows along the valley floor (Masters and Aiello 2007). The Pacific Ocean shoreline lay 30 miles west of the modern shore, just past the Farallon Islands; San Francisco Bay did not yet exist. At the beginning of the Holocene epoch, worldwide sea levels rose rapidly. Around 5,000 years ago, sea levels approached their near-modern elevations. Beginning around 10,000 to 12,000 years ago, the previously dry valley was inundated by marine water as San Francisco Bay formed. As the valley became an embayment, sediments were transported and deposited on the bay floor and bay margins by the daily oscillation of the tides (Atwater et al. 1977; Peterson et al. 2015). As the rate of sea-level rise slowed, around 4,000 years ago, silty and sandy tidal flats and marshes formed along the bay margins. While this was occurring, sands formed in dunes along the ocean coast of the San Francisco Peninsula; these dunes were carried eastward and across the peninsula, forming a large sand dune complex over much of what is now the city of San Francisco (Peterson et al. 2015).

Wind and water continued to be the primary mechanisms for sediment transport and deposition in the Study Area until the middle of the 19th century. At that time, inhabitants of the San Francisco Peninsula began to systematically fill the shoreline to make it level for development. This extended the shoreline bayward from its pre- development location, ultimately filling the former Yerba Buena Cove in what is now the Financial District as well as Mission Bay in what is now the South of Market (SoMa) district (U.S. Coast and Geodetic Survey 1853; U.S. Department of Commerce 1946).

2.0 Cultural Setting

2.1. Precontact

Prior to the arrival of European settlers and the development of Spanish missions, Native American groups occupied the San Francisco Peninsula for at least 7,800 years and probably longer. Our knowledge of the early pre-European contact period of the Bay Area is minimal because early sites along the Bayshore were presumably inundated by the rising bay.

More than 100 years of archaeological research has generated a wealth of information concerning the chronology and characteristics of Native American human adaptations in the Bay Area (based on summaries presented in Jones and Stokes 2007; Byrd et al. 2010; ICF 2022). Most known Native American sites in San Francisco are midden deposits of shellfish and occupation debris that accumulated at locations where Native American groups resided or gathered and processed shellfish near the shores of San Francisco Bay or the ocean coast. The first generation of San Francisco Bay archaeologists (Nels Nelson, Max Uhle, W. E. Schenk, and L. Loud) recorded more than 425 shellmounds around the Bay Area and were among the first to map, excavate, and characterize these shellmounds in the early 20th century. Subsequent development often resulted in these mounds being graded away or buried as the marshy bayshore was raised and the land leveled for buildings and roads. This has resulted in partial or complete destruction or obscuring of many Native American Bay Area sites and loss of knowledge regarding the location and condition of many sites that once existed (Jones and Stokes 2007; Byrd et al. 2010).

The following subsections summarize the pre-European contact period of the Bay Area by the geologic time segments Terminal Pleistocene (13,500–11,600 calibrated years before present [cal BP]), Early Holocene (11,600–7700 cal BP), Middle Holocene (7700–3800 cal BP), and Late Holocene (3800 cal BP onward), with further cultural and chronological divisions of the Late Holocene based on recent data. These periods are academic constructs and are not necessarily reflective of the views of the descendants of Native American peoples.

2.1.1 Terminal Pleistocene (13,500–11,600 cal BP)

The Terminal Pleistocene is largely contemporaneous with the Clovis and Folsom periods of the great plains and the southwest, and is generally considered to be represented by mobile, wide-ranging hunters and gatherers who periodically exploited large game (Haynes 2002). Throughout California, Terminal Pleistocene occupation is infrequently encountered, poorly understood, and most often represented by isolated fluted points (Erlandson et al. 2007; Rondeau et al. 2007; Byrd et al. 2010); however, no fluted points or archaeological deposits dated to the Terminal Pleistocene have been documented in the Bay Area (Byrd et al. 2010). Several factors have very likely contributed to the lack of evidence of this period in the Bay

Area, including what is assumed to be the small, mobile, and quickly moving nature of initial human populations, which would have been less likely to leave archaeological features on the landscape than larger, more sedentary or permanent populations. Factors such as sea-level rise, coastal erosion, and localized subsidence in coastal areas, resulting in the destruction or submersal and burial of such sites (Byrd et al. 2010), also contribute to the lack of the knowledge of archaeological deposits dating to this period in the Bay Area.

2.1.2 Early Holocene (11,600–7700 cal BP)

The Early Holocene cultural landscape of Central California was characterized by semimobile hunter-gatherers exploiting a wide range of food resources from marine, lacustrine, and terrestrial contexts (Erlandson et al. 2007; Jones et al. 2002); however, little cultural evidence of the Early Holocene has been documented in the Bay Area. There are four known and dated Early Holocene sites in or near the Bay Area. All these sites were found in buried terrestrial contexts (Rosenthal and Meyer 2004:30–32); no such sites have been found to date in San Francisco and none has been documented in other bay or coastal settings (Byrd et al. 2010). This almost certainly is due to the fact that sites along the bay or coast would have been inundated as sea levels rose rapidly during this period. The recent discovery of a submerged shell midden (SFR-220) in the Mission Bay area, dated just subsequent to the end of this period, supports this hypothesis and underscores the importance of continuing geoarchaeological investigations in San Francisco in areas that were submerged pre- European contact and subsequently buried in 19th- and 20th-century land fill.

2.1.3 Middle Holocene (7700–3800 cal BP)

The Middle Holocene was characterized by a diverse range of habitation sites and artifact assemblages, which suggests higher population levels, more complex adaptive strategies, and longer seasonal occupation than during the Early Holocene (Byrd et al. 2010). More than 30 Bay Area archaeological sites have produced radiocarbon dates indicating occupation during this time period. Several isolated human burials, including three on the San Francisco Peninsula (SFR-28, SFR-205, SMA-273) and one submerged shell midden in San Francisco's Mission Bay (SFR-220), have also been dated to the Middle Holocene (Byrd et al. 2010; Lentz et al. 2018). Faunal assemblages at these sites suggest a shift toward a lacustrine and maritime focus, associated with the expansion of San Francisco Bay's estuary, mud flats, and freshwater tidal marshes during this time (Byrd et al. 2010).

2.1.4 Late Holocene (3800–170 cal BP)

The Late Holocene is generally divided into the following five main archaeological time periods: Early (4500/3800–2450 cal BP), Early-Middle Transition (2450–2050 cal BP), Middle (2050–900 cal BP), Middle-Late Transition (900–700 cal BP), and Late (700–170 cal BP). There are more than 200 documented Late Holocene sites in the Bay Area.

The Early Period of the Late Holocene marks the establishment of several large shellmounds. Bay margin sites revealed a strong emphasis on marine shellfish (particularly bay mussel and oyster), marine fishes, and marine mammals, whereas interior sites revealed a strong emphasis on freshwater fish and shellfish along with terrestrial mammals (Byrd et al. 2010).

Artifacts and exotic material types suggest that an extensive trade network had been established by this time (Byrd et al. 2010). The Middle Period of the Late Holocene is characterized by greater settlement permanence (either sedentary or multi-season occupation), mound building, and increasing social complexity and ritual elaboration (Lightfoot 1997; Lightfoot and Luby 2002). Both marine and terrestrial food resources were exploited, and the consumption of acorns increased (Bartelink 2006; Bickel 1978; Greengo 1951; Wohlgemuth 2004; Byrd et al. 2010). The Late Period of the Late Holocene is the best-documented Late Holocene division. Small seed exploitation increased, as evidenced by archaeobotanical remains, and sea otters, rabbits, deer, clams, and horn snails were frequently exploited as foodstuffs. The bow and arrow first appeared during the Late Period, and extensive trade relations with neighboring groups continued. Funerary rituals were strongly patterned and included flexed interment positions and "killed" grave offerings, along with occasional cremations (Byrd et al. 2010).

2.2. Ethnographic Background[2]

At the time of the arrival of Europeans in Central California in the 18th century, Ohlone Native Americans occupied an extensive territory that encompassed the San Francisco Peninsula, extended southward to the Big Sur and San Juan Bautista, and, inland, included the areas along both sides of the Carquinez Straits and extended eastward beyond the East Bay hills to Walnut Creek and Livermore (Levy 1978). The Ohlone were speakers of the Penutian language (also referred to as Costanoan or Ohlone), which was comprised of six languages or dialect clusters: Karkin, Mutsun, Awaswas, Rumsen, Chalon, and San Francisco Bay Costanoan, which is comprised of three dialects—Ramaytush, Tamien, and Chochenyo—each the primary dialect of Ohlone peoples in different geographic areas of the bay region (Golla 2011). Anthropologists hypothesize, based on interfamilial relationships reconstructed from mission records, that the Ohlone within each of these geographic areas were loosely politically organized. Whether such distinctions were culturally meaningful to the Ohlone people who spoke those dialects and the exact geographic "boundaries" between linguistic groups are uncertain. While, for purposes of this ethnography, the population of each of these linguistic sub-areas is described as a "Tribe," Milliken (1995) cautions, "[s]uch a linguistic group approach can create a misleading and overly simplistic view of the complex mosaic of cultural variation in the aboriginal San Francisco Bay Area."

[2] This text was prepared in consultation with Ohlone Native American representatives for the Waterfront Plan Final Environmental Impact Report (San Francisco Planning Department 2023).

In the assessment of linguist Richard Levy (1978), the greater San Francisco Peninsula, including the area now occupied by the City and County of San Francisco and most of San Mateo County, was home to the Ramaytush Ohlone Tribe. The total population of Ramaytush Ohlone speakers in the 18th century has been variously estimated at approximately 1,400 (Levy 1978), 1,500 (Milliken et al. 2009), and 2,000 (Bocek 1992). The boundaries of today's San Francisco generally correspond with the territory of the Yelamu, an independent Tribe or Tribal community of the Ramaytush Ohlone peoples, which has been estimated to have included about 140 individuals at the time of the Spanish arrival in San Francisco in 1776 (Milliken et al. 2009). Mission records suggest that the Yelamu, like other Ohlone Tribes, were comprised of a number of smaller bands, each made up of several 10- to 15-person households that were associated with a village or a cluster of villages within the Tribe's territory.

Based on locational data and familial relationships among persons listed in Mission Dolores records, Milliken (1995) suggests that there were three Yelamu bands in San Francisco, each associated with a certain village or villages:

Sitlintac and Chutchui, only a mile or two apart in the valley of Mission Creek, seem to have been Yelamu sites used at different times of year by one band of families. Another Yelamu band seems to have used the village sites of Amuctac and Tubsinte in the Visitacion Valley area in the same way. Petlenuc, perhaps near the site of the Spanish Presidio compound, seems to have been [the village of] a third small band.

Other scholars argue, based on the close proximity to each other of various Yelamu villages along the bay shore, that the use of particular villages was not seasonal, and that movement by family and village members between their home village and other villages within their tribal territory appears to have been quite fluid (Cordero 2021).

Archaeological evidence indicates that San Francisco has been occupied for at least 7,600 years and that the locations and numbers of Native American settlements changed over thousands of years of human habitation. At least 40 sites of Native American origin have been identified in San Francisco through archaeological testing and/or archival information, and about 25 of these have been investigated to some extent by archaeologists. There are clusters of archaeologically recorded Native American occupation sites in the present-day Inner Mission District, around the Presidio, and in Visitation Valley. Some of these may correlate with the ethnographic-period villages referenced above. Three archaeological sites in the general vicinity of Mission San Francisco de Asís (Mission Dolores) have yielded artifacts or features (e.g., 18th-century glass trade beads) that evidence contact-period occupation; whether any of these represents ethnographically identified village sites, such as Chutchui or Sitlintac, or possibly a neophyte (mission convert) settlement, is uncertain. There are also many recorded Native American archaeological sites in the SoMa neighborhood, near the historic-period shoreline of Mission Bay and its marshes. Sites near the historic bay shoreline that have been investigated indicate

widespread Native American occupation, particularly near the coastal and bay shore portions of Yelamu territory, well before the arrival of the Spanish in San Francisco.

Based on Milliken's interpretation of Mission Dolores records, Yelamu bands often were interlinked by marriage within the Tribelet. The Yelamu also intermarried with people who lived in the villages of other Tribes, generally one or two tribal territories distant from their own, including with Tribes who resided north and east of San Francisco and with Tribes immediately to the south along the San Francisco Peninsula (Cordero 2015; Milliken 1995).

Within the Tribe, bands or family households assisted with planning for resource collection and management among bands, and possibly more broadly. Most of the year, households in a band might share a single large village site, but at other times, households might disperse to satellite villages to optimize resource extraction during seasonal changes or for other reasons (Levy 1978). There appears to have been substantial fluidity, both in the population of a given village and in village locations. For instance, Spanish Franciscan missionary Francisco Palou notes of the peninsula's San Andreas Valley in 1774,

The first expedition that passed here did not give it a name on account of not finding any villages, while now, in the short stretch we have traveled we have found five large ones. From this it is inferred that the country is well populated and that the inhabitants move their villages readily from place to place (Bolton 1926).

Like other Ohlone tribes, the Yelamu were hunter-gatherers who acquired and used a wide variety of plant and animal resources, including many varieties of terrestrial and marine game, fish and shellfish, and many species of plants. The primary foods collected and used likely varied seasonally and from year to year, and also over time, depending on the food sources available in the environmental setting of a particular village or territory, available labor, local preferences, and annual resource productivity. Where desirable species of oak were present, acorns were a plant food staple for many Central California groups, including most Ramaytush groups. A variety of seeds, berries, roots, nuts, fruits, fish, mammals, reptiles, and insects were also consumed (Kroeber 1925; Levy 1978; Milliken 1991, 1995). To improve and maintain seasonal resource sustainability, the Ohlone actively managed the landscape, clearing the land through controlled burning, tilling, seed broadcasting, irrigating, weeding, and pruning, to strategically improve browse for game animals and habitat for desirable plants. Controlled burning not only helped replenish the soil and assist in management of plant resources, but also often delineated territories. Individual families and bands might be associated with particular burn zones and resource collection areas (Lightfoot et al. 2009). The intimacy and depth of Ohlone knowledge of plants of both the land and the sea for food, medicinal, and other uses is detailed in anthropologist J.P. Harrington's notes of interviews regarding Ohlone ethnobotany (Harrington 1921–1939).

For groups who had access to the bay shore or ocean coast, which seems to have been the case throughout San Francisco, shellfish were an important dietary stable. These were both

collected from rocks and tidepools at low tide and harvested from sand and mud flats. The importance of shellfish to San Francisco Ohlone is reflected not only in the fact that shellfish shells are a major constituent of most archaeological deposits in San Francisco, including one site dated to 7,900 years old, but also in the use of Olivella and abalone shells as currency, ceremonial ornaments, trade goods, and grave offerings.

Archaeological findings from sites around Mission Bay and elsewhere in San Francisco and ethnographic studies document the rich inventory of other animal resources of the sea and shoreline marshes harvested by the Ohlone. Fish, ranging in size from anchovies to sturgeons, were obtained using methods adapted to the site and the size and habitat of the game. Fiber nets with drilled or grooved stone weights were cast from shore or from tule boats to capture schooling fish, while stone, shell, or bone hooks on fiber lines were used for larger fish. Sturgeon or large salmon were harpooned with spears tipped with finely fashioned stone tips. Fish weirs facilitated mass captures at low tide of shallow-water fish of the marsh, such as bat rays. Stranded whales were used for meat and for their bones.

Harpoons were used to hunt sea otters and other sea mammals, which provided meat and furs that were valued for their warmth and as trade goods. The Ohlone used nets, bow and arrow, and spear and atlatl to hunt waterfowl and a wide range of other animals that frequented the marshes and the shore, including tule elks, bear, deer, and rabbits. The Ohlone made use not only of the meat provided by these animals, but also of their sinews, bones, fur, and feathers. Animal bones were used in the manufacture of a plethora of items, including harpoon and spear tips, whistles, hide scrapers, drills, gaming pieces, and ornaments.

The Ohlone made and used a wide range of basketry items and a variety of chipped and ground stone tools, primarily from locally available materials, with the exception of obsidian, which was obtained in trade. Ohlone Tribes also engaged in trade, both locally and with Tribes throughout California and beyond. Milliken notes, “The Yelamu tribe probably played a key role in regional trade, moving obsidian and other goods from the north and east across the Bay and down the Peninsula, while bringing coastal shells to the East Bay” (Milliken 1995).The primary trading partners of the Ohlone were the Coast Miwok, Pomo, Yokuts, and Wappo tribes. Exports included mussels, salt, abalone shells, dried abalone meat, Olivella shells, and likely sea otter pelts (Levy 1978). The Ohlone imported piñon nuts, which were obtained from the Yokuts (Davis 1961), and locally unavailable lithic materials. Obsidian for stone tools was obtained through a trade network that stretched north to Santa Rosa and Napa and eastward over the Sierra Nevada to the Owens Valley. Trade feasts called together Tribal and Tribelet neighbors for social and ceremonial gatherings. These trade feasts redistributed wealth and provided opportunities for groups to socialize, form alliances, and exchange trade goods across different regions (Milliken 1995).

Spanish colonization in the Bay Area began with the establishment of several missions and associated presidios (military outposts) in the last quarter of the 18th century. Mission San

Francisco de Asís (Mission Dolores) and the San Francisco Presidio, established in San Francisco in 1769, marked the initial non-native arrival and settlement in San Francisco. The purpose for establishing these outposts was to extend and enforce Spain's control over California, in large part by converting California Native Americans to Catholicism and enslaving them as a Spanish labor source. The subsequent, often forceable recruitment of Native Americans into the mission system resulted in catastrophic social upheaval and demographic decline for the region's native Ohlone inhabitants. The Yelamu, like other Ohlone groups, were subjected to disruption of traditional subsistence patterns and cultural practices, physical punishment, and new forms of labor discipline. Native people who had entered the mission system were generally prohibited from returning to their homes except for occasional visits, which greatly hampered native peoples' ability to maintain traditional practices and ties to community and land. A variety of factors contributed to high death rates at the mission, including austere living and working conditions imposed by the Spanish, as well as European diseases. More than a quarter of the mission Indian population of the Bay Area died of the measles or related complications between March and May 1806.

Based on Spanish records, the last Ohlone elder from the San Francisco Peninsula was baptized at Mission San Francisco in 1801 (Milliken et al. 2009). The Spanish sources report that the villages of San Francisco and the vicinity were vacant by this time, or nearly so. While some Ramaytush Ohlone possibly had fled to remote refuge sites or to reside with more distant Tribes, most apparently either had died or were resident at the missions at the start of the 19th century (Levy 1978). The total Ohlone population Bay Area-wide decreased from between 7,000 and 17,000 in 1770 (based on various estimates by Kroeber (1925), Cook (1940, 1943); and Milliken et al. (2009) to fewer than 2,000 in 1832 (Levy 1978).

Ohlone peoples were brought into the mission system at missions San Carlos Borromeo, San Francisco de Asís, Santa Clara de Asís, Santa Cruz, and San José. Mission Dolores on the San Francisco Peninsula absorbed Ohlone peoples as well as other California indigenous Tribal groups including the Esselen, Yokuts, Miwok, Pomo, and Patwin. Although, in theory, Native American mission converts were to be trained in agricultural practices at the mission and then "granted" land and materials to establish their own farms, in practice no such land grants to Ohlone converts occurred in San Francisco. By the time the missions were secularized in 1834, a new class of Hispanic rancho landowners had arisen. The Native American survivors of the mission system, who had been deprived of the ability to pursue native subsistence practices on their own land, were exploited as labor for Hispanic crop cultivation, cattle raising, hide and tallow production, and delivery to Yerba Buena cove (the location of the fledgling port of San Francisco) (Levy 1978). Some of these Native American laborers may have lived in the settlement at Yerba Buena at least part time during the 1830s and 1840s, but whether these included persons of Ohlone descent is unknown. Other Native Americans of various tribes who had resided at Mission Dolores relocated to ranchos on the San Francisco Peninsula. The main centers of Indian life and culture on the Peninsula after secularization were at Mission Dolores

and Rancho San Mateo, 20 miles to the south (Milliken et al. 2009), and possibly the Sanchez Adobe, a former Mission Dolores outpost in Pacifica.

On July 9, 1846, during the Mexican-American War, Army Captain John B. Montgomery claimed San Francisco for the United States. In the following year, a census recorded only 34 Native Americans (Tribe not specified) in the San Francisco area (Soule et al. 1855). With the discovery of gold in the Sierra Nevada foothills in 1848, gold seekers from around the world flooded into San Francisco, the closest seaport to the gold-rich foothills. As a result, the total population of San Francisco grew from 600 in 1848 to 100,000 by 1849 (Milliken et al. 2009). French traveler Ernest De Massey, who visited Mission Dolores in 1849, recounted that, "[a]bout one hundred and twenty persons live around the mission. Most of them are Mexicans, Indians or half-breeds; Europeans and Americans are in the minority" (DeMassey 1927). German traveler Friedrich Gerstaecker, who also visited San Francisco during the Gold Rush, noted that some Native American women who lived around Mission Dolores at that time were employed as domestic servants or took in washing and sewing for Hispanic families. Gerstaecker also notes that there were "still small bands of these Indians roving about, camping in the open air, and living on what they secure in some way, or beg from the settlers" (Engelhardt 1924). With the flood of unemployed Caucasians during the mid-19th century, Native American labor was no longer sought after in urban areas (Cook 1943; Milliken et al. 2009). Milliken et al. (2009) assert that Native American peoples continued to survive in urban areas, but that due to the challenges of finding work, low wages, and lack of housing, few individuals married or had children.

California enacted a series of laws in the 1850s that codified the marginalization of the state's native peoples. In 1851, California's first governor called for a war of extermination to be waged "until the Indian race should become extinct" (Hittell 1878). Under this political regime, unemployed Native Americans could be arrested and sold as indentured laborers; orphaned Native American children could be taken and held in custody by White families until adulthood; and Native Americans were allowed virtually none of the rights of citizenship (Castillo 1978; Heizer and Almquist 1971). While not as physically violent as the state's sponsored bounties for murdering indigenous people in earlier years, in practice these laws led to enslavement of native peoples.

Despite this adversity, native peoples continued to persist on the San Francisco Peninsula (Heizer and Almquist 1971). Because of the disenfranchisement of people of native descent by this time, the census of native populations almost certainly was incomplete. However, a special California census of 1852 recorded only 140 Native Americans in San Francisco and San Mateo counties, and the U.S. Census of 1860 reported only 93 Indians in San Francisco and San Mateo counties and fewer than 1,400 Bay Area-wide (Milliken et al. 2009). Milliken et al. (2009) note that:

In the City and County of San Francisco, the 1860 and 1870 censuses document the disappearance of acknowledged Mission Dolores Indians from the public record and the emergence of an urban pan-California Indian community. Only 37 Indians were reported [in San Francisco] in 1860 and 45 in 1870, remarkably low figures in a total San Francisco population of over 57,000 (1860) and 149,000 (1870).

Due to the population shifts associated with missionization, these numbers likely included individuals representing or descended from native groups outside of the Bay Area, as well as those of Ohlone descent.

Today, there are no known living descendants of the Yelamu Ohlone who once occupied the land now known as the City and County of San Francisco. Until recently, anthropologists believed that the last known descendant of a native of the San Francisco Peninsula died in the 1920s. However, the Association of Ramaytush Ohlone includes families who descend from an Aramai Ramaytush Ohlone individual, whose origin was a village in Pacifica. Geographically, these families are the closest known Ohlone descendants to the native bands of San Francisco, and the only known living descendants of the Ramaytush Ohlone peoples (Milliken et al. 2009).

Ohlone recognition and political assertion gained momentum during the early 20th century, spurred in part by legal suits brought against the U.S. government for reparation due to the Indians of California for the theft of traditional lands. In 1928, under the Indian Land Claims Act, the state established a new roll of Native American descendants and, eventually, provided small reparations payments in which some Ohlone participated. More importantly, these lawsuits brought more attention to the rights of California's indigenous peoples and inspired a new focus on the reevaluation of rights due to the community and its members (Bean 1994). The political organization necessary to mount legal actions led to the formation of Native American advocacy groups throughout California, including a number of Ohlone groups.

Although none of the Ohlone Tribes has yet been formally recognized by the Federal government, a number of Ohlone groups have been politically active since the 1920s and increasingly by the 1960s in efforts to obtain Federal recognition and renewed land rights; to preserve ancestral burial sites and control the treatment of ancestral human remains; to preserve and renew their ancestral heritage, cultural traditions, and languages; and in community advocacy on American Indian issues.

In response to Native American advocacy and to broader social justice movements, the San Francisco Board of Supervisors has formally acknowledged the Ramaytush Ohlone community as the indigenous and sovereign people of the City and County of San Francisco (San Francisco Board of Supervisors 2020). This following acknowledgement is read at the opening of each Board meeting:

The San Francisco Board of Supervisors acknowledges that we are on the unceded ancestral homeland of the Ramaytush Ohlone, who are the original inhabitants of the San Francisco Peninsula. As the indigenous stewards of this land and in accordance with their traditions, the

Ramaytush Ohlone have never ceded, lost, nor forgotten their responsibilities as the caretakers of this place, as well as for all peoples who reside in their traditional territory. As guests, we recognize that we benefit from living and working on their traditional homeland. We wish to pay our respects by acknowledging the Ancestors, Elders, and Relatives of the Ramaytush Ohlone community and by affirming their sovereign rights as First Peoples.

City Commissions and departments have also incorporated this land acknowledgment into their public hearings and public materials. In addition, the City and County of San Francisco recognized the Ramaytush Ohlone as the original peoples of San Francisco County in the Indigenous Peoples' Day Proclamation of 2019.

Additionally, at the encouragement of and in consultation with the Native American community and other groups, the Planning Commission and the Historic Preservation Commission passed resolutions in summer 2020 apologizing for the history of racist, discriminatory, and inequitable historic preservation and planning policies and practices in San Francisco, and committed to centering the work program of the Planning Department on racial and social equity; specifically, to increasing the involvement of historically disenfranchised communities, including Native American peoples (San Francisco Historic Preservation Commission 2021).

2.3 Historic Background

2.3.1 Spanish and Mexican Periods (1769–1848)

Spanish navigation and exploration of the California coast began in 1542–1543, and initial European exploration of the Study Area began in 1769 and lasted until 1810 (Donley et al. 1979). In spring 1776, the site of San Francisco was chosen by Juan Batista Anza for the establishment of a mission and military post. Later that same year, the Mission San Francisco de Asís (also known as Mission Dolores) and Presidio de San Francisco were officially dedicated, and Spain took formal possession in the name of King Carlos III (Hoover et al. 1990:331–334). Mission Dolores was located on land occupied seasonally by the *Yelamu* peoples, and most *Yelamu* were baptized and forced into the mission system as *neophytes* (converts) at Mission Dolores between 1777 and 1784 (Milliken et al. 2007:99–124).

The Spanish annexation and colonization of Alta California, as manifested in the religious-military mission system, produced profound and destructive changes in the cultures of the indigenous Ohlone peoples. The mission system at missions San Carlos Borromeo, San Francisco de Asís, Santa Clara de Asís, Santa Cruz, and San José resettled and concentrated the aboriginal hunter-gatherer population into agricultural communities. The concentration of mission populations, coupled with the indigenous people's lack of immunity to European diseases, decimated the Tribes' populations by common diseases, which were generally not fatal to Europeans. Additionally, many died as a result of austere living and working conditions imposed by the missionaries. It has been estimated that the Ohlone population decreased from 10,000 or more in 1770 to fewer than 2,000 in 1832 (Levy 1978:486).

Jurisdiction over Alta California was established by Mexico in April 1822. A small Mexican-period (1822–1848) settlement known as Yerba Buena was established on the shores of the cove by the same name. A public square that would later be named Portsmouth Square was established in the 1830s near the center of Yerba Buena (and located one block from the waterfront), and it became the primary space for public announcements and events and the nucleus around which municipal and business dealings occurred in Yerba Buena. Some Native American survivors of the mission system may have lived in Yerba Buena during the 1830s and 1840s, while others relocated to *ranchos* (i.e., privately owned cattle ranching estates) outside the townsite. Yerba Buena was surveyed in 1835 by William A. Richardson under the authority of the Mexican government. The land south of Mission Bay was subdivided among numerous individuals in the 1830s and by 1840, the 4,400-acre Rancho Rincón de las Salinas y Potrero Viejo (Ranch of the Salt Marsh and Old Pasture) was granted to Don José Cornelio Bernal (ARG 2018:15).

Friction between Mexico and the United States ultimately led to the Mexican-American War of 1846–1847. On July 9, 1846, a crew from the sloop-of-war *USS Portsmouth* came ashore and raised the first American flag over San Francisco (Beck and Haase 1974:47; Hoover et al. 1990:336). However, as Mexico had ceased stationing regular troops in San Francisco following secularization, the raising of the flag was a symbolic gesture rather than a result of battle(Hoover et al. 1990:331).

2.3.2 American Period (1848–Present)

2.3.2.1 Gold Rush Through the Early 20th Century

After the United States claimed California during the Mexican-American War in 1846, Yerba Buena's first American mayor, Lieutenant Washington A. Bartlett, renamed the settlement San Francisco. Following the discovery of gold at Sutter's Mill in 1848, the settlement's population rapidly expanded, growing from fewer than 1,000 people in 1848 to as estimates 100,000 by the end of 1849 (Milliken et al. 2009). Following a series of devastating fires between December 1849 and June 1851, infrastructure improvements began to push eastward into Yerba Buena Cove as it was filled, and as wharves and city streets were extended into the former bay. Beginning in about 1850 and continuing for more than a decade, Yerba Buena Cove was filled with earth, debris, rubble, and abandoned ships, creating "made land" that extended eastward to today's waterfront at the Embarcadero (i.e., Front Street). While sand made up the bulk of the fill material tossed into the Bay, any available solid material would suffice (Dow 1973:43, 46). Trash, building rubble, and even hulks of abandoned Gold Rush-era ships contributed to the "made land" in Yerba Buena Cove….At the peak of the Gold Rush, Yerba Buena Cove teemed with vessels, many of which were abandoned by their crews, eager to set out to the gold fields. In summer 1850, according to one source, there were more than 500 vessels in the port, consisting of ships, barks, brigs, and schooners (Soule et al. 1855:281). The majority of the fleet eventually returned to sea, but scores of abandoned vessels remained anchored in the

cove well into the 1850s. Most of these were broken up and salvaged by a ship-breaking enterprise based at Rincon Point, but the best preserved and intact were reused as floating storehouses and occasionally hotels or boarding houses (Byrd et al. 2010:43).

Recent scholarship indicates that the remains of 40 or more vessels may still exist encased within the filled lands of old Yerba Buena Cove, extending from Montgomery Street south to Rincon Point (Delgado 2009:9-12, 114-136; Olmsted and Olmsted 1977:281–284).

By 1859, Yerba Buena Cove south of Market Street had been filled east to the Beale Street alignment, with the exception of a small lagoon at Mission and Fremont streets and a larger one at the foot of Howard Street. Some fill extended even beyond Beale Street as far east as Main along Folsom Street. In 1859, much of the cove still remained unfilled, but it was entirely enclosed: wharves extended south along Steuart Street into the open waters of the Bay and completely bridged the cove from Market Street south to Folsom Street. Within the enclosed cove, wharves along the Main Street alignment nearly bridged the inlet, with only a small gap at the foot of Mission Street (U.S. Coast and Geodetic Survey 1859).

From 1860, when the first railroad began service on Market Street, to the calamitous earthquake and fire of 1906, development transformed San Francisco from a frontier port city to a modern Victorian city. Private investment in industry, commerce, and improved transportation helped fuel this growth. Although few individuals became truly wealthy from the Gold Rush, those who made fortunes after 1860 from railroad development, real estate, banking, and the Comstock Lode increasingly made San Francisco their homes, including William C. Ralston and Darius O. Mills of the Bank of California and Leland Stanford, one of the "Big Four," who organized the Central Pacific Railroad (later the Southern Pacific Railroad) and completed the first transcontinental railroad in 1869 (Hittell 1878:366, 429; Scott 1959/1985:50–51).

While San Francisco spread to the west and south, with increasing density, Market Street became the grand avenue that Jasper O'Farrell, the city's first surveyor, had envisioned. Although the Financial District remained concentrated north of Market Street, by the last decades of the 19th century Market Street had come to function as the main circulation artery for both the city's transit system and its commercial culture (Olmsted 1991:14). San Francisco cable cars began operations in 1873 and eventually expanded its system to include a powerhouse and car barn, a fleet of cable cars, and embedded tracks and cables. By 1899, cable cars were running on approximately 10 miles of city streets in downtown San Francisco.

The property types that emerged from pre-1906 development in downtown and near the waterfront included the mostly wood-frame commercial buildings that served adjacent transit lines but also masonry buildings, which were constructed with greater regularity near the turn of the 20th century (Page & Turnbull 2009:46). The Ferry Building (originally known as the Union Depot and Ferry House) was constructed between 1894 and 1903 in the Neoclassical style at Market Street's northeastern terminus. The building marked an entry point to the city

for ferry passengers. Industrial, commercial, and shipping development was positioned strategically in proximity to the waterfront. These property types included offices for shipping agents; ship chandlers; working-class residences, mostly lodging houses; suppliers of construction materials, such as coal and lumber; grocery and liquor stores; and buildings for light manufacturing (Sanborn Fire Insurance Maps 1887:Volume 1; Woodbridge 1988:75).

2.3.2.2 1906 Disaster and Reconstruction, 1906–1920

On April 18, 1906, San Francisco experienced an earthquake that caused a series of devastating fires. Reconstruction efforts included repairing or replacing utility infrastructure throughout San Francisco's core. Along with new streets, sidewalks, and sewers, San Francisco built the Auxiliary Water Supply System (AWSS) between 1908 and 1913. The fire-suppression system relied on high-pressure water hydrants and cisterns, among other elements, to prevent future fires from spreading (Van Dyke 1922).

Replacing infrastructure and utilities in downtown San Francisco occurred in tandem with returning the city's transit system to operation as quickly as possible. Market Street's cable car system was swiftly rebuilt (Ute et al. 2011:11–12). In 1909, the first municipally owned streetcar system in the United States was built along Geary Street from Market Street to the Richmond District; by 1913, it extended to the Ferry Building, replacing horse car service on Market Street (Ute et al. 2011:7, 24; Laubscher 2016). Soon after, traffic lights were introduced on Market Street, and the San Francisco Municipal Railway (Muni) expanded rail service into the city's many residential districts (Ute et al. 2011:52). Railroad companies, such as the Southern Pacific Railroad, also expanded their services in the early 20th century along San Francisco's ports (VerPlanck Historic Preservation Consulting 2018:4, 28).

Large buildings that survived the 1906 earthquake and fires (such as the Chronicle Building) provided models for resilient construction methods, which were replicated in the new downtown district of San Francisco. After 1906, larger steel-frame buildings with fireproof concrete or masonry skins multiplied dramatically along Market Street and across San Francisco. By 1909, San Francisco had 20,500 new buildings, a large number of which accounted for approximately half of the steel-frame and concrete buildings constructed in the United States by that year (Corbett 1979:27–28, 32, 34; Woodbridge 1988:75–77). Amid the devastation of 1906, financial interests and better- funded surviving businesses were able to acquire new property from less-fortunate owners. The Financial District expanded and pushed the warehouse district along the Embarcadero south of Market Street (Corbett 1979:35; Kelley and VerPlanck 2008:43).

2.3.2.3 San Francisco Boom to Bust to World War II, 1920–1945

During the economic boom years of the 1920s, nationwide economic growth and business prosperity encouraged Market Street planners to include public spaces that reflected the consumer-oriented mass culture; this continued through World War II (ICF International 2016:4–22). Increasing numbers of white-collar corporate workers occupied the newer and

larger office buildings downtown (Faragher et al. 2001:427–35; Tim Kelley Consulting 2011:19, 27–31, 35).

The 1930s and early 1940s are remembered as a period of extensive federally funded public works projects, which were associated with President Roosevelt and his close advisers known as the "Brain Trust," the New Deal, and World War II mobilization.

However, the built environment of downtown San Francisco was not dramatically altered by public works projects during this period. Two of the most important New Deal–funded projects of the 1930s, construction of the San Francisco-Oakland Bay Bridge (1936) and Golden Gate Bridge (1937), dramatically increased automobile traffic in the city (Faragher et al. 2001:448–54; MIG 2015:20; Scott 1959/1985:234–238; no author 1978:8–24).

Although 24 transit lines operated along Market Street, transit infrastructure remained relatively unchanged from 1920 through 1947. During that time, automobile traffic increased as personal vehicle ownership increased (Laubscher 2016). In 1930, an initiative was passed to give the private Market Street Railway Company a 25-year operating permit extension (Ute et al. 2011:61); however, in 1944, the company was purchased by its public competitor, Muni, for $7.2 million (Vielbaum et al. 2004:7).

2.3.2.4 Downtown San Francisco Decline and Redevelopment, 1945–1979

Like much of America, by the end of World War II, downtown San Francisco's commerce went into decline as middle-class residents fled the city for the suburbs (Tim Kelley Consulting 2011:61–63, 69–70; Scott 1959/1985:273, 280, 283–84). However, the advent of the information economy and deindustrialization aided the development of new office buildings. Beginning in the 1960s, San Francisco's blue-collar jobs decreased while white-collar jobs increased in finance and related sectors. Between the 1960s and 1980s, downtown San Francisco office space more than doubled with new construction (Godfrey 1997:317–318; Kelley and VerPlanck 2008:44–45). Many new office buildings were designed in the style that came to be known as Corporate Modernism, which favored clean horizontal lines and cubic forms that expressed their structure and function through their use of materials (Brown 2011:167, 135; Kelley and VerPlanck 2008:45).

With the establishment of the San Francisco Redevelopment Agency in 1948, San Francisco became one of the first American cities to plan for large-scale redevelopment initiatives and make use of federal funding to clear areas and neighborhoods that had been classified as slums. However, negative reaction to redevelopment gave birth to an organized opposition movement. Still, between 1948 and 1970, the San Francisco Redevelopment Agency completed eight major redevelopment projects, including Golden Gateway (Brown 2011:41; Kelley and VerPlanck 2008:46–47, 49–51; Page & Turnbull 2009:67–70). The Embarcadero Center formed the southern portion of the five- block Golden Gateway Redevelopment Project—the largest office development in San Francisco. These Modernist buildings departed from the International Style and Corporate Modernism, representing development of Late Modern

architecture (Brown 2011:47, 190, 245; Kelley and VerPlanck 2008:45–46). Other San Francisco Redevelopment Agency projects in the Study Area included the Butchertown (now known as India Basin), Rincon Park and South Beach, and Mission Bay.

Approval of the San Francisco Bay Area Rapid Transit District (BART) in 1962 by voters spurred redevelopment of Market Street, which occurred in conjunction with construction of the BART subway system. The Market Street Redevelopment Plan (MSRP), which was designed and implemented between 1968 and 1979, refers to the designed landscaped areas and plazas for the section of Market Street between the Embarcadero and Octavia Boulevard. The MSRP incorporated Embarcadero Plaza, which was funded as part of the Golden Gateway Redevelopment Project (Brown 2011:148, 150, 153).

Embarcadero Plaza, designed by Lawrence Halprin and completed in 1972, connected Market Street to the Ferry Building and other waterfront areas, despite the obstruction presented at the time by the elevated Embarcadero Freeway (Hirsch 2014:17).

2.4 San Francisco Waterfront Development History: 1848–Present

2.4.1 Gold Rush Period and the Establishment of the Port of San Francisco

Following the discovery of gold in the Sierra Nevada in January 1848, Northern California experienced a significant population increase as immigrants poured into the territory seeking gold and other opportunities. San Francisco transformed quickly from an isolated hamlet into a bustling center of commerce around Yerba Buena Cove and on the surrounding sand dunes and hills (Hoover et al. 1990:334–336). The influx of thousands of newcomers included several immigrant communities. The Latin (i.e., Italian) quarter was established at the base of Telegraph Hill, and the Chinese community established itself in the area southwest of Portsmouth Square beginning around 1850 (Beck and Haase 1974). To accommodate the growing population, San Francisco rapidly expanded in all directions (Pastron et al. 2007). By the late 1840s, a shortage of wharfage in San Francisco was already apparent. During the early gold rush period, the urbanization and topographic changes occurring along the San Francisco waterfront led to a dramatic transformation of the contours of the bay shoreline, primarily due to the development of timber wharves and piers, as described below:

Wharf development was one of the most competitive areas of San Francisco's early economy. The city lacking the funds to construct the needed wharfs, the development of San Francisco's wharves was from the beginning proprietary ventures. The wharf-companies sought to maximize their interests by extending wharves as far as possible to reach deep-water and, thus, ocean-going vessels with deep drafts (Dean 1997).

The subsequent filling between the wharves soon extended the city's shoreline (including the entire Study Area) and further changed the topography of the northern peninsula:

Soon after the city's many wharves had been built out from the original shoreline of the bay for some distance, cross connecting streets on pilings were erected to join one wharf to the next. Soon, the enclosed areas were filled with sand or other materials and the shoreline began to advance bayward. The amount of filling necessary for a given piece of property was based on the need to bring it to the level of the officially established city grade. Landfill most commonly consisted mostly of dune sand, accessible almost everywhere; other fill included rubbish, building rubble, abandoned ships, or anything else which had no immediate value (Dow 1973).

The gold rush sparked the development of a large-scale port in San Francisco. Until 1863, the City managed the Port, and private interests built the wharves, piers, and facilities that handled 83 percent of the cargo shipped out of the Pacific coast. In 1863, the State assumed ownership of the Port of San Francisco and created the Board of State Harbor Commissioners (BSHC) to bring consistency to the administration, development, and maintenance of the Port. The BSHC followed a policy of financing Port improvements through Port revenue, which supported incremental development. Permanent development of the Port began in 1881 with the construction of a 21-section seawall along the waterfront, which was completed in 1915 and resulted in the gently curving form of the waterfront. The seawall replaced the jagged waterfront developed between the 1840s and 1860s (ARG 2018:20–21). After the seawall was completed, the BSHC constructed new timber wharves and piers. The wood structures deteriorated quickly, and many were reconstructed using more resilient materials (e.g., Pier 7 was built with steel piles in 1895, and Piers 19, 21, 23, and 25 were built with unreinforced concrete piers in 1901), although these also failed in a matter of years (Corbett et al. 2006:8-130). The piers north of Market Street were given consecutive odd numbers, and the piers south of Market Street were given consecutive even numbers. The Union Ferry Depot (commonly known as the Ferry Building) was completed in 1898 at the intersection of the Embarcadero and Market Street and immediately became an iconic landmark that functioned as the gateway to San Francisco for thousands of people (San Francisco Planning Department 1977).

The land south of Mission Bay, much of which was distant from downtown San Francisco and lacked transportation connections to the city, was sold to real estate buyers. Rather than struggle to establish residential communities in these relatively remote locations, many of the landowners turned to industrial development of the central and southern waterfront. Within the Study Area, some of the major industries included gunpowder production, rope-making, shipbuilding, iron and steel works, barrel production, sugar refineries, butcheries, and power generation (ARG 2018:16–17; San Francisco Planning Department 2018:4.D-2–4.D-7; Carey & Co. 2014).

2.4.2 1906 Earthquake and Fires

On April 18, 1906, a major earthquake occurred that caused widespread damage across the Bay Area, and much of San Francisco was devastated by the ensuing fires. The earthquake ruptured

water mains across the city, and the fires burned for 3 days, engulfing approximately 500 city blocks. Van Ness Avenue was used as a *firebreak*[3] and the fire damage was generally contained to the area east of Van Ness Avenue.

Along the waterfront, tugboats pumped seawater from the bay into hoses and fire engines (Niderost 2006). Some waterfront features, including the Ferry Building, were saved from extensive fire damage. However, many of the wharves and pier sheds were destroyed, as noted in a 1907 report by the U.S. Geological Survey, "Most of the structures built on piles along the bay suffered considerable damage, especially the [wood-]frame sheds on the wharves." Another contemporary account by the Port's former chief engineer, Marsden Manson, described the general condition of the Port, "The facilities upon our waterfront were utterly inadequate before the catastrophe. They are more so now" (Corbett et al. 2006:8-131). South of Mission Bay, the waterfront experienced relatively little damage (San Francisco Planning Department 2001:11).

2.4.3 Reconstruction and Development of the Waterfront Through World War II

The BSHC spent the 2 years following the 1906 earthquake and fire planning, financing major repairs, and modernizing the Port. The new Port would not only be functional and resilient (i.e., constructed mostly of reinforced concrete with some creosoted timber piles), its design also would enhance San Francisco, which, like many other American cities, was undergoing large-scale changes that reflected the City Beautiful Movement. Beginning in 1908, the new pier bulkhead buildings constructed south of the Ferry Building were designed in the Mission Revival Style, such as the Pier 22½ Fireboat Station 35 and Piers 26, 28, and 38. Beginning in 1915, the new pier bulkhead buildings constructed north of the Ferry Building were designed in the Neoclassical Style, such as Piers 1, 1½, 3, 5, 7 (altered), 9, 15, 19, 23, 29, 31, 33, 35, and 43 (remnant). In the late 1920s, Piers 45 and 48 were built with bulkhead buildings designed in the Gothic Revival Style (Corbett et al. 2006:8-156 to 8-158). Today, these facilities constitute the majority of historic resources in the Port of San Francisco Embarcadero Historic District (Embarcadero Historic District).

Beginning with the opening of the Panama Canal and the beginning of World War I in 1914, the waterfront was transformed. The Bethlehem Steel Corporation's shipbuilding yard at Pier 70 (formerly the Union Iron Works) manufactured submarines and ships for the Royal British Navy, launching hundreds of freighters and destroyers during the war (San Francisco Planning Department 2001:15). While post-war production south of Mission Bay slowed significantly, San Francisco was the second largest port in the United States in terms of the value of its cargo through the 1920s and 1930s. As a *breakbulk* port with general cargo,[4] all goods arrived on ships and were unloaded and stored in warehouses before being loaded onto trucks or trains.

[3] A firebreak is an area that is cleared (or in this case properties that were dynamited) to prevent the spread of fire.

[4] *Breakbulk cargo* are goods that must be stowed individually, and will be listed on multiple bills of lading, each covering a different commodity.

Goods that arrived in crates were opened and distributed to warehouses, then reloaded for delivery to their final destinations. Port workers handled a wide variety of finished products, such as automobiles, as well as agricultural produce, and port facilities accommodated the growing military needs of the area. The combination of a wide variety of goods coming through the port, the large number of warehouses constructed on each pier, and the direct access to labor and transportation to the rest of the state allowed the Port to weather the Great Depression better than other commercial centers in the country (Corbett et al. 2006:8-23 to 8-24).

During World War II, the Port of San Francisco was the largest part of the San Francisco Port of Embarkation, which included other ports in the region. It also served as the gateway to the Pacific Theater and became the second-largest military port in the United States during the war. People, equipment, and supplies flowed through the San Francisco Port of Embarkation and Fort Mason from the industrial centers of the Midwest to the bases and ships in and around the Pacific rim. Bethlehem Steel produced war ships through the duration of World War II. This period marked the peak of activity for San Francisco's waterfront, and shipping and manufacturing activities declined sharply after the war ended in 1945 (San Francisco Planning Department 2011:5.5-14).

2.4.4 Containerization and Decline in the Mid-20th Century

Following the war, profitability declined as competition from other ports in the region, which were faster to adopt containerized shipping technologies, eroded the Port of San Francisco's long-held dominance of the Pacific coast shipping industry. At the Port of San Francisco, adaptation to containerized shipping included increasing the size of some piers up to 100 feet in width and several hundred feet in length to accommodate the new, larger cargo ships. The first project under this new plan was a two-phase development that resulted in the Mission Rock Terminal and expanded facilities at Pier 50. However, these improvements could not keep pace with other west coast ports in Oakland, Los Angeles, and Seattle, where there was more space to expand (Corbett et al. 2006:8-41 to 8-42).

2.4.5 Revival in the Late 20th Century

The port also suffered as a result of its disconnection from the rest of the city when, in 1959, a 1-mile-long elevated freeway known as the Embarcadero Freeway opened to vehicular traffic within the Study Area from Folsom Street to Broadway. The elevated freeway structure created a visual and physical barrier between the waterfront and San Francisco's Financial District. During the 1960s, many of the piers were vacant; others burned down or were demolished (San Francisco Planning Department 2011:5.5-14). In response, the San Francisco Port Authority replaced the BSHC in 1965. In 1968, State management of the port transitioned to a new City agency, the San Francisco Port Commission (San Francisco Planning Department 2011:5.5-14) via the Burton Act.

The 1970s ushered in a new era of adaptive use and rehabilitation for port facilities. In 1989, the Embarcadero Freeway was damaged in the Loma Prieta earthquake; it was demolished by 1991. Today, the Embarcadero is an open street-level boulevard along the San Francisco waterfront. Port property includes mixed uses, such as maritime, recreational, tourism-related, commercial, light-industrial, and storage uses, along a waterfront landscape that has been recognized for its unique historic and architectural significance, including several Historic District listings (see Section 4.5, *Aboveground Resources Findings*) in the National Register of Historic Places (NRHP) (San Francisco Planning Department 2011:5.5-15).

2.4.6 Transportation Development along the San Francisco Waterfront

2.4.6.1 Railroad Infrastructure

Initially thousands of miles from the nearest railhead, early San Franciscans relied on maritime commerce to move people and goods to and from the city. That began to change in the 1870s with the arrival of the Southern Pacific Railroad, which approached the city by way of an old San Francisco-San José Railroad right-of-way as well as ferry service from Oakland. The railroad filled in much of the bay in the Mission Bay area and built a network of lead and spur tracks to service the Union Iron Works and other industries along the waterfront. In 1890, the city's bayfront witnessed creation of the State Beltline Railroad, which transported freight along the Embarcadero. The railroad extended along the bayfront from the Presidio to Islais Creek. In 1900, Southern Pacific's monopoly on freight and passenger rail service to San Francisco was broken with the arrival of the Santa Fe Railway, which reached the city by building railheads at Oakland and Richmond, then ferrying its railcars across the bay. Santa Fe also laid tracks down Illinois Street and filled in approximately 40 acres of bay tidelands for a freight railyard. By the mid-1980s, both Southern Pacific and Santa Fe ended freight and passenger service to the city; the city's beltline shut down in 1993 (VerPlanck 2018:12–14, 48; Sanborn Fire Insurance Company n.d.).

2.4.6.2 Streetcars and Cable Cars

Cable cars were first introduced in San Francisco in 1873. In the years that followed, San Francisco witnessed a proliferation of cable car operations by various private companies. However, their lines were greatly damaged by the 1906 earthquake. In the years that followed, many of the city's cable car lines were rebuilt for electric streetcars, which proved more economical. Cable car service was retained only on the city's steepest hills. By the early 1940s, the city's various transit lines were consolidated and under the control of two operators: the publicly run Muni and the privately run Market Street Railway. Together, these two entities operated dozens of streetcar and cable car lines, many of which terminated at or graced the city's bayfront. In the mid-1940s, voters approved the City's purchase of the Market Street Railway. In the years that followed, numerous streetcar routes were replaced by bus routes. By the mid-1950s, only a handful of streetcar and cable car lines remained. Today, the city's bayfront is served principally by the F-Market and E-Embarcadero streetcar lines; Aquatic Park

can be reached by the Powell-Hyde cable car. The city's surviving cable car infrastructure was designated a National Historic Landmark in 1964 (Arvin 2020; San Francisco Municipal Transportation Agency 2020; Dillon 1964).

2.4.6.3 Bridges and Freeways

Following the stock-market crash in 1929, the 1930s and early 1940s saw extensive federally funded public works projects, which were associated with President Roosevelt, the New Deal, and World War II mobilization. Two of the most important New Deal–funded projects in California, the San Francisco-Oakland Bay Bridge (1936) and Golden Gate Bridge (1937), dramatically increased automobile traffic in San Francisco. In response, State and local traffic engineers hatched plans for a network of freeways and expressways that would blanket the city. Included in these plans was a freeway to be built along the Embarcadero and through North Beach and the Marina District to provide access to the Golden Gate Bridge. However, in the face of widespread community opposition in the 1950s and 1960s, only portions of the plans were realized. This included a portion of the Embarcadero Freeway, which was built in 1959. However, the freeway was damaged in the 1989 Loma Prieta earthquake and subsequently removed in the early 1990s. It was replaced by a wide multi-use urban boulevard, the Embarcadero (De Leuw, Cather & Company 1948; Congress for the New Urbanism n.d.).

2.4.6.4 Ferry Service

The first ferry service in San Francisco was established in 1850; it provided service to Oakland. Over the next century, ferry service expanded, with more than two dozen major transbay ferry lines serving nearly 30 destinations. The proliferation of ferry service eventually led to construction of the Union Depot and Ferry House (now the Ferry Building), located on the Embarcadero at Market Street. The depot opened in 1898 and was completed in 1903. It served as the primary hub for ferry service to and from the city. With eight ferry slips, the depot served approximately 50 million commuters and visitors every year—more than 130,000 per day. Ferry service to the city peaked in the 1930s but then declined sharply after the Bay Bridge and Golden Gate Bridge opened in 1936 and 1937, respectively. Both bridges induced more automobile travel to the city and undercut demand for ferry service. In 1978, the Ferry Building was listed in the NRHP (Carlsson n.d.; McGuire 1977).

2.4.7 Commercial and Industrial Land Use: Northeast Waterfront, Mission Bay, Dogpatch, and India Basin

Waters east of Black Point on the north shore of the peninsula lacked the deep water needed to support substantial port operations. Although the commercial and industrial businesses that began to populate the area in the 1850s included some with a less direct association with maritime commerce and more general manufacturing, some businesses did build private wharfs along the north shore. This area continued to support manufacturing as well as

commercial fishing through the middle of the 20th century (San Francisco Planning Department 2011:5.5-16, 17).

Closer to the port in Yerba Buena Cove, the Northeast Waterfront, located in the area now bound by the Embarcadero on the east, Sansome Street on the west, Broadway on the south, and Union Street on the north, was populated with commercial warehouse storage and industrial buildings for maritime uses as early as the 1850s (San Francisco Planning Department 2011:5.5-15). Brick and concrete industrial buildings associated with maritime uses were built throughout the 1960s (City and County of San Francisco 1983).

By the middle of the 19th century, waterfront development began to extend to the south, and ports and piers for shipping populated Mission Bay. Use of the area expanded quickly and included railroads and warehouses that provided land transport and storage in support of the break-bulk cargo port (Olmsted 1991:14). South of Mission Bay, Dogpatch (sometimes referred to as the Central Waterfront) was a center of industrial development early on because it was near a deep-water anchorage and, at the time, in a relatively remote location compared to the settlement of Yerba Buena.

Some of the earliest industries to populate the shoreline included a black powder factory (1854); a cordage factory (1857); several ship builders (after 1862); a rolling mill (1868); slaughterhouses, tanneries, tallow works, and butchers (after 1865); and the Union Iron Works (1883). Industrial growth along the waterfront continued prior to the turn of the century with the construction of gasworks, ironworks, food and fertilizer companies, barrel manufacturers, and canneries (San Francisco Planning Department 2001; Olmsted and Olmsted 1977).

Substantial waterfront development south of Mission Bay continued into the 20th century. In 1908, Union Iron Works brought large-scale industry to Potrero Point. It was later acquired by the United States Shipbuilding Company, renamed the San Francisco Yard, and subsequently combined with the neighboring Risdon Iron & Locomotive Shipbuilding Works to create an even larger shipbuilding operation. The San Francisco Yard continued to expand its facilities through World War I (San Francisco Planning Department 2001).

Between 1868 and 1877, the area south of Islais Creek became home to malodorous and noisy slaughterhouses and tanneries that were banned from the developed areas of San Francisco to the north. Such facilities in Butchertown, as the area came to be known, were constructed on piers and wharves along the Islais Creek estuary, where tidal action flushed waste into the bay (ICF 2022:153–154). At Islais Creek, marshland restricted development until 1925, when the Islais Creek Reclamation District was formed. Marshes and tidelands were filled, Islais Creek was dredged, a turning basin at the western end of the creek was created to allow ships to maneuver, and a bulkhead was constructed (San Francisco Planning Department 2001:16, 17). Farther south, India Basin developed slowly. Although there was a concentration of Chinese fishing camps from the 1860s to the 1950s, as well as various other small industries (e.g.,

slaughterhouses, tanneries, tallow works, butcher, shipyards, dry docks), this part of the waterfront remained relatively rural into the 20th century (AECOM 2017:14).

During World War II, waterfront industrial facilities expanded to meet military demand. The San Francisco Yard expanded operations to provide ships and submarines in support of the war effort. At that time, it had one of the largest labor forces in the region, employing more than 18,500 workers. During that same period, several small oil companies also built facilities along the waterfront (San Francisco Planning Department 2001). Rural land around India Basin was used to build temporary housing, which accommodated the influx of labor in the shipyards during World War II (AECOM 2017:14).

Despite this war-time boom, after World War II, orders for ships at the San Francisco Yard decreased, and other industries began to shutter as manufacturing jobs moved overseas, reducing demand for industrial jobs in the region (San Francisco Planning Department 2001). Although many warehouse and manufacturing facilities associated with the city's industrial legacy were demolished, some were retained into the 21st century through efforts to adapt the buildings for commercial or multi-family residential uses (Port of San Francisco 2010).

2.4.8 Military Occupation and Public Recreation along the Northern Waterfront

Military occupation of Black Point began following an 1850 executive order that identified 10,000 acres of land on the San Francisco Peninsula for U.S. military use. However, it was not until 1882 that the fortification on the point became known as Fort Mason. Although the landscape was improved for new military facilities during the Civil War, the site was not ideal for defense relative to the battery fortifications farther west. As such, Fort Mason was used as a site for temporary housing for displaced citizens after the 1906 earthquake as well as used as the site for the Panama Pacific International Exposition. The fort was active during World War I and World War II, but its relevance diminished during the 20th century. However, in 1972, Fort Mason was transitioned to the National Park Service (NPS) for recreational use. It includes an NRHP Historic District. In addition, a portion is designated as a National Historic Landmark District (NPS 2010; San Francisco Planning Department 2011:5.5-18).

Use of the northern waterfront for recreation had a legacy that began in the 1880s when Black Point Cove first became a popular bathing site. As early as 1866, landscape architect Fredrick Law Olmsted advocated for creation of an aquatic park at Black Point Cove, seeing it as an ideal location for public recreational amenities. By 1931, construction of Aquatic Park began with a municipal pier, followed by facilities built by the Works Progress Administration from 1935 to 1939, including the Aquatic Park Bathhouse, amphitheater, speaker towers, convenience stations, a seawall, and promenade. In the late 1950s, the Maritime State Park was formed. In 1988, Maritime State Park and Aquatic Park were designated the San Francisco Maritime National Historical Park by NPS. Much of this area was also designated as the Aquatic Park National Historic Landmark District and listed as an NRHP Historic District (San Francisco Planning Department 2011:5.5-17).

3.0 Previously Identified Resources

For the purposes of this project the USACE developed a Study Area that includes all areas within 1,000 feet (~300 meters) of the proposed alternatives. The Study Area (Figure 1) is entirely within the city and county of San Francisco and extends for 7.5 miles along the waterfront between Fort Mason and Heron's Head Park, with expanded areas around Mission and Islais Creeks.

3.1 Records Search Summary

There were two records search efforts for this study to date. On July 17, 2020, a cultural resources records search for the study was conducted by staff of the Northwest Information Center (NWIC). The NWIC is the California Historical Resources Information System (CHRIS) repository, which houses records of previously recorded cultural resources records and studies in the Study Area. The 2020 records search identified previously recorded archaeological and aboveground cultural resources within ⅛ mile of the alternatives footprint. This effort was repeated on March 2, 2023, for the expanded Study Area.

The records search was performed using data from the following sources:

- NRHP
- California Register of Historical Resources (CRHR)
- California Inventory of Historic Resources (1976)
- California State Historical Landmarks (1996)
- San Francisco Property Information Map
- Built Environment Resources Directory for San Francisco County
- The results of the records search were provided in the following forms:
- Mapped locations of
- Previously recorded archaeological resources
- Previously recorded architectural resources
- Copies of resource records for previously recorded archaeological resources
- Resource records for previously recorded architectural resources.

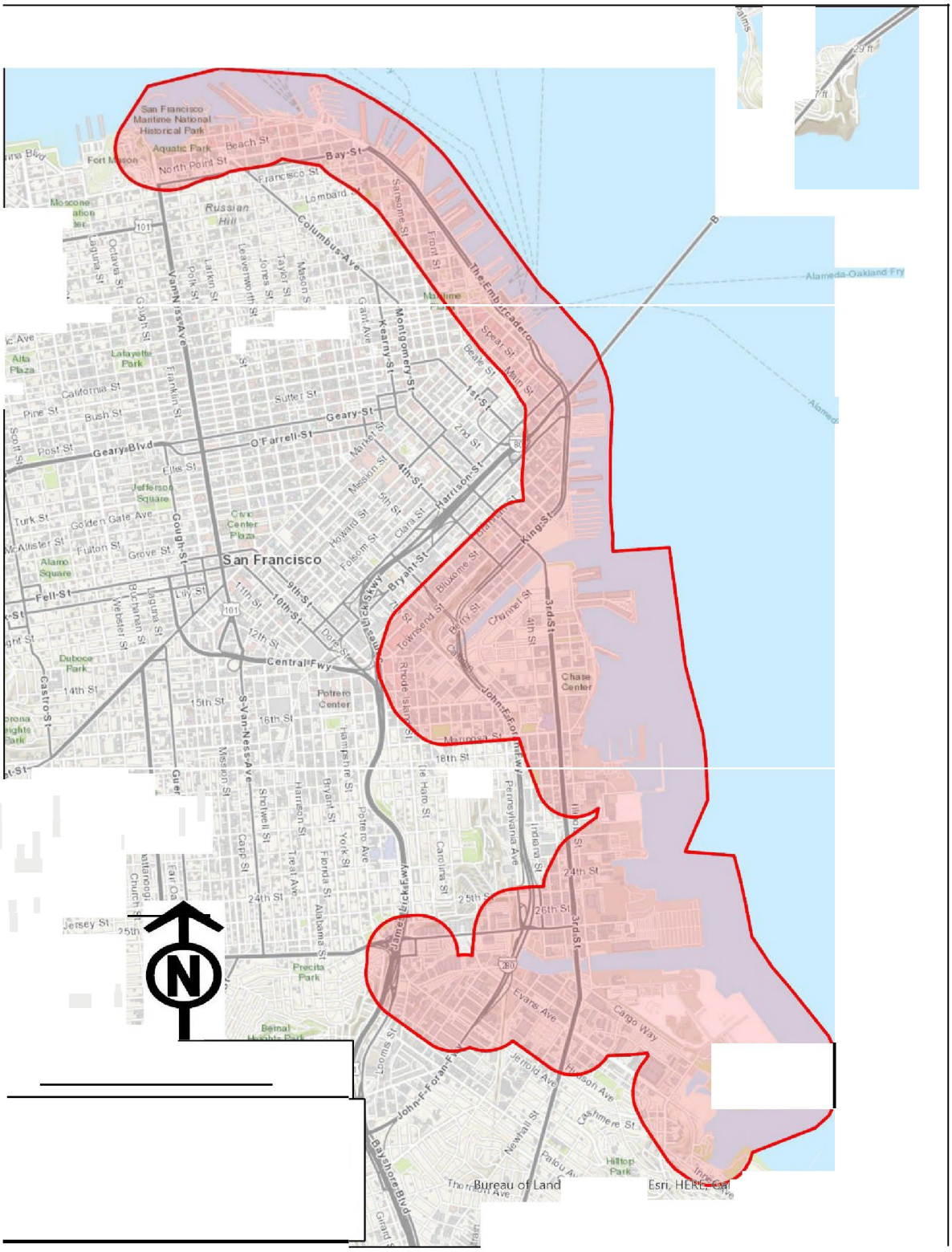


Figure 4. San Francisco Waterfront Coastal Flood Study Area

3.2 Background Literature Review

Recent and relevant research efforts in San Francisco were used to compile historic context statements and identify historic properties in the Study Area. The Market Street Cultural Landscape Evaluation (ICF International 2016), the Better Market Street Environmental Impact Report (San Francisco Planning Department 2019), and the NRHP informed the physical development and social contexts related to the Market Street corridor and adjacent buildings in the Study Area. This research effort was performed using materials received from the San Francisco Planning Department, which included local landmark designation reports, historic maps and images, and original plans and drawings of City-owned properties in the Study Area.

Available surveys and historic documentation for the Study Area were also collected, including current and completed surveys, the *Port of San Francisco Historic Resources Data Base* (ARG 1996), NRHP and CRHR historic district context statements, and California Department of Parks and Recreation series 523 (DPR 523) form sets for previously identified properties in the Study Area, through the San Francisco Planning Department website and through the online San Francisco Property Information Map. Much of this information was synthesized in the *Waterfront Plan Final Environmental Impact Report* that was certified in March 2023 (San Francisco Planning Department 2023).

The 2020 background literature review for the AWSS NRHP evaluation also informed the current study. The AWSS is a *discontiguous*[5] historic district that has been determined to be eligible for listing in the NRHP under Criteria A and C for its association with post-1906 earthquake reconstruction and engineering in San Francisco, with a period of significance of 1906 to 1913. The AWSS is a citywide gravity-fed water supply system for fire suppression that comprises numerous buildings, structures, and infrastructural features that extends across the Study Area and beyond. None of the contributing features of the AWSS Historic District is owned or managed by the Port. In the 2020 background literature review, primary and secondary sources associated with physical development of the AWSS and its historic context of fire suppression infrastructure in San Francisco were referenced. Primary sources consulted included the following: the *San Francisco Chronicle* and *San Francisco Call*, available online through the San Francisco Public Library (SFPL) website and the California Digital Newspaper Collection, respectively; AWSS-related materials available in the SFPL Ephemera Collection; administrative materials contained in the San Francisco Public Works (SFPW) Bureau of Engineering Records collection, held by the SFPL; and scanned historical maps provided by SFPW. Secondary historical sources, recent planning studies, environmental compliance documents, and equipment/systems operations manuals prepared for City agencies, including

[5] The AWSS is characterized as a *discontiguous* historic district because some of its contributing features, such as cisterns, are not physically connected to the remainder of the system. However, all elements of the AWSS are functionally linked.

SFPW, the San Francisco Public Utilities Commission, and the San Francisco Fire Department were also consulted.

An updated NWIC CHRIS records search was conducted in 2023 to inventory cultural resources within a Study Area that was expanded relative to the Study Area established in 2020. Historic contexts were not developed for all captured resources at the time. It is expected that another cultural resources identification effort will be necessary closer to the anticipated construction start date.

The Port of San Francisco plans to complete flood resilience measures by 2040. The buildings, structures, and districts that currently meet (in 2025) or will meet the 50-year threshold for consideration as potential historic properties by 2040 (i.e., those constructed in and before 1990) are documented in this report.

3.3 Methods and Findings

This section presents the identification methods for known historic properties in the Study Area, which included NWIC CHRIS record searches, San Francisco Property Information Map record review, and review of documentation available in the NPS NRHP database. Also, an analysis of archaeological sensitivity to determine as-yet-unrecorded resources is presented by reach sections. This section also presents the findings of historic property identification yielded from identification methods. The findings are summarized by archaeological resources, traditional cultural properties, and aboveground historic properties. Finally, evaluation methods for the assessment of impacts on previously identified resources are introduced. Impacts and proposed alternatives are discussed in the next chapter.

3.3.1 Identification of Archaeological Historic Properties

This section provides information regarding known archaeological sites identified in the Study Area, based on findings from the July 17, 2020, and March 2, 2023, NWIC CHRIS record searches. To facilitate review, the areas of the coast are broken down into four reaches (USACE 2024). The section also includes an analysis of archaeological sensitivity and describes where as-yet unrecorded resources may be found. Most of the sites are categorized as "Undetermined" under the NRHP eligibility criteria.

3.3.2 Archaeological Sensitivity

To understand the archaeological character of the Study Area, this study reviews the existing literature, archival city maps, historical maps, geological reports, an updated archaeological records search, archaeological reports, and site records. For an understanding of more modern development, it reviews aerial imagery, the San Francisco Property Information Map, and records of ground disturbance and foundation types from recent building projects. These data are then used to characterize the potential archaeological resources and relative archaeological sensitivity of the Study Area.

A review of the Geoarchaeological Assessment and Prehistoric Site Sensitivity Model for the City and County of San Francisco, California (Meyer and Brandy 2019), reveals that much of the Study Area has moderate to high sensitivity for both buried and submerged Native American archaeological resources and low sensitivity for Native American archaeological resources that would have been on the surface prior to historic-era landscape modifications, including the import of fill material and modern construction. This study used a variety of factors, including pre-development distance to water, landform age, topography, and the timing of local sea-level rise. The model does not generally consider factors like the depth of historic-period ground disturbance at specific locations and therefore may not accurately reflect the archaeological site sensitivity. A more detailed project-specific analysis must be performed to precisely define archaeological site sensitivity when additional information becomes available. Furthermore, an analysis of the potential for a project to result in impacts on archaeological sites is based on the extent and depth of proposed construction-related ground disturbance relative to the potential depth at which resources may occur.

3.3.2.1 Native American Archaeological Resources

Native American property types that might be encountered within the Study Area include midden, artifact and/or ecofact scatters, burials, isolated finds, and re-deposited Native American material (Byrd et al. 2014). Recently, Far Western developed the San Francisco Planning Department's citywide sensitivity model for Prehistoric Resources, a Native American archaeological sensitivity model covering the entire city and county of San Francisco (Meyer and Brandy 2019). The model addresses sensitivity for surface archaeological resources (Native American archaeological deposits that tend to occur at or near the present ground surface, or the historic-era surface as it existed before about 1850 A.D., including those that are capped by built structures or covered by artificial deposits), buried archaeological resources (land surfaces that were covered by terrestrial sediments such as alluvium, colluvium, or wind-blown dune sand, subsequent to the formation of the deposit and before the historic period), and submerged archaeological resources associated generally with the submerged pre-Middle Holocene (8,200 to 4,200 Before Present) land surface, but potentially submerged much more recently, depending on setting. The sensitivity model is based on a diachronic reconstruction of the bay and ocean shoreline at 1,000-year intervals (based on known rate of sea-level rise and pre-bay landform elevations, developed based on bathymetric and geotechnical coring data; degree of slope; proximity to the bay shore, creeks, creek confluences, and other water sources; distance from recorded Native American archaeological sites; landform history (e.g., whether an area was subject to alluvial burial or erosion); and available data on areas of extensive historic or modern grading). This modeling suggests that areas within a 200- to 240-meter (about 650- to 800-foot) radius of a perennial stream channel or lake or of the bay shore have the highest sensitivity for the presence of Native American archaeological resources (Meyer and Brandy 2019). This is consistent with the historically documented distribution of Native American archaeological sites in San Francisco, and as documented in the confidential

San Francisco County archaeological records on file at the CHRIS, NWIC at Sonoma State University (Nelson 1908).

3.3.2.2 Historic-Era Archaeological Resource Types

The Study Area includes the city's waterfront from India Basin at the southern end to the Aquatic Park at the northern end, and is divided into to four reaches: Fisherman's Wharf (Reach 1), Embarcadero (Reach 2), Mission Creek/Mission Bay (Reach 3), and Islais Creek/Bayview (Reach 4). With the exception of Potrero Point, the entire Study Area was within the waters of the bay through the mid-1850s and therefore there is the potential for historic-era resources, including shipwrecks, wharfs, and storeships, to be present under or at the base of later historic-period landfill. There are shipwrecks and storeships in the Study Area. Recorded shipbreaking sites (300 Spear, 201 Folsom-Hare's yard) have been discovered on the Yerba Buena Cove shoreline southwest of the Study Area, and there is potential for deposits associated with shipbreaking to be present in the Study Area. Other mid- to late-19th-century maritime-related features that could be present in the Study Area include shipbuilding facilities near Steamboat Point and, later in time, at Potrero Point.

From the 1850s to the 1870s, there were a series of wharfs and piers that extended into the Study Area (see below for detailed list under each reach). Most of these structures were burned, demolished, or buried as the city filled in the bay to create what is today the modern shoreline of the city. Remnants of the city's waterfront seawalls, which include sections built in the late 1860s, and the current seawall, constructed between 1880 and 1924, also could be present in the Study Area. Given the large amount of fill deposited and the many sequences of fill events, there is potential for the presence of ships sunk as part of water lot filling, landfills and dumps, localized dumping off of piers as well as fill infrastructure within the fill, railroad remnants (ballast, grade, ties, fasteners, plates), and retaining walls. Other property types that could be present in the Study Area include Chinese/Chinese American habitation and occupational areas along waterfront. There are no known burial places or isolated historic-era human remains in the Study Area; however, the Marine Hospital (1854–1868) may have had a burial ground in close proximity. Finally, railroads dramatically altered the eastern shoreline of the city between the 1860s and the 20th century. A review of the historic-era rail lines within the city indicates that remnants of the Southern Pacific, Santa Fe, Western Pacific, California Belt, and Oceanshore line may be present in the Study Area. Although not specially recorded as an entire system, sections of the California Belt track are designated as contributing features to the multiple historic districts along the waterfront including the Central Embarcadero Piers Historic District, the South End Historic District, the Embarcadero Historic District, the Northeast Waterfront Historic District, and Pier 1. In addition, 19th- and early-20th-century transportation infrastructure, such as omnibuses, could be encountered in the Study Area.

Historic-era resources in the Study Area have been documented at depths ranging from 3 and 5 feet below the modern surface to as much as 30 feet below the surface. Historic maritime

features (seawalls, ships, piers, and wharves) most often are found at depths of 10 to 30 feet below the modern surface (Lentz 2021).

3.3.2.3 Reach 1

Reach 1 includes Aquatic Park, Fisherman's Wharf, Pier 31 to Pier 35, and the North Beach neighborhood. This reach contains unique open space, recreational opportunities, historic resources, and tourism attractions that are recognized as global icons.

There are five archaeological sites in the Study Area in Reach 1. Given the existence of these pre-European-contact archaeological resources, as well as the proximity to the shoreline, freshwater sources, and food sources, there is high likelihood for additional Native American resources to be present (Meyer and Brandy 2019). Reach 1 appears to have moderate to high sensitivity for historic-era archaeological resources. Potential historic archaeological resources include features and deposits associated with early unmarked cemeteries, buried ships, wharves and piers, and 19th-century privies, wells, and trash features. Historical research themes might include maritime industries, immigration, and the Gold Rush. In addition, Reach 1 contains areas of moderate, high, and highest near-surface, buried, and submerged resource sensitivity, especially along the shoreline. Despite the area being subject to early development, there is a potential for undocumented buried Native American archaeological sites. There are four shell middens (P-38-000023, P-38-000030, P-38-000031, and P-38-0005647) recorded in the reach. The predevelopment shoreline and the area around historic freshwater sources are expected to have higher probability of containing buried undocumented Native American archaeological sites.

3.3.2.4 Reach 2

Reach 2 includes the Northeast Waterfront and Financial District. This area comprises a significant portion of the Embarcadero Historic District from Pier 27 to the Bay Bridge and includes popular sites such as the Exploratorium, Embarcadero Promenade, and the San Francisco Ferry Building.

The pre-European-contact sensitivity analysis assessed Reach 2's sensitivity for near-surface and buried sites along the original shoreline as ranging from low sensitivity to the highest level of sensitivity (Meyer and Brandy 2019). Some areas along the historical shoreline are also sensitive for potential submerged pre-European contact resources.

The historical shoreline at the base of Telegraph Hill and the original Yerba Buena Cove shoreline are considered areas with the highest levels of sensitivity; the hilltops are assessed as having the lowest pre-European-contact sensitivity. Expected Native American site types for Reach 2 include shell middens. Isolates, such as projectile points and burials, could also be encountered. Potential historic archaeological resources include features and deposits associated with the Juana Briones adobe, early unmarked cemeteries, buried ships, wharves

and piers, and 19th-century privies, wells, and trash features. Historical research themes might include maritime industries, immigration, and the Gold Rush.

3.3.2.5 Reach 3

Reach 3 includes South Beach, Mission Creek, Mission Rock, Mission Bay, and Pier 70, and includes the South Beach, SoMa, and Mission Bay neighborhoods. This area is known for the Giants' baseball stadium, Chase Center, and access to Mission Creek and the Bay.

Both Yerba Buena Cove and Mission Bay were filled in to accommodate historic development; some maritime resources such as piers, wharves, or scuttled ships also may be present in the former waters of Mission Bay and Yerba Buena Cove in Reach 3. There is high sensitivity for submerged sites east of the historical bayshore and along the former course of Mission Creek. The highest potential is assigned to the zone within 1,225 feet (375 meters) of the pre-Gold Rush shoreline; high potential is assigned to the zone 1,225 feet (375 meters) to 2,500 feet (750 meters) from that historical shoreline. The Central SoMa Plan Environmental Impact Report indicates that expected Native American site types may include villages; special-use sites, such as shellfish collection camps; and isolated artifacts, cemeteries, and deep Early Holocene burials (Byrd et al. 2014).

Given the number of known historic-era and Native American archaeological resources present within Reach 3, as well as the lack of study that has been conducted in the southern portion, Reach 3 appears to have a high sensitivity for both historic-era and Native American archaeological resources.

3.3.2.6 Reach 4

Reach 4 encompasses Pier 80, Islais Creek, Cargo Way, Pier 96, and Heron's Head Park. This area is comprised of industrial uses along the waterfront and provides critical industrial, maritime, and commercial port functions. Much of the original shoreline, as well as the land adjacent to freshwater sources, has high to highest potential for the discovery of pre-European-contact archaeological sites; higher elevations along the western edge and southwest edge of the Reach around Bernal Heights and Bayview have the lowest potential (Meyer and Brandy 2019).

Reclaimed areas of land along the Islais Creek drainage are highly sensitive for submerged pre-European-contact sites (Byrd et al. 2014). It was also the location of significant historic-era developments during the late 19th and early 20th centuries. Consequently, Reach 4 appears to have high sensitivity for both Native American and historical archaeological resources.

3.3.3 Identification of Aboveground Historic Properties

This section provides information on the buildings, structures, objects, sites, and districts identified in the Study Area. This information is based on findings from July 17, 2020, and

March 2, 2023, NWIC CHRIS record searches; San Francisco Property Information Map record review; and review of documentation available in the NPS NRHP database. Aboveground historic properties identified from the San Francisco Property Information Map as being 33 years old or older (i.e., built in or before 1990) meet the NRHP age eligibility threshold for the purposes of this study.

The first identification effort in 2020 encompassed a large portion of the current Study Area. Resources were categorized as listed, age eligible and undetermined, or ineligible. The 2023 identification effort broadened the Study Area and includes resources that qualify as Section 106 historic properties (NRHP listed, NRHP eligible), resources with potential to qualify as historic properties in the future (CRHR listed, CRHR eligible, California Environmental Quality Act [CEQA] assumed eligible, age eligible, and undetermined) and resources that are not NRHP eligible, exempt, or unknown.

3.4 Archaeological Resources Findings

This section on archaeological resources provides information on the known archaeological sites identified in the Study Area, based on findings from the NWIC CHRIS record searches. The section also includes an analysis of archaeological sensitivity, which describes where as-yet-unrecorded resources may be found. Based on the records searches, a total of 39 previously identified archaeological resources are located in or adjacent to the Study Area. Of these, 32 are historic-age archaeological resources, four are precontact age, and three are multi-component with precontact and historic-age components. Table 1 summarizes the key attributes of these resources. Due to the sensitive nature of archaeological sites, each resource is categorized by reach only (and not a specific location) and ordered north to south in the table. Each resource is further categorized by NRHP eligibility.

Table 1. Archaeological Resources Summary

Reach	State Resource Identifier (P#)	Period	Name or Description	NRHP Eligibility
1	P-38-000023	Precontact/ Historic	Circular, fire-burnt rock, with quantities of decayed fish bones and crushed shells.	Undetermined
1	P-38-000030	Precontact/ Historic	Shell midden with hearths, bone, fire affected rock.	Undetermined
1	P-38-000031	Precontact	Black, sandy midden	Undetermined
1	P-38-005444	Historic	N-5 Dump	Undetermined
1	P-38-005647	Precontact	Franklin Street Midden	Undetermined
2	P-38-000095	Historic	Frederick Griffing's ship	Listed
2	P-38-000126	Historic	Mid-Embarcadero Roadway Project	Eligible

Reach	State Resource Identifier (P#)	Period	Name or Description	NRHP Eligibility
2	P-38-002324	Historic	The site includes two early wharf piles from the 1850s and a historic-era domestic artifact deposit from the mid-1860s.	Undetermined
2	P-38-004493	Historic	300 Spear Street	Undetermined
2	P-38-004926	Historic	333 Fremont Street Feature 100	Undetermined
2	P-38-004965	Historic	Thompson's Cove	Undetermined
2	P-38-005247	Precontact/ Historic	201 Folsom Street	Potentially Eligible
2	P-38-005499	Historic	240 Pacific Avenue	Undetermined
2	P-38-005683	Historic	Broadway-Vallejo Street Block (Temp No. 17-124-01)	Undetermined
3	P-38-000085	Historic	The Lydia	Eligible
3	P-38-000163	Historic	Three archaeological features associated with the marine railway operated by Henry Tichenor from 1851 to 1868.	Undetermined
3	P-38-004294	Historic	San Francisco Glass Works	Ineligible
3	P-38-004304	Historic	Bayshore Viaduct Block 5	Undetermined
3	P-38-004306	Historic	Buried remains of a historic city block, developed as Butchertown in 1853, used for industrial purposes through 1950.	Undetermined
3	P-38-004307	Historic	Bayshore Viaduct Block 8	Undetermined
3	P-38-004308	Historic	Bayshore Viaduct Block 9	Undetermined
3	P-38-004309	Historic	Bayshore Viaduct Block 10	Undetermined
3	P-38-004327	Historic	SFWBA Block 7; St. Mary's Hospital	Undetermined
3	P-38-004367	Historic	Coal Gasification Facility	Undetermined
3	P-38-004368	Historic	Built between 1887 and 1889, a brick foundation wall and office floor at 170 King Street, San Francisco.	Undetermined
3	P-38-004884	Historic	Rincon Point South Beach	Undetermined
3	P-38-005033	Historic	399 Fremont Street Privy 1	Undetermined
3	P-38-005102	Historic	Pier 68, Pier 3	Ineligible
3	P-38-005103	Historic	Pier 68, Pier 4	Undetermined
3	P-38-005151	Historic	The Crystal Hotel Site	Undetermined

Reach	State Resource Identifier (P#)	Period	Name or Description	NRHP Eligibility
3	P-38-005452	Historic	1913 Potrero Power Plant Wharf	Undetermined
3	P-38-005453	Historic	Sugar Refinery East Wharf	Undetermined
3	P-38-005501	Historic	Mission Bay Fourth Street Streetscape	Ineligible
3	P-38-005517	Historic	Abandoned Railroad Spurs	Undetermined
3	P-38-005641	Historic	Chase Center Railcar	Undetermined
4	P-38-004361	Historic	Middle Point War Dwellings	Undetermined
4	P-38-004638	Precontact	Quint Street Site	Undetermined
4	P-38-005445	Precontact	Submerged Flake	Undetermined
4	P-38-005504	Historic	Core 17 historic dump	Undetermined

3.5 Aboveground Resources Findings

This section provides information on the buildings, structures, and districts identified in the Study Area based on findings from NWIC CHRIS record searches completed on July 17, 2020, and March 2, 2023; San Francisco Property Information Map record review; and review of documentation available in the NPS NRHP database. Much of this information was synthesized in the *Waterfront Plan Final Environmental Impact Report* that was certified in March 2023 (San Francisco Planning Department 2023). Architectural resources identified in the San Francisco Property Information Map as being 33 years old or older (i.e., built in or before 1990) meet the 50-year age eligibility threshold and may be resources that will require evaluation at a future date. Table 2 provides a summary of these resources.

Table 2. Summary of Aboveground Cultural Resources

Historic Property Category	Number within the Study Area
NRHP-Listed Individual Properties	32
NRHP-Listed Districts	9
NRHP-Eligible Individual Properties	6
NRHP-Eligible Districts	5
CRHR Eligible Districts[1]	10
CEQA Historical Resources Not Yet Evaluated for NRHP Eligibility[2]	544
Determined Not Eligible[3]	306
Age Eligible and Undetermined (constructed in or before 1990)	858
Exempt (constructed after 1990)	198
Exempt (vacant lots)	353
Unknown (unable to identify)	8

See subsequent tables for more details regarding historic built-resource status.

Notes:Ten historic districts in the Study Area are considered eligible for listing in the CRHR because they have been designated as historic districts for the purposes and standards of Article 10 of the City Planning Code. Pursuant to Section 1004 of the City Planning Code, Chapter II, Part II, of the San Francisco Municipal Code, the designated historic districts were approved by resolutions of the City Planning Commission. There are 544 parcels identified in the Study Area that contain resources that met the criteria for a "historical resource" as defined in the CEQA Statutes and Guidelines. The San Francisco Planning Department determined that these properties will be evaluated as historical resources for purposes of CEQA, based on their evaluation and the inclusion of specified registers or surveys. This includes resources listed in or formally eligible for listing in the CRHR, resources within adopted local registers, resources that have been determined to appear eligible, or resources that may become eligible for the CRHR. Resources designated under Articles 10 and 11 of the City Planning Code are also assumed to be historic resources because they have been designated by the City as landmarks, historic districts, or conservation districts. Recognition of historical significance under CRHR or other local criteria indicates a high potential that these historic properties may possess significance to meet the NRHP threshold. Considering a full NRHP evaluation is not being conducted at this time, it is difficult to speculate as to the level of significance (local, state, or national) for each historic property, or which aspects of integrity are intact. The historic properties in this category will need to be addressed during the phased identification process, which is detailed in the Programmatic Agreement. Determinations by San Francisco Planning Department, 2008–present.

A total of 2,846 parcels were identified in the Study Area. This includes resources listed in or eligible for listing in the NRHP as well as resources listed in or eligible for listing in the CRHR, as follows:

- 32 individual historic properties and nine districts that are listed in the NRHP;
- Six individual historic properties and five districts that are eligible for listing in the NRHP;
- 10 CRHR-eligible districts;
- 544 parcels with CEQA historical resources not yet evaluated for NRHP eligibility;
- 306 properties determined not eligible for the NRHP;
- 858 parcels that require further research to classify them among the preceding categories because they are age eligible (i.e., constructed in 1990 or earlier) and unevaluated;
- 198 parcels exempt because parcel data indicates that they are not age eligible (i.e., constructed after 1990);
- 353 parcels exempt because they are vacant; and
- 8 parcels that are unknown because their geospatial location could not be determined.

Fourteen of the NRHP-listed or NRHP-eligible properties in the Study Area are historic districts. Four of the NRHP-listed districts are also designated as National Historic Landmarks. Of the properties that are assumed to be NRHP eligible, five are districts. Examples of the types of historic properties within the Study Area include maritime infrastructure such as piers, wharfs,

bulkheads, and seawalls; boats; commercial and industrial buildings; transportation infrastructure; utility infrastructure; a military landscape; and recreational facilities.

3.6 NRHP-Listed Historic Properties

There are 41 aboveground historic properties in the Study Area that are listed in the NRHP, including 9 historic districts and 32 individual historic properties. Table 3 and Table 4 provide summaries of these resources.

Several NRHP-listed properties are located within NRHP-listed districts. Furthermore, there are five maritime NHLs (i.e., ships) within the San Francisco Maritime National Historical Park and two within the Port of San Francisco Embarcadero Historic District that are individually listed in the NRHP.

Table 3. NRHP-Listed Districts in the Study Area

Historic Property Name	NRIS Number	Number of Significant Features
Aquatic Park Historic District (NHL)	84001183	9
Central Embarcadero Piers Historic District	02001390	5
Fort Mason Historic District[1]	72000109	9
Port of San Francisco Embarcadero Historic District	06000372	47
San Francisco Cable Car Historic District (NHL)	66000233	48
San Francisco Maritime National Historical Park (NHL)	01000281	11
San Francisco Port of Embarkation, U.S. Army Historic District (NHL)	85002433	19
South End Historic District	4101-2500-9999	55 contributors[2]
Union Iron Works Historic District	14000150	33

NRIS = National Register Information System; NHL = National Historic Landmark

Notes:
The Fort Mason Historic District was formerly known as the Black Point Historic District.
Page & Turnbull, South End Historic District National Register Certification, Ju
ne 2008.

Table 4. NRHP-Listed Individual Properties in the Study Area

Historic Property Name	NRIS Number	Year Built	Resource Type	NRHP Area of Significance
San Francisco–Oakland Bay Bridge	00000525	1935	Bridge	Architecture; Engineering
Baker and Hamilton	05000001	1905	Property	Architecture

Historic Property Name	NRIS Number	Year Built	Resource Type	NRHP Area of Significance
Haslett Warehouse	75000172	1907	Property	Industry, Community Planning and Development, Commerce, Architecture
Audiffred Building	79000528	1889	Property	Commerce, Architecture
Coit Memorial Tower	07001468	1933	Property	Art
Armour & Co. Building	09001117	1900	Property	Commerce, Architecture
Fuller Co. Glass Warehouse	01001101	1907	Property	Architecture
Daniel Gibb & Co. Warehouse/Gibb-Sanborn Warehouse	97001189	1906	Property	Architecture, Commerce, Community Planning and Development
1254–1256 Montgomery Street	79000532	1962	Property	Architecture
Merchant's Ice and Cold Storage Co.	09001300	1904	Property	Architecture
Otis Elevator Company Building	99001265	1971	Property	Engineering, Industry
Pioneer Woolen Mills and D. Ghirardelli Company	82002249	1858; 1893; 1962	Property	Industry, Landscape Architecture, Commerce, Art, Conservation, Architecture
Pumping Station No. 2, San Francisco Fire Department AWSS	76000177	1900	Property	Community Planning and Development, Engineering
Rincon Annex	79000537	1925	Property	Art, Architecture
Irving Murray Scott School	85000714	1900	Property	Education
U.S. Customhouse	75000476	1974	Property	Architecture
Matson Building and Annex	95001384	1921	Property	Transportation, Architecture
Folger Coffee Co. Building	96000679	1903-05	Property	Architecture, Commerce, Community Planning/ Development, Engineering
Tubbs Cordage Co. Building	79000254	1890	Property	Architecture, Commerce, Industry
Balclutha	76000178	1886	Ship	Commerce, Education, Transportation

Historic Property Name	NRIS Number	Year Built	Resource Type	NRHP Area of Significance
Eureka (Ferry Boat)	73000229	1890	Ship	Commerce, Transportation
C.A. Thayer	66000229	1895	Ship	Commerce, Industry
Alma (Scow Schooner)	75000179	1891	Ship	Commerce, Transportation
Hercules (Tugboat)	75000225	1906	Ship	Commerce, Industry
S.S. *Jeremiah O'Brien*	78003405	1943	Ship	Commerce, Engineering, Military, Transportation
U.S.S. *Pampanito*	86000089	1943	Submarine	Military
M.V. *Santa Rosa*	79000469	1926	Ship	Transportation, Maritime History
Ferry Building/Union Ferry Depot	78000760	1895	Property	Architecture, Engineering, Transportation
Ferry Station Post Office	78000756	1915	Property	Architecture, Commerce
Beltline Railroad Roundhouse Complex/Belt Railroad Engine House and Sandhouse	86000207	1913-14	Property	Commerce, Engineering, Transportation
Pier One	98001551	1931	Property	Commerce, Transportation, Architecture
Sinton House, 1020 Francisco Street	11000944	1927	Property	Art, Architecture

NRIS = National Register Information System
NRHP-Eligible Properties in the Study Area

There are five districts and six individual aboveground historic properties in the Study Area that are determined eligible for listing in the NRHP. All are considered historic properties under Section 106. Table 5 and Table 6 provide summaries of these resources.

Table 5. NRHP-Eligible Districts in the Study Area

Historic Property Name	Documentation	Number of Significant Features
Bluxome Townsend Historic District	DPR 523 form set (Page & Turnbull 2009)	9
Auxiliary Water Supply System (discontiguous)	Historical Resources Evaluation (Tetra Tech, Inc. 2009)	5
South End Historic District Addition	DPR 523 form set (Page & Turnbull 2009)	12

Historic Property Name	Documentation	Number of Significant Features
Bridges and Tunnels	DPR 523 form set (San Francisco Planning Department 2001)	N/A
Market Street Cultural Landscape District	Better Market Street Project Cultural Landscape Evaluation (ICF 2016)	Numerous

Table 6. Additional NRHP-Eligible Properties in the Study Area

Historic Property Name	Documentation	Year Built	Significance
Embarcadero Plaza/Justin Herman Plaza	Better Market Street EIR (San Francisco Planning Department 2019)	1971–72	
Army-Navy YMCA (161–169 Steuart Street)	National Register survey (2019)	1925	Appears individually eligible for NRHP
Oriental Warehouse (650 Delancey Street)	South of Market Area Historic Resource Survey (San Francisco Planning Department 2011)	1867	Contributor to the NRHP-listed South End Historic District
Fireboat House/Fire Station No. 35 (Pier 22 ½)	Waterfront Plan EIR (San Francisco Planning Department 2023)		Determined eligible for NRHP (criteria and period of significance are not identified).
Kneass Boatworks Building (671 Illinois Street)	Pier 70 Mixed-Use District Project EIR (San Francisco Planning Department 2016)	Ca. 1870s	Determined eligible for NRHP under Criterion A with a period of significance of 1854–1948.
Fire House No. 25 (3305 Third Street)	Waterfront Plan EIR (San Francisco Planning Department 2023)		Determined eligible for NRHP under Criterion C (period of significance is not identified).

3.7 Properties Not Eligible for the NRHP

For the purposes of the study, it was determined that the 306 aboveground historic properties identified in the Study Area are not historical resources under CEQA. The San Francisco Planning Department made a determination through listings in historic registers and surveys that pertain to the City or properties for which the City has no information indicating their qualification as historical resources. Properties that were determined not to be historical resources are listed in the CHRIS database and have a California Historical Resource Status Code of 6, determined

ineligible for the NRHP. Credible evidence/research presented by a qualified expert would be needed in order for them to be considered historical resources.

Age Eligible and Undetermined

For the purposes of the study, 858 parcels require further research to classify them among the preceding categories because they are unevaluated and age eligible (i.e., constructed in 1990 or earlier). NPS uses a threshold age of 50 years as a criterion for consideration as to NRHP eligibility (NPS 1995:20). For purposes of this report, as well as the flood resilience measures considered for the 2040s, historic property identification in the Study Area considers resources that would meet the 50-year threshold as of 2040. Thus, buildings constructed in 1990 and before are considered age-eligible resources for the study.

Exempt: Properties Constructed Later than 1990 (not age eligible)

For the purposes of the study, 198 parcels are exempt because records indicate that they are not age eligible (i.e., constructed after 1990). San Francisco Planning Department data determined that these properties were constructed later than 1990.

Exempt: Vacant Parcels

For the purposes of the study, 353 parcels are exempt because they are vacant and without aboveground historic properties present. These parcels are either located within water or are vacant, vegetated, or paved land.

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APPENDIX C
DEFINITIONS

In addition to the definitions provided here for ease of Consulting Party review, all definitions set forth in 36 CFR § 800.16 are incorporated into the PA by reference and apply throughout (PA Stipulation III).

Advisory Council on Historic Preservation (ACHP): Issues regulations to implement Section 106 and provides guidance and advice on the application of procedures and generally oversees the operation of the Section 106 process. The ACHP consults with and comments to agency officials on individual undertakings and programs that affect historic properties.

Archaeological Site: A place in which evidence of past human activity is preserved. Sites are categorized as Precontact (from before Native American contact with Europeans) or Historic (Post-European Contact). Sites determined eligible for the National Register of Historic Places (NRHP) are referred to as "historic properties." While an archaeological site may contain a building, the archaeological focus is primarily on the information preserved in the ground, whereas the built-environment focus is on the standing structure itself.

Area of Potential Effects (APE): The geographic area or areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

Built Environment: Defined broadly as human-made resources and infrastructure that define the urban fabric, support communities, and enable economic activity. This definition includes transportation infrastructure, utilities, recreation, aesthetics, land use planning, ports and marine facilities, and existing coastal defenses. Historic architectural and built-environment resources in California most frequently postdate Native American contact with Europeans and include buildings, structures, objects, landscapes, and districts. However, this term may also encompass engineered features or Traditional Cultural Places of importance to living communities that pre-date European contact.

Concurring Party: A consulting party invited to concur with the agreement document but who does not have the authority to amend or terminate the agreement. A concurring signature is essentially an endorsement of the agreement and is not required for it to be executed.
Consultation: The process of seeking, discussing, and considering the views of other participants, and, where feasible, seeking agreement with them regarding matters arising in the Section 106 process.

Consulting Party: A participant in the Section 106 consultation process. Consulting parties for this project include the SHPO; Indian Tribes and Native Hawaiian Organizations; applicants for Federal assistance/permits; representatives of local governments; and certain individuals and organizations with a demonstrated interest in the undertaking.

Historic Property: Any prehistoric/precontact or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Historic properties include artifacts, records, and remains that are related to and located within such properties, and may be, but are not limited to, above-ground historic, architectural, terrestrial and marine archaeological resources, and Traditional Cultural Places (TCPs).

Historic Property Treatment Plan (HPTP): A component-specific compliance document authorized by this PA that details the specific mitigation measures, data recovery methodologies, and protective protocols required to resolve adverse effects on historic properties, eliminating the need for a separate Memorandum of Agreement (MOA).

Invited Signatory: Additional parties invited by the Federal Agency to sign the agreement who assume a responsibility under the agreement and, upon signing, have the authority to amend and terminate the agreement (e.g., the Port of San Francisco).

Lands, Easements, Rights-of-Way, Relocation, and Disposal (LERRDs): The real estate interests required for the construction, operation, and maintenance of the Civil Works project. For this undertaking, the Port will provide the necessary LERRDs.

Non-Federal Sponsor (NFS) / Port: The Port of San Francisco, acting as the lead agency for the City and County of San Francisco (CCSF). The Port is the Non-Federal Sponsor for this undertaking. and participates in this PA as an Invited Signatory.

Notice to Proceed (NTP): The formal, written authorization issued by the USACE Contracting Officer (or designated representative) allowing the construction contractor to begin physical, ground-disturbing activities within a specified Project Component.

Traditional Cultural Place (alternately, Traditional Cultural Property) (TCP): National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties (1990) defines a traditional cultural property as one that is "eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." Draft updates, including striking the word property and replacing it with place, were published in November, 2023, in National Register Bulletin: Identifying, Evaluating, and Documenting Traditional Cultural Places. This bulletin defines a Traditional Cultural Place as "a building, structure, object, site, or district that may be listed or eligible for listing in the National Register for its significance to a living community because of its association with cultural beliefs, customs, or practices that are rooted in the community's history and that are important in maintaining the community's cultural identity."

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.3.2
AGENCY AND TRIBAL COORDINATION

JULY 2026

DRAFT

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

SHPO CONSULTATION

INVITATION TO CONSULT ON ALTERNATIVES

UNDER NEPA AND

SHPO RESPONSE DECLINING TO CONSULT UNDER NEPA DUE TO NO

STANDING OCTOBER 2022

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, TULSA DISTRICT
2488 EAST 81ST STREET
TULSA, OK 74137-4290

October 5, 2022

Julianne Polanco
State Historic Preservation Office
State Historic Preservation Officer
1725 23rd St
Sacramento, CA 95816

Dear Ms. Polanco:

The U.S. Army Corps of Engineers (Corps) Tulsa District, in partnership with the Port of San Francisco, have resumed the San Francisco Waterfront Coastal Flood Study, California (SFWS) and are initiating actions to comply with the National Environmental Policy Act (NEPA) of 1969, as amended. As part of the SFWS, an Integrated Feasibility Report and Environmental Impact Statement (IFR-EIS) will be prepared to describe the results of investigations and analyses used to determine the feasibility of reducing flood risks along the San Francisco Bay shoreline in San Francisco County, California.

This study began in 2018 under the Corps' San Francisco District, South Pacific Division, and after a pause in work, this effort is being resumed by the Tulsa District, Southwestern Division. The study will follow the Corps' SMART planning process. Due to the complexities of the study, including consideration of seismic risks that introduce flood vulnerability and the diversity of the geographic regions and stakeholders, the study has been approved for an additional four years of study time for a total of seven years.

As a result of the resumption with a new district and the amount of time that has passed since initial study start, the Corps is initiating new participating agency requests. Under Section 2045(e) of the Water Resources Development Act (WRDA) of 2007, your agency has been identified as having interest in the proposed project based on your having jurisdiction over the project by law and/or special expertise. Participating agencies are responsible for identifying, as early as practicable, any issues of concern regarding the project's potential environmental or socioeconomic impacts that could substantially delay or prevent an agency from granting a permit or other approval needed for the project. We suggest that your agency's role in the development of the Draft IFR-EIS, which will primarily occur from October 2022 to June 2023, should include the following as they relate to your area of expertise:

- Provide meaningful and early input on the overall scope of the document, study and impact assessment methodologies, range of alternatives, mitigation need, and level of detail required in the alternatives analysis;

- Participate in coordination meetings, and/or field visits, as appropriate;
- Guidance on relevant technical studies; and
- Timely review and comment on early project information to reflect the views and concerns of your agency on the adequacy of the document, alternatives considered, and the anticipated impacts and mitigation.

Furthermore, we would like to coordinate our review schedule for study completion so that all reviews and approvals will, to the maximum extent practicable, be conducted concurrently pursuant to Section 2045 of WRDA 2007 and Section 1001 of Water Resources Reform Development Act (WRRDA) of 2014. The following review periods for the IFR-EIS have been established in accordance with the current project schedule:

- Draft IFR-EIS: 60-day public review period begins September 2023
- Final IFR-EIS: 30-day State and Agency review begins June 2025

A written response to accept or decline this invitation to be a participating agency is requested by November 10, 2022. Your written response may be transmitted electronically to Ms. Melinda Fisher, Biologist, Environmental Branch, Regional Planning and Environmental Center at Melinda.Fisher@usace.army.mil or by mail to U.S. Army Corps of Engineers, ATTN: Melinda Fisher (RPEC), 2488 E 81st Street, Tulsa, Oklahoma 74137-4290. Please note, your designation as a participating agency does not imply you support the proposed project nor does it diminish or otherwise modify your agency's independent statutory obligations and responsibilities under applicable federal laws, regulations, and Executive Orders.

We look forward to working with your agency on preparing the IFR-EIS. If you have any questions or would like additional information, please contact Ms. Fisher at the email address above or via telephone at 918-669-7423.

Sincerely,

Brandon Wadlington

Brandon Wadlington
Chief, NEPA & Natural Resources Section
Regional Planning and Environmental Center

Enclosure

State of California • Natural Resources Agency
Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION
Armando Quintero, *Director*

Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

October 10, 2022
VIA ELECTRONIC MAIL

Melinda Fisher
Wildlife Biologist
Regional Planning & Environmental Center (RPEC)
U.S. Army Corps of Engineers, Environmental Branch
2488 E 81st Street, Tulsa, OK, 74137-4290

RE: Participating Agency Invitation for the San Francisco Coastal Flood Resiliency Feasibility Study, San Francisco County

Dear Melinda Fisher,

By email received on October 10, 2022, the U.S. Army Corps of Engineers (COE) is inviting the State Historic Preservation Officer (SHPO) to participate in the National Environmental Policy Act (NEPA) environmental review process as a participating agency pursuant to 40 CFR Part 1501.8. The COE is seeking the SHPO's attendance at planning meetings with the purpose of providing feedback and concerns on measures, alternatives, impact analyses, and assistance in identifying mitigation and/or conservation measures for the Federal agency's consideration.

The COE has requested the SHPO confirm or reject their invitation to act as a participating agency in the NEPA-level environmental review process. As the SHPO has no special standing in the NEPA process, I respectfully decline the COE's invitation. However, I am willing to informally attend meetings in a listening capacity, subject to SHPO staff availability and scoped appropriately to focus upon issues regarding cultural resources. Additionally, should the COE wish to provide an update as the COE considers alternatives, a meeting would be agreeable.

I anticipate actively engaging with the COE when the Federal agency initiates consultation under Section 106 of the National Historic Preservation Act (NHPA). If you require further information, please contact Elizabeth Hodges of my staff at (916) 445-7017 or Elizabeth.Hodges@parks.ca.gov.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

USACE TO ACHP

INVITATION TO CONSULT TO DEVELOP PROGRAMMATIC AGREEMENT,

ACHP RESPONSE TO USACE THAT THEIR INVOLVEMENT WAS PREMATURE

AND

REQUEST FOR ADDITIONAL INFORMATION AFTER 180 DAYS

FEBRUARY 2023

From:	Murphey, Joseph S CIV USARMY CESWF (USA)
To:	e106@achp.gov
Cc:	Capone, Kelley (PRT); Fisher, Melinda CIV USARMY CESWF (USA); Campbell, John A CIV USARMY CESWF (USA); Paez, Mark (PRT); Tavel, January
Subject:	USACE San Francisco Waterfront Coastal Flood Study Invitation to Consult
Date:	Thursday, February 9, 2023 3:05:23 PM
Attachments:	ACHP e106 form.docx CALSHPO SFWF CONSULT LETTER.pdf San Francisco Waterfront Coastal Flood Study.pdf

---

Dear Sirs,

USACE invites the ACHP to consult to develop a project Programmatic Agreement for the San Francisco Waterfront Coastal Flood Study. Forms attached.

Joseph Scott Murphey, Historical Architect
Regional Planning and Environmental Center/ CESWF-PEE-E
Currently teleworking. Available by phone/text: (817) 229-1956 or
email: joseph.s.murphey@usace.army.mil

Advisory Council on Historic Preservation
Electronic Section 106 Documentation Submittal System (e106) Form
MS Word format

Send to: *e106@µchp.gov*

Please review the instructions at www.achp.gov/e106-email-form prior to completing this form. Questions about whether to use the e106 form should be directed to the assigned ACHP staff member in the Office of Federal Agency Programs.

I. **Basic information**

1. Purpose of notification. Indicate whether this documentation is to:

- D Notify the ACHP of a finding that an undertaking may adversely affect historic properties
- D Invite the ACHP to participate in a Section 106 consultation
- IZI **Propose to develop a project Programmatic Agreement (project PA) for complex or multiple undertakings in accordance with 36 C.F.R. 800.14(b)(3)**
- ☐ Supply additional documentation for a case already entered into the ACHP record system
- D File an executed MOA or PA with the ACHP in accordance with 800.6(b)(iv) (where the ACHP did not participate in consultation)
- D Other, please describe
  Click here to enter text.

2. ACHP Project Number (If the ACHP was previously notified of the undertaking and an ACHP Project Number has been provided, enter project number here and skip to Item 7 below): Click here to enter text.

3. Name of federal agency (If multiple agencies, list them all and indicate whether one is the lead agency): U.S. Army Corps of Engineers (USACE)

4. Name of undertaking/project (Include project/permit/application number if applicable):

The San Francisco Waterfront Coastal Flood Study

5. Location of undertaking (Indicate city(s), county(s), state(s), land ownership, and whether it would occur on or affect historic properties located on tribal lands): The Port of San Francisco, San Francisco, California.

6. Name and title of federal agency official and contact person for this undertaking, including email address and phone number: Joseph Mmphey, Historical Architect for above ground resources, joseph.s.murphey@usace.army.mil and John Campbell, archeologist and Tribal consultation, john.a.campbell@usace.army.mil

II. **Information on the Undertaking***

7. Describe the undertaking and nature of federal involvement (if multiple federal agencies are involved, specify involvement of each):

The USACE, in partnership with the Port of San Francisco, are conducting the San Francisco Waterfront Coastal Flood Study to examine the risk of flooding from bay water during coastal storms, extreme tides, and future sea level rise with milestones at the years 2040 and 2090. USACE intends to address potential effects through an initial 15-year Programmatic Agreement.

8. Describe the Area of Potential Effects (APE):

The Study Area and the Area of Potential Effects are to be refined in consultation with consulting parties for each alternative.

9. Describe steps taken to identify historic properties:

There are National Register Historic Districts, one of which is a National Historic Landmark (Fort Mason). Efforts are underway to identify additional properties.

10. Describe the historic property (or properties) and any National Historic Landmarks within the APE (or attach documentation or provide specific link to this information):

Fort Mason. **https://www.nps.gov/places/fort-mason-historic-district.htm**

11. Describe the undertaking's effects on historic properties:

The San Francisco bayside shoreline is at risk of flooding from bay water during coastal storms, extreme tides, and future sea level rise. Flooding along the waterfront could cause extensive damage to the cultural, social, and economic character of the entire waterfront community. The risk is expected to increase with time as sea levels rise in the bay. The Study and the associated Environmental Impact Statement (EIS) conducted under the National Environmental Policy Act (NEPA) will involve investigation and analysis to determine the feasibility of reducing flood risks through a range of alternatives for the years 2040 through 2140. The enclosure, San Francisco Waterfront Costal Flood Study gives more detail on the Study, current alternatives under consideration and a timeline.

12. Explain how this undertaking would adversely affect historic properties (include information on any conditions or future actions known to date to avoid, minimize, or mitigate adverse effects):

The range of alternatives for the years 2040 through 2140 encompass a large area of the San Francisco Bay, an area rich in cultural resources, including a National Historic Landmark. Due to the size, temporal parameters and complexity of the project, long term implementation of a tentatively selected plan is likely to have some adverse effects even when avoidance and minimization efforts are implemented. The enclosure, San Francisco Waterfront Costa! Flood Study gives more detail on the study, alternatives under consideration and a timeline.

13. Provide copies or summaries of the views provided to date by any consulting parties, Indian tribes or Native Hawai'ian organizations, or the public, including any correspondence from the SHPO and/or THPO. A plan to involve the public is being developed. Tribes are being invited to consult. SHPO consultation was initiated 9 February 2023 (letter attached).

III. **Additional Information**

14. Please indicate the status of any consultation that has occurred to date, including whether there

are any unresolved concerns or issues the ACHP should know about in deciding whether to participate in consultation. Providing a list of consulting parties, including email addresses and phone numbers if known, can facilitate the ACHP's review response.

The U.S. Army Corps of Engineers (USACE), in partnership with the Port of San Francisco, have resumed the San Francisco Waterfront Coastal Flood Study that began in 2018 and was suspended in 2020. There were no outstanding unresolved cultural issues at the time. The list of consulting parties are:

- **Amah Mutsun Tribal Band of Mission San Juan Bautista.**
  Irene Zwierlein, Chairperson. amahmutsuntribal@gmail.com (650) 851 - 7489
- **American Indian Cultural District SF.**
  Sharaya Souza, Executive Director. general@americanindianculturaldistrict.org/ (415) 287-2820
- **Association of Ramaytush Ohlone.**
  Jonathan Cordero. jonathan@ramaytush.org and glcastro@pacbell.net
- **California Office for Historic Preservation.**
  Julianne Polanco, State Historic Preservation Officer. info.calshpo@parks.ca.gov
- **California Preservation Foundation.**
  Cindy Heitzman, Executive Director. cpf@califomiapreservation.org 415-495-0349 ext. 203
- **Costanoan-Rumsen Carmel Tribe.**
  Tony Cerda, Chairperson. rumsen@aol.com (909) 629 - 6081
- **Dogpatch Neighborhood Association.**
  Katherine Doumani, President. info@dogpatchna.org 415-713-4561
- **Indian Canyon Mutsun Band of Costanoan.**
  Ann Marie Sayers, Chairperson. ams@indiancanyons.org (831) 637 - 4238
- **Muwekma Ohlone Indian Tribe of the San Francisco Bay Area.**
  Monica Arellano, Vice Chairwoman. monicavarellano@gmail.com (408) 205 - 9714
- **National Park Service Region 10.**
  Frank Lands, Regional Director. 415-623-2100
- **National Trust for Historic Preservation.**
  info@savingplaces.org (415) 947-0692
- **Ohlone Indian Tribe.**
  Andrew Galvan, Chairperson. chochenyo@AOL.com 510) 882 - 0527
- **Port of San Francisco** (non-federal sponsor)
  Kelly Capone, Project Manager USACE Coastal Flood Study. kelley.capone@sfport.com
- **San Francisco Architectural Heritage.**
  Karalyn Montiel, Executive Director http://www.sfheritage.org/ (415) 441-3000
- **San Francisco Historic Preservation Commission.**
  Diane Matsuda, President. diane.matsuda@sfgov.org
- **South Beach Rincon Mission Bay Neighborhood Association.**
  Alice Rodgers, President. SBRMBNA@gmail.com
- **Telegraph Hill Dwellers Neighborhood Association.**
  Al Fontes, President. hello@thd.org (415) 843-1011
- **Wuksache Indian Tribe/Eshom Valley Band.**
  Kenneth Woodrow, Chairperson. kwood8934@aol.com (510) 882 - 0527

15 Does your agency have a website or website link where the interested public can find out about this project and/or provide comments? Please provide relevant links:

https://sfport.com/wrp/usace

16. Is this undertaking considered a "major" or "covered" project listed on the Federal Infrastructure Projects Permitting Dashboard? If so, please provide the link:

No.

The following are attached to this form (check all that apply):

IZl Section 106 consultation correspondence (letter to California SHPO initiating consultation).

D Maps, photographs, drawings, and/or plans

D Additional historic property information

D Consulting party list with known contact information

IZl Other: San Francisco Waterfront Coastal Flood Study

February 27, 2023

Kenneth Shingleton
Cultural and Environmental Programs Support Section
Regional Planning and Environmental Center
U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, TX 76102-0300

Ref: *San Francisco Waterfront Coastal Flood Study*
San Francisco, California
ACHP Project Number: 019241

Dear Mr. Shingleton:

On February 10, 2023, the Advisory Council on Historic Preservation (ACHP) received your notification and supporting documentation regarding the initiation of Section 106 consultation regarding the referenced undertaking. Based upon the information you provided, we have concluded, pursuant to 36 CPR § 800.2(b)(1), of the regulations, "Protection of Historic Properties" (36 CPR Part 800) implementing Section 106 of the National Historic Preservation Act, that our participation may be premature.

The U.S. Army Corps of Engineers, Fort Worth District should continue consultation with the California State Historic Preservation Officer, Indian tribes, and other consulting parties, as appropriate, to identify and evaluate historic properties and to assess any potential adverse effects on those historic properties. We re uest that within 180 calendar days of receiving tliis corres onoence,)'.OU rovide the ACHP wit an u date as to the rogress of the consultation since ebruary 2023. Upon receipt of the additional information we will notify you within 15 days regarding our decision on participation.

If you have any questions or require our further assistance at this time, please contact Mr. Christopher Daniel at (202) 517-0223 or by e-mail at cdaniel@achp.gov and reference the ACHP Project Number above.

Sincerely,

Christopher Koeppel
Assistant Director
Office of Federal Agency Programs
Federal Property Management Section

and existing agreement documents. This address is not intended for case specific communication, correspondence, or scheduling. Such communications should be directed to the assigned ACHP staff member using their ACHP email address.******

USACE TO SHPO

INVITATION TO CONSULT UNDER SECTION 106 ON PROPOSED PA

AND

SHPO RESPONSE: MEETING DESIRED TO DISCUSS PROJECT

MARCH 2023

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

Feburary 8, 2023

Julianne Polanco
State Historic Preservation Officer
1725 23rd Street, Suite 100
Sacramento, CA 95816

Dear Ms. Polanco:

The U.S. Army Corps of Engineers (USACE), in partnership with the Port of San Francisco, have resumed the San Francisco Waterfront Coastal Flood Study, California (the Study) and are initiating Section 106 consultation in accordance with the National Historic Preservation Act (NHPA) of 1966, as amended.

The San Francisco bayside shoreline is at risk of flooding from bay water during coastal storms, extreme tides, and future sea level rise. Flooding along the waterfront could cause extensive damage to the cultural, social, and economic character of the entire waterfront community. The risk is expected to increase with time as sea levels rise in the bay. The Study and the associated Environmental Impact Statement (EIS) conducted under the National Environmental Policy Act (NEPA) will involve investigation and analysis to determine the feasibility of reducing flood risks through a range of alternatives for 2040 through 2140. The enclosure, San Francisco Waterfront Costal Flood Study gives more detail on the Study, alternatives under consideration and a timeline.

The Study initially began in 2018 under the USACE San Francisco District, South Pacific Division, and after an extended pause, this effort is being resumed by the USACE Tulsa District, Southwestern Division. Due to the complexities of the Study, including consideration of seismic risks that introduce flood vulnerability and the diversity of the geographic regions and stakeholders, the Study has been approved for an additional four years of study time for a total of seven years.

The Study will investigate several alternatives plus a no action alternative with milestones of 2040, 2090, and 2140. The San Francisco bayside shoreline is rich in previously identified National Register listed and eligible cultural resources, including National Historic Landmarks. Given the magnitude of the Study in such an area rich in historic properties, adverse effects to some properties are expected in the NEPA Tentatively Selected Plan (TSP).

In consultation with your office through the Section 106 process, the USACE seeks to develop a Programmatic Agreement (PA) of an initial 15-year duration to programmatically address ways to identify architectural and archeological historic properties and seek ways to avoid, minimize or mitigate adverse effects from long-term implementation of the TSP.

USACE is inviting the following parties to consult:

- Advisory Council on Historic Preservation
- Amah Mutsun Tribal Band of Mission San Juan Bautista
- American Indian Cultural District SF
- Association of Ramaytush Ohlone
- California Office for Historic Preservation
- California Preservation Foundation
- Costanoan-Rumsen Carmel Tribe
- Dogpatch Neighborhood Association
- Indian Canyon Mutsun Band of Costanoan
- Muwekma Ohlone Indian Tribe of the San Francisco Bay Area
- National Park Service
- National Trust for Historic Preservation
- Ohlone Indian Tribe
- Port of San Francisco (non-federal sponsor)
- San Francisco Architectural Heritage
- San Francisco Historic Preservation Commission
- South Beach Rincon Mission Bay Neighborhood Association
- Telegraph Hill Dwellers Neighborhood Association
- Wuksache Indian Tribe/Eshom Valley Band

We seek your assistance in identification of any additional parties. We are currently developing a plan to involve the public. We are tentatively planning our first Section 106 consultation meeting on a weekday between March 8 -14, 2023. Please let us know if that date works for you within that range or propose an alternative date.

We look forward to working with your agency to develop the PA. If you have any questions or would like additional information, please contact Joseph Murphey, historical architect at the joseph.s.murphey@usace.army.mil regarding architectural resources or John Campbell, archeologist at john.a.campbell@usace.army.mil regarding archeological or Tribal issues.

Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs Support Section
Regional Planning and Environmental Center

Enclosure

From:	Morlet, Aubrie@Parks
To:	Murphey, Joseph S CIV USARMY CESWF (USA); Campbell, John A CIV USARMY CESWF (USA)
Cc:	Polanco, Julianne@Parks
Subject:	[Non-DoD Source] RE: USACE Section 106 Initiation of Consultation for the San Francisco Waterfront Coastal Flood Study
Date:	Wednesday, March 29, 2023 1:00:49 PM
Attachments:	COE_2023_0209_001 San Francisco Waterfront Coastal Flood Study response.pdf

Good morning.

The SHPO's response to this consultation is contained in the attached letter. It is being sent in electronic format only. Please confirm receipt of the letter and let me know if you would prefer a hard copy mailed.

Thank you for your request to consult. Please let me know if you have any questions.

Aubrie Morlet
Cultural Resources Program Supervisor
Architectural Review and Environmental Compliance Unit
California Office of Historic Preservation
1725 23rd St, Ste 100, Sacramento CA 95816
916-893-8270 phone
Aubrie.morlet@parks.ca.gov
www.ohp.parks.ca.gov

From: Murphey, Joseph S CIV USARMY CESWF (USA) <Joseph.S.Murphey@usace.army.mil>
Sent: Thursday, February 9, 2023 8:57 AM
To: OHP, CALSHPO@Parks <CALSHPO.OHP@parks.ca.gov>
Cc: Capone, Kelley (PRT) <kelley.capone@sfport.com>; Fisher, Melinda CIV USARMY CESWF (USA) <Melinda.Fisher@usace.army.mil>; Campbell, John A CIV USARMY CESWF (USA) <John.A.Campbell@usace.army.mil>
Subject: USACE Section 106 Initiation of Consultation for the San Francisco Waterfront Coastal Flood Study

You don't often get email from joseph.s.murphey@usace.army.mil. Learn why this is important

Dear Sirs,

The attached letter with enclosure serves as the formal initiation to consult regarding the Port of San Francisco and the U.S. Army Corps of Engineers San Francisco Waterfront Coastal Flood Study.

Regards

Joseph Scott Murphey, Historical Architect
Regional Planning and Environmental Center/ CESWF-PEE-E
Currently teleworking. Available by phone/text: (817) 229-1956 or

email: joseph.s.murphey@usace.army.mil

State of California • Natural Resources Agency
Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION
Armando Quintero, *Director*

Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

March 29, 2023 In reply refer to: COE_2023_0209_001

VIA ELECTRONIC MAIL

Kenneth Shingleton
Chief, Cultural and Environmental Programs Support Section
Regional Planning and Environmental Center
U.S. Army Corps of Engineers, Fort Worth District
P.O. Pox 17300
Fort Worth, TX 94102

RE: Section 106 consultation for the San Francisco Waterfront Coastal Flood Study, San Francisco County

Dear Kenneth Shingleton,

The U.S. Army Corps of Engineers (COE) is initiating consultation with the State Historic Preservation Officer (SHPO) to comply with Section 106 of the National Historic Preservation Act of 1966, as amended (54 USC § 306108) and its implementing regulation at 36 CFR Part 800. By letter received on February 9, 2023, the COE is seeking consultation on the San Francisco Waterfront Coastal Flood Study and the possible development of a Programmatic Agreement for the future undertaking.

The San Francisco Waterfront Coastal Flood Study and the associated Environmental Impact Statement conducted under the National Environmental Policy Act will involve investigation and analysis to determine the feasibility of reducing flood risks through a range of alternatives for 2040 through 2140. The COE is currently developing a plan to include the public in the consultation for the study.

The list of interested parties with whom the COE intends to consult seems adequate. It is also recommended, if not previously done, that the COE contact the Native American Heritage Commission (NAHC) for a complete list of Native American entities listed by the NAHC as having cultural ties to the project area.

As the SHPO typically does not consult on planning studies, but does once the proposed undertaking has been selected, and the COE is requesting a programmatic agreement, it is recommended that our agencies meet to better understand the request. Please contact Ms. Aubrie Morlet to schedule a meeting and with any questions at (916) 893-8270 or Aubrie.Morlet@parks.ca.gov.

Sincerely,



Julianne Polanco
State Historic Preservation Officer

USACE TO SHPO

INVITATION TO CONSULT UNDER SECTION 106 , with DRAFT PA and PROJECT DESCRIPTION

AND

ADDITIONAL CORRESPONDENCE WITH SHPO TO GET RESPONSE STATUS

JULY 2024

From: Crippen, Leslie A CIV USARMY CESWF (USA)
To: calshpo.ohp@parks.ca.gov
Cc: Smith, Holly C CIV USARMY CESWF (USA)
Subject: 106 San Francisco Waterfront Coastal Flood Study
Date: Tuesday, July 16, 2024 2:18:55 PM
Attachments: 20240716_SFWS_SHPO_PA_Cover.pdf
20240716_SFWCS_PA.pdf
20240716_Attach_A_Project_Summary.pdf

Good afternoon,

Please find attached a Section 106 consultation request from the U.S. Army Corps of Engineers, Tulsa District (USACE) regarding the San Francisco Waterfront Coastal Flood Study. Please also find attached enclosures:

Draft Programmatic Agreement
Draft Attachment A: Project Summary

We look forward to receiving your feedback and working together to ensure consideration of impacts to historic properties associated with this undertaking. Please don't hesitate to contact us directly with any questions or requests for additional information.

Respectfully,

Leslie Crippen | Archaeologist | she/her
U.S. Army Corps of Engineers
Regional Planning & Environmental Center
817-886-1470 Office
Leslie.Crippen@usace.army.mil

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
2488 EAST 81ST STREET
TULSA, OKLAHOMA 74137-4290

July 16, 2024

Julianne Polanco
State Historic Preservation Officer
1725 23rd Street, Suite 100
Sacramento, CA 95816

Dear Ms. Polanco,

The U.S. Army Corps of Engineers, Tulsa District (USACE), in partnership with the Port of San Francisco, a non-federal sponsor (NFS), has published the San Francisco Waterfront Coastal Flood Study Draft Integrated Feasibility Report and Environmental Impact Statement (IFR-EIS) and has conducted agency and public review via comment period held between February 26 and March 29, 2024. On October 10, 2022, the USACE invited the California State Historic Preservation Officer (SHPO) to participate in the National Environmental Policy Act (NEPA) environmental review process as a participating agency pursuant to 40 CFR Part 1501.8. The SHPO declined the invitation due to having no special standing in the NEPA process and pending initiation of consultation under Section 106 of the National Historic Preservation Act (NHPA) (54 USC 306108) of 1966, as amended.

The IFR-EIS is being conducted under the authority of Section 110 of Rivers and Harbors Act of 1950, Section 142 of WRDA 1976, as amended by Section 705 of WRDA 1986 and Section 8325(b) of WRDA 2022, and Section 203 of WRDA 2020, as amended by Section 8325(a) of WRDA 2022. The IFR-EIS presents a range of alternatives that were considered for coastal flood risk management and presents a sea level rise adaptation plan based on a series of actions over time, with monitoring of climate change and sea level rise informing subsequent actions based on a feasibility level of analysis and design detail.

Once Congress authorizes the project (potentially 2026), the plan will through the pre-construction, engineering and design (PED) phase where construction level details will be developed and any required analyses completed including cultural and environmental compliance. The PED phase will last many years and will be staggered based on the sequencing that will be identified in the IFR-EIS and availability of funding.

After construction level details are complete for the identified component of the project including all compliance secured for that component and construction funding is available, construction would begin. As construction is completed, the project will be analyzed for performance in light of changing conditions. The Period of Analysis (POA) for the study extends for 100 years, from 2040-2140, with 2040 being the baseline year in which the plan is anticipated to be in operation, and benefits are being produced. Project performance is quantified by estimating future damages through 2140, for a Period of Analysis of 100 years. Adaptation to the plan alignment or features may occur before or after 2090 (the midpoint of the POA) and would have a subsequent construction phase.

The proposed Area of Potential Effects (APE) is in the city and county of San Francisco, California, spanning a densely developed area of San Francisco that includes residential, commercial, light industrial, recreational, and transportation uses; utilities; and decommissioned military infrastructure; primarily along the eastern and northeastern waterfront from Fort Mason to Heron's Head, and extending inland around Mission Creek and Islais Creek. The final APE will be determined in consultation and will include areas where archaeological resources may be encountered or disturbed as well as areas where historic structures, landscapes, and viewsheds may be directly or indirectly affected. Although potential effects on archaeological sites are anticipated primarily where ground disturbance would occur during construction, historic properties may be directly affected by construction activities as well as indirectly affected by noise, vibration, or changes in the visual environment associated with construction and implementation of the alternatives.

Because effects on historic properties cannot be fully determined or resolved prior to the approval of the undertaking, the USACE has determined that it is advisable to develop a programmatic agreement (PA) for the purpose of identifying and evaluating potential effects on historic properties related to the undertaking in accordance with 36 CFR § 800.6, 36 CFR § 800.14(b)(1)(ii), and 36 CFR § 800.14(b)(3). As such, we have developed the enclosed draft PA and hereby formally request your review and consultation under Section 106 of the NHPA.

In addition to your office, USACE has invited the following agencies, historical societies, non-federally recognized tribes, and interested parties to consult:

- Advisory Council on Historic Preservation
- Amah Mutsun Tribal Band of Mission San Juan Bautista
- American Indian Cultural District SF
- Association of Ramaytush Ohlone
- California Preservation Foundation
- Costanoan Rumsen Carmel Tribe
- Dogpatch Neighborhood Association
- Ellen Johnck
- Indian Canyon Mutsun Band of Costanoan
- Muwekma Ohlone Indian Tribe of the San Francisco Bay Area

- National Park Service
- National Trust for Historic Preservation
- Ohlone Indian Tribe
- Rumsen Am:a Tur:ataj Ohlone
- San Francisco Architectural Heritage
- San Francisco Historic Preservation Commission
- South Beach Rincon Mission Bay Neighborhood Association
- Telegraph Hill Dwellers Neighborhood Association
- Wuksache Indian Tribe/Eshom Valley Band

To date, no federally recognized tribes have been identified which attach religious or cultural significance to historic properties which may be affected by the undertaking. The USACE and the NFS have held 2 early public scoping meetings, 2 public comment periods, 6 workshops (4 English, 1 Spanish, 1 Cantonese), and 2 webinars to solicit public input on the overall project and the consideration of impacts to historic properties. Consultation is ongoing and comments and feedback obtained through these engagements are being considered as we work to develop the final EIS and the PA.

In addition to the draft PA, a project summary, which describes the tentatively selected plan as well as previously identified historic properties in the project area, is enclosed for your review. Comments provided by the City of San Francisco Planning Department and the U.S. Department of the Interior, which identified additional historic themes and possible corrections within the existing historic context, as well as additional resources for consideration, are currently being reviewed for incorporation. We look forward to working with your agency to develop the PA. We welcome your recommendations of additional consulting parties or tribes with an expressed interest in the project area and respectfully request comments on the draft PA be provided no later than August 30, 2024. If you have any questions or would like additional information, please contact Holly Smith, Archaeologist at holly.c.smith@usace.army.mil or by telephone at (918) 669-4397.

Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Support Section
Regional Planning and Environmental Center

Enclosures: Draft Programmatic Agreement
Attachment A: Project Summary

From: Crippen, Leslie A CIV USARMY CESWF (USA)
To: alicia.perez@parks.ca.gov
Cc: Smith, Holly C CIV USARMY CESWF (USA)
Subject: FW: 106 San Francisco Waterfront Coastal Flood Study
Date: Tuesday, September 3, 2024 12:10:58 PM
Attachments: 20240716_SFWS_SHPO_PA_Cover.pdf
20240716_SFWCS_PA.pdf
20240716_Attach_A_Project_Summary.pdf

Good morning Alicia,

I am following up on this submission from 16 July 2024 regarding the San Francisco Coastal Waterfront Flood Study. I understand there have been some changes in the review assignments at your office and am hoping to find the correct point of contact. I was given the number 916-503-3378 by your office staff but I reached a busy signal. I am also including my colleague Holly Smith, who will be taking over as lead for cultural resources for USACE on this project. We look forward to speaking with you; please let us know if we can schedule a time to provide you a brief project overview and update, or if we need to seek an alternative point of contact.

Sincere thanks,

Leslie Crippen | Archaeologist | she/her
U.S. Army Corps of Engineers
Regional Planning & Environmental Center
817-886-1470 Office
Leslie.Crippen@usace.army.mil

From: Crippen, Leslie A CIV USARMY CESWF (USA)
Sent: Tuesday, July 16, 2024 2:18 PM
To: calshpo.ohp@parks.ca.gov
Cc: Smith, Holly C CIV USARMY CESWF (USA) <Holly.C.Smith@usace.army.mil>
Subject: 106 San Francisco Waterfront Coastal Flood Study

Good afternoon,

Please find attached a Section 106 consultation request from the U.S. Army Corps of Engineers, Tulsa District (USACE) regarding the San Francisco Waterfront Coastal Flood Study. Please also find attached enclosures:

Draft Programmatic Agreement
Draft Attachment A: Project Summary

We look forward to receiving your feedback and working together to ensure consideration of impacts to historic properties associated with this undertaking. Please don't hesitate to contact us directly with any questions or requests for additional information.

Respectfully,

Leslie Crippen | Archaeologist | she/her
U.S. Army Corps of Engineers
Regional Planning & Environmental Center
817-886-1470 Office
Leslie.Crippen@usace.army.mil

From: Perez, Alicia@Parks
To: Crippen, Leslie A CIV USARMY CESWF (USA)
Cc: Smith, Holly C CIV USARMY CESWF (USA)
Subject: [Non-DoD Source] RE: 106 San Francisco Waterfront Coastal Flood Study
Date: Wednesday, September 4, 2024 11:16:18 AM

Hi Leslie,

I forwarded your inquiry to Mike McGuirt yesterday. Please feel free to reach out to Mike if you have any questions. He can be reached at Michael.McGuirt@parks.ca.gov.

Thank you,

Alicia C. Perez, M.A.
Associate State Archaeologist
Department of Parks and Recreation
Office of Historic Preservation
1725 23rd St. Suite 100
Sacramento, CA 95816-7100

916-503-3378 (direct line)
916-445-7000 (main OHP line)
916-445-7053 (main OHP fax)

Please note my new direct line.

From: Crippen, Leslie A CIV USARMY CESWF (USA) <Leslie.A.Crippen@usace.army.mil>
Sent: Tuesday, September 3, 2024 10:11 AM
To: Perez, Alicia@Parks <Alicia.Perez@parks.ca.gov>
Cc: Smith, Holly C CIV USARMY CESWF (USA) <Holly.C.Smith@usace.army.mil>
Subject: FW: 106 San Francisco Waterfront Coastal Flood Study

> You don't often get email from leslie.a.crippen@usace.army.mil. Learn why this is important

Good morning Alicia,

I am following up on this submission from 16 July 2024 regarding the San Francisco Coastal Waterfront Flood Study. I understand there have been some changes in the review assignments at your office and am hoping to find the correct point of contact. I was given the number 916-503-3378 by your office staff but I reached a busy signal. I am also including my colleague Holly Smith, who will be taking over as lead for cultural resources for USACE on this project. We look forward to speaking with you; please let us know if we can schedule a time to provide you a brief project overview and update, or if we need to seek an alternative point of contact.

Sincere thanks,

Leslie Crippen | Archaeologist | she/her
U.S. Army Corps of Engineers

USACE TO SHPO

ADDITIONAL CORRESPONDENCE WITH SHPO INCLUDING PREVIOUS INVITATION TO CONSULT THAT WAS SENT IN MARCH 2023

SEPTEMBER 2024

From: Smith, Holly C CIV USARMY CESWF (USA)
To: Michael.McGuirt@parks.ca.gov
Subject: Add"l previous 106 consultation San Francisco Waterfront Coastal Flood Study (COE_2023_0209_001)
Date: Wednesday, September 11, 2024 9:53:00 AM
Attachments: SHPO_CORRESPONDENCE_SFWS_MARCH_2023.pdf
20240716_SFWS_SHPO_PA_Cover.pdf
106 San Francisco Waterfront Coastal Flood Study.msg

Good morning,
A previous invitation to consult (and subsequent SHPO response) has been located for the subject project (currently under review). Please see below correspondence and the attached email submitted July 16, 2024, which includes a draft PA and Project Summary for the San Francisco Waterfront Coastal Flood Study. Leslie Crippen has taken a position in Oregon, so I will be project lead going forward. I have been her back-up this year and am well versed in the current iteration of the project.

In compiling all correspondence to date, I see that additional consultation with your office took place in March of 2023 (attached), and it appears this was not included in the most recent review request. The letters from that time invited the SHPO to Section 106 consultation, introduced the project, and resulted in a commitment to meet to discuss the project. After that time there were both Corps staff changes and multiple iterations of the project. A Draft Feasibility Study/EIS has been published, and is currently being reviewed and updated. The final PA will be included in the Final Report.

I'm providing the March 2023 consultation request and correspondence (COE_2023_0209_001) directly to you, in case review has already begun on the recent submission (attached).
Please advise how to best incorporate this into the current review. Shall I submit this with a new cover letter and include this new information as an addendum along with the most recent submission, or submit only a new cover letter with the March 2023 correspondence as an addendum?

Thank you,
Holly Smith

Holly C. Smith
Archaeologist
Environmental Branch |Cultural and Environmental Program Support Section
SWD Regional Planning and Environmental Center (RPEC)
Mobile: 918-699-9655
Holly.C.Smith@usace.army.mil

Mailing address:
US Army Corps of Engineers
Attn: Holly Smith
CESWF-PEE-E
2488 E 81st Street
Tulsa, OK 74137-4290

ACHP TO USACE NOTIFICATION OF USACE REQUIREMENTS

AND

USACE RESPONSE TO ACHP AND ADDITIONAL COORDINATION

AUGUST THROUGH OCTOBER 2024

From:	Chris Daniel
To:	kelley.capone@sfport.com; Smith, Holly C CIV USARMY CESWF (USA); Fisher, Melinda CIV USARMY CESWF (USA); Crippen, Leslie A CIV USARMY CESWF (USA)
Subject:	[Non-DoD Source] FW: [External] USACE & Port of SF Flood Study, NHPA Section 106
Date:	Monday, August 26, 2024 8:13:24 AM
Attachments:	Outlook-lzomwb2b.png 20240802_SFWS_DRAFT_PA.pdf ca.coe-c.fort worth district.san francisco waterfront coastal flood study.20230227.con.pdf

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All,

On February 30, 2023, the ACHP sent the attached letter to the Corps, in which we requested that within 180 calendar days of receiving this correspondence, it provide the ACHP with an update as to the progress of the consultation since February 2023. Upon receipt of the additional information, the ACHP would notify the Corps within 15 days regarding our decision on participation. This below response provides limited information on the consultation from the non-federal sponsor. While we appreciate receiving the information, it is the sponsoring federal agency who is responsible for complying with Section 106 of the National Historic Preservation Act and its implementing regulations, "Protection of Historic Properties" (36 CFR Part 800). Upon receipt of an updated response from the Corps regarding the status of this undertaking, the ACHP will resume its evaluation for our participation.

Christopher Daniel (he/him/his)
Program Analyst
Advisory Council on Historic Preservation
202.517.0223 (Office & Mobile)
cdaniel@achp.gov

From: e106 <e106@achp.gov>
Sent: Thursday, August 22, 2024 9:42 AM

From: Capone, Kelley (PRT) <kelley.capone@sfport.com>
Sent: Tuesday, August 20, 2024 7:02 PM
To: DPH-jonathan <jonathan@ramaytush.org>; glcastro@pacbell.net; DPH-gregg <gregg@ramaytush.org>; vlopez@amahmutsun.org; aerieways@aol.com; vjltestingcenter@aol.com; rumsenama@gmail.com; amahmutsuntribal@gmail.com; amtbinc21@gmail.com; chochenyo@AOL.com; dirwin0358@yahoo.com; vincent.d.medina@gmail.com; rumsen@aol.com; carlamarieohlone@gmail.com; ohlonesisters@gmail.com; ams@indiancanyon.org; kanyon@kanyonkonsulting.com; indiancanyon.kanyon@gmail.com; admin@kanyonkonsulting.com; cnijmeh@muwekma.org; monicavarellano@gmail.com; Muwekma@muwekma.org; MuwekmaOhloneTribe@gmail.com; marellano@muwekma.org; kwood8934@aol.com; e106 <e106@achp.gov>; DPH-jonathan <jonathan@ramaytush.org>; elizabeth.hodges@parks.ca.gov; cpf@californiapreservation.org; president@thd.org; hello@thd.org; info@dogpatchna.org; Dualan, Dale <dale_dualan@nps.gov>; info@savingplaces.org; Matsuda, Diane (CPC) <diane.matsuda@sfgov.org>; sbrmbna@gmail.com; Ellen Johnck

<ellen@ellenjohnckconsulting.com>; Woody LaBounty <wlabounty@sfheritage.org>
Cc: Paez, Mark (PRT) <mark.paez@sfport.com>; Vanderslice, Allison (CPC) <allison.vanderslice@sfgov.org>; Barata, Luiz (PRT) <luiz.barata@sfport.com>; Crippen, Leslie A CIV USARMY CESWF (USA) <leslie.a.crippen@usace.army.mil>; Smith, Holly C CIV USARMY CESWT (USA) <Holly.C.Smith@usace.army.mil>; Fisher, Melinda CIV USARMY CESWF (USA) <Melinda.Fisher@usace.army.mil>
Subject: [External] USACE & Port of SF Flood Study, NHPA Section 106

Dear Consulting Parties,

This message is an update on the US Army Corps of Engineers (USACE) and Port of San Francisco's Flood Study and National Historic Preservation Act (NHPA) Section 106 process, including an updated Draft Programmatic Agreement (PA) and a request for your availability for a proposed meeting with Consulting Parties in September 2024.

Flood Study Update

The San Francisco Waterfront Coastal Flood Study reached an important milestone in June 2024, the Agency Decision Milestone. At this milestone the USACE and the City of San Francisco agreed that the Plan described in the *Draft Integrated Feasibility Report and Environmental Impact Statement* (Draft Report), revised with public and USACE policy and technical comments, will be the Recommended Plan, which will go to Congress for authorization and funding. The Draft Report included a copy of the Draft PA and was provided to agencies, interested non-federally recognized tribes and other consulting parties for review, and was made available for a 60-day comment period.

The Draft Plan will be revised into the Recommended Plan and will be evaluated in the *Final Integrated Feasibility Report and Environmental Impact Statement* (Final Report). The Final Report is anticipated mid to late 2025.

Section 106 Update

Comments were received on the Draft Report and on the Draft PA. Many of the comments received have been addressed in the attached updated version of the Draft PA. However, the PA is a work in progress; we are still working to incorporate feedback and anticipate further revision as we continue consultation. The Draft PA was submitted to the California State Historic Preservation Officer (SHPO) along with a request to begin consultation on July 16, 2024. The Draft PA will continue to be revised with feedback from Consulting Parties and the SHPO.

We would like to schedule a meeting with Consulting Parties in September 2024. Please respond to this message with your preferred meeting time: Weekday morning, afternoon, or evening. We will follow up with potential meeting dates and times and will hold as many meetings as needed to accommodate everyone but will try to consolidate where

we can.

We can also schedule a tour of the project area if folks are interested.

If you have any questions or concerns, please contact USACE's Holly Smith at holly.c.smith@usace.army.mil or the Port of SF's Kelley Capone at kelley.capone@sfport.com .

Thank you for your continued participation in the NHPA Section 106 process.

Thank you,

Holly and Kelley

Kelley Capone

Waterfront Resilience Program, Port of San Francisco
415.307.9881 | Kelley.Capone@sfport.com

Pier 1, The Embarcadero, San Francisco, CA 94111

From:	Smith, Holly C CIV USARMY CESWF (USA)
To:	e106@achp.gov; Chris Daniel
Cc:	Jensen, Tacy M CIV USARMY CESWT (USA); Fisher, Melinda CIV USARMY CESWT (USA); Capone, Kelley (PRT); Paez, Mark (PRT); Mckinney, Taylor D CIV USARMY CESWF (USA); calshpo.ohp@parks.ca.gov
Subject:	ACHP Project 019241 San Francisco Waterfront Coastal Flood Study, USACE and Port of San Francisco
Date:	Wednesday, October 23, 2024 9:36:00 AM
Attachments:	SWT_to_Advisory_Council_10-22-24.pdf 20240802_SFWS_PA_Project Summary.pdf 20240802_SFWS_DRAFT_PA (005).pdf SFWS COMMENT TRACKING.xlsx SFWS_USACE Consultation List_August 2024_av.xlsx ACHP USACE San Francisco Waterfront Coastal Flood Study ALL.pdf SHPO USACE San Francisco Waterfront Coastal Flood Study ALL.pdf Consulting Tribes Mtg 01-04-24 Fed Process San Francisco Waterfront Coastal Flood Study.pdf Consulting Party Mtg 01-03-24 w slides Federal Process and San Francisco Waterfront Coastal Flood Study .pdf SFWS_Amah Mutsun Tribal Band of Mission San Juan Bautista_106 invite_20230308.pdf TELEGRAPH HILL DWELLERS CONSULTING PARTIES CORRESPONDENCE.pdf City"s EIS comment letter.pdf SFH-Comments-Waterfront-Flood-Study.pdf ER 24 0036 DOI Comment Letter Coastal Flood Study.pdf e106 form SFWS.docx Consulting Party Involvement Form_DRAFT1_TM_HCS_MP_changes_accepted.docx

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Good morning,

The U.S. Army Corps of Engineers (USACE) received your letter dated February 27, 2023, as well as your follow up email dated August 26, 2024, requesting an update on the status of Section 106 consultation for the San Francisco Waterfront Coastal Flood Study. Per your initial letter, the USACE understands that the Advisory Council on Historic Preservation (ACHP) has not yet determined whether to participate in the consultation. The February 27, 2023, letter requested a report of consultation progress be submitted within 180 calendar days, which the USACE has not yet provided. We wish to apologize for this oversight and to provide your agency an update of project activities and consultation status. One of the letters to tribes is attached, as it is the same letter sent to all consulting tribes so far identified (none Federally recognized). Attached please find all correspondence, information regarding consulting parties, and a comments tracker. The attached letter (SWT_to_Advisory_Council_10-22-24) provides information regarding consultation which is currently ongoing. I have also attached a draft Consulting Party Involvement Form we are creating for more effective communication with non-agency consulting parties.

The attached PA and Project Summary are currently being revised. The project has had multiple leads due to staffing and workload, and I have taken over as lead since Leslie Crippen took a job in the Northwest. The Draft Integrated Feasibility Report and Environmental Impact Statement has been published and comments have been received. Comments are in the attached Comment Tracker and are being addressed in the revised documents. The Draft PA and Project Summary (attached) are draft versions in need of significant revision, which is currently ongoing. Comments are being incorporated into the revisions of the Draft IFR/EIS and the Draft PA and Project Summary.

USACE invites the ACHP to participate in drafting the PA for this complex and significant project.

Please let me know if I can provide additional information that would be helpful in your

review, or if you would like to discuss the project. (Also, please advise if any of the attachments won't open- tech issues are abundant at the moment.)

Respectfully,
Holly

Holly C. Smith
Archaeologist
Environmental Branch |Cultural and Environmental Program Support Section
SWD Regional Planning and Environmental Center (RPEC)
Mobile: 918-699-9655
Holly.C.Smith@usace.army.mil

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Tulsa, OK 74137-4290

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
2488 EAST 81ST STREET
TULSA, OKLAHOMA 74137-4290

October 22, 2024

Christopher Koeppel
Assistant Director
Office of Federal Agency Programs
Federal Property Management Section
401 F Street NW, Suite 308
Washington, DC 20001-26

RE: *San Francisco Watershed Coastal Flood Study*
San Francisco, CA
ACHP Project Number 019241

Dear Mr. Koeppel,

The U.S. Army Corps of Engineers (USACE) received your letter dated February 27, 2023, as well as your follow up email dated August 26, 2024, requesting an update on the status of Section 106 consultation for the San Francisco Waterfront Coastal Flood Study. Per your initial letter, the USACE understands that the Advisory Council on Historic Preservation (ACHP) has not yet determined whether to participate in the consultation. The February 27, 2023, letter requested a report of consultation progress be submitted within 180 calendar days, which the USACE has not yet provided. We wish to apologize for this oversight and to provide your agency an update of project activities and consultation status.

In accordance with the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA), the USACE, in partnership with the Port of San Francisco, a non-federal sponsor (NFS), published the Draft Integrated Feasibility Report and Draft Environmental Impact Statement (DIFR-DEIS) in February 2024, and conducted agency and public review of the DIFR-DEIS via comment period held between February 26 and March 29, 2024. Because effects on historic properties cannot be fully determined or resolved prior to the approval of the undertaking, the USACE has determined that it is advisable to develop a programmatic agreement (PA) for the purpose of identifying and evaluating potential effects on historic properties related to the undertaking in accordance with 36 CFR § 800.6, 36 CFR § 800.14(b)(1)(ii), and 36 CFR § 800.14(b)(3).

The NEPA process is ongoing, with the DIFR-DEIS currently under revision. The USACE invited the California State Historic Preservation Officer (SHPO) to participate in the NEPA review process on October 10, 2022. (All USACE correspondence with the SHPO is enclosed.) In their response, the SHPO declined to participate due to lack of special standing in the NEPA process. In a subsequent letter, dated February 09, 2023, the USACE requested consultation with the

SHPO under Section 106 of the NHPA to develop a PA. The SHPO responded with a request to meet to further discuss the project in a letter dated March 29, 2023, and stated that SHPO "typically does not consult on planning studies but does once the proposed undertaking has been selected." On July 16, 2024, the USACE provided the Tentatively Selected Plan and a draft of the PA to the SHPO and requested SHPO comments on the draft PA in accordance with Section 106 of the NHPA. The SHPO has not yet replied or provided additional feedback. In addition to your office and the SHPO, USACE has invited the following agencies, historical societies, non-federally recognized tribes, and interested parties to consult:

- Amah Mutsun Tribal Band of Mission San Juan Bautista
- American Indian Cultural District SF
- Association of Ramaytush Ohlone
- California Preservation Foundation
- Costanoan Rumsen Carmel Tribe
- Dogpatch Neighborhood Association
- Ellen Johnck
- Indian Canyon Mutsun Band of Costanoan
- Muwekma Ohlone Indian Tribe of the San Francisco Bay Area
- National Park Service
- National Trust for Historic Preservation
- Ohlone Indian Tribe
- Rumsen Am:a Tur:ataj Ohlone
- San Francisco Architectural Heritage
- San Francisco Historic Preservation Commission
- South Beach Rincon Mission Bay Neighborhood Association
- Telegraph Hill Dwellers Neighborhood Association
- Wuksache Indian Tribe/Eshom Valley Band

To date, no federally recognized tribes have been identified who attach religious or cultural significance to historic properties which may be affected by the undertaking. The USACE and the NFS have held 2 early public scoping meetings, 2 public comment periods, 6 workshops (4 English, 1 Spanish, 1 Cantonese), and 2 webinars to solicit public input on the overall project and the consideration of impacts to historic properties. Three meetings have been held with identified consulting parties. Consultation is ongoing and comments and feedback obtained through these engagements are being considered as we work to develop the final EIS and the PA. In order to track and respond to comments, the USACE has developed a comment matrix. A copy of this matrix is enclosed for your review.

Once Congress authorizes the project (potentially 2026), the plan will move into the pre-construction engineering and design (PED) phase where construction level details will be developed, intensive cultural resources investigations will be conducted, and effects to individual

historic properties will be determined in consultation. USACE will work with the PA signatories and consulting parties to identify appropriate historic properties management or mitigation plans. The PED phase will last many years and will be staggered based on the sequencing that will be identified in the IFR-EIS and availability of funding.

In addition to the comment matrix, copies of correspondence, and the draft PA, a project summary, which depicts the draft area of potential effect (APE) and describes the tentatively selected plan, as well as previously identified historic properties in the project area, is enclosed for your review. Comments provided by the City of San Francisco Planning Department and the U.S. Department of the Interior, which identified additional historic themes and possible corrections within the existing historic context, as well as additional resources for consideration, are currently being reviewed for incorporation. Comments received from the SHPO and consulting parties will be reviewed and addressed in a revised draft PA, which we anticipate recirculating for review in November or December 2024.

We wish to reiterate our invitation to the ACHP to participate in the consultation if deemed appropriate and look forward to receiving any feedback on the enclosed materials. If you have any questions or would like additional information, please contact Holly Smith, Archaeologist, at holly.c.smith@usace.army.mil or by telephone at (918) 669-4397.

Sincerely,

Kenneth Shingleton

Kenneth L. Shingleton
Chief, Cultural and Environmental Support Section
Regional Planning and Environmental Center

Enclosures: Draft Programmatic Agreement
Attachment A: Project Summary
Section 106 Consultation Correspondence
Draft IFR-EIS/PA Comment Matrix

cc: Port of San Francisco
California Office of Historic Preservation

ACHP TO USACE

ACHP PARTICIPATION NOT NEEDED

NOVEMBER 2024

November 14, 2024

Joseph Murphey
Cultural Resource Specialist
U.S. Army Corps of Engineers
ForthWorth District

Ref: *San Francisco Waterfront Coastal Flood Study, Port of San Francisco, San Francisco*
San Francisco, California
ACHP Project Number: 019241

Dear Mr. Murphey:

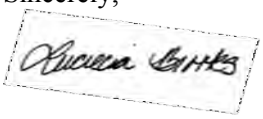
On November 13, 2024, the Advisory Council on Historic Preservation (ACHP) received your notification and supporting documentation regarding the potential adverse effects of the referenced undertaking on a property or properties listed or eligible for listing in the National Register of Historic Places. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act, does not apply to this undertaking. Accordingly, we do not believe our participation in the consultation to resolve adverse effects is needed.

However, if we receive a request for participation from the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer, affected Indian tribe, a consulting party, or other party, we may reconsider this decision. Should the undertaking's circumstances change, consulting parties cannot come to consensus, or you need further advisory assistance to conclude the consultation process, please contact us.

Pursuant to Section 800.6(b)(1)(iv), you will need to file the final Section 106 agreement document (Agreement), developed in consultation with the California SHPO and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the Agreement and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with your notification of adverse effect. If you have any questions or require our further assistance, please contact Christopher Daniel at (202) 517-0223 or by e-mail at cdaniel@achp.gov and reference the ACHP Project Number above.

Sincerely,



Lucrecia Brooks
Historic Preservation Technician
Office of Federal Agency Programs

USACE AND SHPO CONSULTATION

2025

State of California • Natural Resources Agency
Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION
Armando Quintero, *Director*

Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

January 28, 2025

VIA EMAIL

In reply refer to: COE_2023_0209_001

Mr. Kenneth Shingleton
Chief, Cultural and Environmental Support Section
U.S. Army Corps of Engineers
Regional Planning and Environmental Center
2488 East 81st Street
Tulsa, Oklahoma 74137-4290

VIA EMAIL

RE: Programmatic Agreement regarding the San Francisco Waterfront Coastal Flood Study, San Francisco County

Dear Mr. Shingleton,

The California State Historic Preservation Officer (SHPO) received your consultation letter dated July 16, 2024, initiating consultation for the above referenced undertaking pursuant to Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. § 300101), as amended, and its implementing regulation, 36 CFR Part 800.

The U.S. Army Corps of Engineers, Tulsa District (Corps), in partnership with the Port of San Francisco is considering a range of alternatives to manage coastal flood risk and plan for sea level rise. Once the project is authorized by Congress, construction level details will be developed in a pre-construction, engineering, and design phase and will require Section 106 compliance by the Corps. Because effects from the project on historic properties cannot be fully determined prior to approval, the Corps seeks to develop a programmatic agreement (PA) in accordance with 36 CFR § 800.14(b)(1)(ii) and has provided a draft with a formal request for review and comments.

With this letter, I acknowledge your formal request for review and comment on the draft PA and I'm pleased to transmit initial comments in the attached document. Detailed comments and suggested edits can be found within the body of the draft PA. An overarching theme in the comments being provided however concerns consultation procedures; ensuring transparency and clarity in expected timelines and processes for seeking input from consulting parties, and that those are consistent in principle with the review procedures found in 36 CFR Part 800 will be important to achieving successful collaboration with signatories and stakeholders and positive Section 106 outcomes.

I look forward to continuing consultation in partnership with the Corps to develop the programmatic agreement for the San Francisco Waterfront Coastal Flood Study. If you have any questions or concerns, please contact Senior State Archaeologist Brendon Greenaway at Brendon.Greenaway@parks.ca.gov.

Sincerely,



Julianne Polanco
State Historic Preservation Officer

From:	Smith, Holly C CIV USARMY CESWF (USA)
To:	calshpo.ohp@parks.ca.gov
Cc:	Capone, Kelley (PRT); Jain, Devyani (PRT); Paez, Mark (PRT); Mckinney, Taylor D CIV USARMY CESWF (USA)
Subject:	106 COE_2023_0209_001 PA USACE SF Waterfront, revised
Date:	Friday, May 2, 2025 8:52:00 AM
Attachments:	2025-05-01 DRAFT SFWS PA.pdf 2025-05-01_USACE_to_SHPO_PA_Submission_2_signed.pdf

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Good morning,

Please find attached for your review the revised programmatic agreement associated with the San Francisco Waterfront Coastal Flood Study, San Francisco County (2020-05-01 DRAFT SFWS PA), and accompanying consultation letter (2020-05-01_USACE_to_SHPO_PA_Submission_2_signed).

Respectfully,

Holly

Holly C. Smith
Archaeologist
Environmental Branch |Cultural and Environmental Program Support Section
SWD Regional Planning and Environmental Center (RPEC)
Mobile: 918-699-9655
Holly.C.Smith@usace.army.mil

Mailing address:
US Army Corps of Engineers
Attn: Holly Smith
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2488 E 81st Street
Tulsa, OK 74137-4290

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
2488 EAST 81ST STREET
TULSA, OKLAHOMA 74137-4290

May 1, 2025

Regional Planning and Environmental Center

Julianne Polanco
State Historic Preservation Officer
1725 23rd Street, Suite 100
Sacramento, CA 95816

RE: COE_2023_0209_001 Programmatic Agreement associated with the San Francisco Waterfront Coastal Flood Study, San Francisco County.

Dear Ms. Polanco,

The U.S. Army Corps of Engineers (USACE) received your letter dated January 28, 2025, regarding the subject undertaking. This letter is to continue consultation pursuant to Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. § 300101), as amended, and its implementing regulation, 36 CFR Part 800, for the San Francisco Waterfront Coastal Flood Study. The Study's recommended plan has been finalized, and the project will henceforth be referenced as the *Proposed Implementation of the San Francisco Waterfront Coastal Flood Study*.

USACE appreciates the comments you provided for the draft Programmatic Agreement (PA). Please find attached the revised PA, which incorporates your comments and edits, and the revised Project Summary and Culture History (included as Appendices to the PA). Special attention has been paid to detailing the timeline and processes for consultation and reviews, and we look forward to your input. We have also accounted for the complexity of the project by addressing the sequencing for implementation of project components, and we look forward to working with you to refine terminology and ensure clarity of both timelines and processes.

In response to the public and consulting party comments received for the first draft of the PA, and at the request of the Port, we have included definitions for key terminology in the body of the PA rather than solely referencing the applicable regulations. We look forward to your input on this approach. Many comments reflected frustration with the lack of detail included in the PA. To address this, we have included more detail in the PA, revised the Project Summary, separated the Project Summary from the Culture History and Literature Review, and have included both as Appendices. The enclosed PA is being provided to the consulting parties for review concurrent with your review. USACE will provide all comments received from consulting parties to the SHPO at the close of the consulting parties' review period. An additional 15 days will be added to the SHPO review period to accommodate review of comments from consulting parties. Extensions to the review period may be provided upon request.

Construction of project components will begin when the undertaking receives authorization and funding, and all compliance is achieved. The Planning Period of Analysis (POA) includes the dates of 2040 and 2090 as benchmarks for evaluation of the success of the flood risk management measures, and assessment of the need for additional measures to be implemented in response to their success (or lack thereof), relative sea level change, and/or other changing conditions. First actions are those which are slated to be constructed and/or implemented *prior* to 2040, with subsequent actions responsive to the aforementioned variables. However, USACE is including both first and second actions in the defined undertaking due to the possibility that adaptive monitoring could reveal the need for an already implemented measure to be modified while other project components are yet to be completed.

If you have questions or would like additional information, please reach out to Holly Smith, Archaeologist, at holly.c.smith@usace.army.mil or by phone at 918-699-9655.

Sincerely,



Robert Morrow, PMP
Chief, Environmental Branch
Regional Planning & Environmental Center

Enclosures: Programmatic Agreement, Appendices

cc: Kelley Capone, Port of San Francisco, kelley.capone@sfport.com
Devyani Jain, Port of San Francisco, devyani.jain@sfport.com
Mark Paez, Port of San Francisco, mark.paez@sfport.com
Allison Vanderslice, City of San Francisco, allison.vanderslice@sfgov.org

From:	Smith, Holly C CIV USARMY CESWF (USA)
To:	Greenaway, Brendon@Parks
Cc:	kelley.capone@sfport.com; devyani.jain@sfport.com; mark.paez@sfport.com; Mckinney, Taylor D CIV USARMY CESWF (USA); Brown, Jody L@Parks
Subject:	RE: 106 COE_2023_0209_001 PA USACE SF Waterfront, revised
Date:	Tuesday, May 20, 2025 3:52:00 PM
Attachments:	2025-05-02_REDLINE_SHPO_PA - Copy.docx 2025-05-20 DRAFT SFWS PA w APPENDICES CP- Copy.docx

Good afternoon,

Please find attached the requested clean Word document and redline version of the PA as requested below. The PA has gone through numerous revisions, so much so that the redline document is actually mostly red. Due to the lack of clarity, the Port is assisting with preparation of a table of SHPO comments on the previously submitted draft and how we have addressed them in the current iteration. They are also assisting us with collating consulting parties and public comments we have received previously so that we can provide those in a table as well. (Note that the attached Word version of the PA includes a more detailed Project Summary, as more detailed information was provided since we submitted the PA.)

We will provide both tables asap. In the PA we outlined the timelines for review with SHPO and Consulting Parties, providing 30 days to review, with 15 day extensions as needed. The USACE shall provide any written comments provided by Consulting Parties within their review timeframe to the SHPO, who will then have an additional 10 days from receipt to review comments from Consulting Parties (I think I said 15 previously, and that's fine).

The Consulting Parties have until June 20, 2025 for review (30 days), and we will meet with them during the next couple of weeks to answer any questions. Given that we are just now providing you the requested information, will the SHPO review start now or not until we submit the tables?

Following the initial review period, USACE will collate any written comments provided by the SHPO and Consulting Parties within their respective review timeframes, including within any approved review time extensions. The USACE shall address comments, and document and report the written comments received for the document or deliverable, as well and how comments were addressed.

USACE shall provide a revised draft final document or deliverable to the SHPO and Consulting Parties. The SHPO and Consulting Parties shall have thirty (30) calendar days from receipt to respond. Extensions of review times by fifteen (15) calendar days shall be granted upon request. It is anticipated that more than one iteration of draft reviews may be needed.

I look forward to working with you further.

Thank you,

Holly

Holly C. Smith
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Environmental Branch |Cultural and Environmental Program Support Section
SWD Regional Planning and Environmental Center (RPEC)
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From: Greenaway, Brendon@Parks <Brendon.Greenaway@parks.ca.gov>
Sent: Friday, May 2, 2025 12:30 PM
To: Smith, Holly C CIV USARMY CESWF (USA) <Holly.C.Smith@usace.army.mil>
Cc: kelley.capone@sfport.com; devyani.jain@sfport.com; mark.paez@sfport.com; Mckinney, Taylor D CIV USARMY CESWF (USA) <Taylor.D.Mckinney@usace.army.mil>; Brown, Jody L@Parks <Jody.L.Brown@parks.ca.gov>
Subject: [Non-DoD Source] RE: 106 COE_2023_0209_001 PA USACE SF Waterfront, revised

Thank you Holly.

Can you please provide me with the following:

- A clean word document of this draft
- A track changes version of the last draft that provides responses to our comments.
- Comments received from other consulting parties and Corps responses.

Also, please clarify the timeline for review that you are asking for. You note in your letter that SHPO will be afforded an additional 15 days to review comments from other parties, but I don't see a timeline provided for either.

Thanks again,

Brendon Greenaway, M.A., Senior State Archaeologist
Section 106 Review and Compliance

California Office of Historic Preservation
1725 23rd Street Suite 100
Sacramento CA 95816
(916) 503-4958
Brendon.Greenaway@parks.ca.gov

From: Smith, Holly C CIV USARMY CESWF (USA) <Holly.C.Smith@usace.army.mil>
Sent: Friday, May 2, 2025 7:00 AM
To: OHP, CALSHPO@Parks <CALSHPO.OHP@parks.ca.gov>
Cc: Capone, Kelley (PRT) <kelley.capone@sfport.com>; Jain, Devyani (PRT) <devyani.jain@sfport.com>; Paez, Mark (PRT) <mark.paez@sfport.com>; Mckinney, Taylor D CIV USARMY CESWF (USA) <Taylor.D.Mckinney@usace.army.mil>
Subject: 106 COE_2023_0209_001 PA USACE SF Waterfront, revised

> You don't often get email from holly.c.smith@usace.army.mil. Learn why this is important

Good morning,

Please find attached for your review the revised programmatic agreement associated with the San Francisco Waterfront Coastal Flood Study, San Francisco County (2020-05-01 DRAFT SFWS PA), and accompanying consultation letter (2020-05-01_USACE_to_SHPO_PA_Submission_2_signed).

Respectfully,

Holly

Holly C. Smith
Archaeologist
Environmental Branch |Cultural and Environmental Program Support Section
SWD Regional Planning and Environmental Center (RPEC)
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Mailing address:
US Army Corps of Engineers
Attn: Holly Smith
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2488 E 81st Street
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From:	Smith, Holly C CIV USARMY CESWF (USA)
To:	calshpo.ohp@parks.ca.gov
Cc:	Greenaway, Brendon@Parks; Capone, Kelley (PRT); Jain, Devyani (PRT); Paez, Mark (PRT); Jody L. Brown; Mckinney, Taylor D CIV USARMY CESWF (USA)
Subject:	106 COE_2023_0209_001 PA USACE SF Waterfront, Consulting Party Comments
Date:	Monday, June 2, 2025 9:58:00 AM
Attachments:	March 11th 2024 HP-TAC Comments on the Draft Plan and EIS.docx THD COMMENT LTR_Revised Sec 106 PA_FINAL 9-17-24 - Copy.pdf THD COMMENT LTR_Revised Sec 106 PA_FINAL 9-17-24 - Copy.pdf 20 May 2025 USACE to CP Programmatic Agreement, SF Waterfront Coastal Flood Study.pdf 05-22-25 SHPO comments response TABLE.xlsx Non-DoD Source RE 106 COE_2023_0209_001 PA USACE SF Waterfront revised.msg 2025-05-20 DRAFT SFWS PA w APPENDICES CP- Copy.docx

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Good morning,

Please find attached the requested SHPO and Consulting Parties comments on the previous version of the Programmatic Agreement. The Revised Programmatic Agreement was submitted on Friday, May 2, 2025. I'm attaching the Revised PA and Appendices provided to the Consulting Parties because a more complete Project Summary was made available after the SHPO submission. It replaces Appendix A.

Consulting Parties were provided the Revised PA on May 20, 2025, with a response deadline of June 20, 2025. We, along with the Port of SF, are currently in the process of narrowing down dates and times to hold Consulting Party meetings next week to provide opportunity for questions related to the PA. Meetings will be hybrid, with the Port hosting in-person and me and others attending virtually. We are also available to meet with your office to discuss the PA or project concerns.

We will provide comments received on the most recent version of the PA (including any from the meetings) after the June 20th Consulting Parties deadline, so that your office has an additional 15 days to review and respond to the PA.

Thank you,
Holly

Holly C. Smith
Archaeologist
Environmental Branch |Cultural and Environmental Program Support Section
SWD Regional Planning and Environmental Center (RPEC)
Mobile: 918-699-9655
Holly.C.Smith@usace.army.mil

Mailing address:
US Army Corps of Engineers
Attn: Holly Smith

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	Section/ page #	SHPO Comment	Response\Revision	Revised Text						
	Title, pg. 1	The title of agreement documents should include signatories: Army Corps, SHPO, and ACHP if participating, but not invited signatories.	Title block revised for signatories				Review Revisions to confirm responsive			
	Title, pg. 1	Please clarify: With a Tentatively Selected Plan (TSP) being identified, have USACE moved on from the Waterfront Coastal Flood Study to a defined project/undertaking? It would seem as though the flood risk reduction project (or whatever the TSP is titled) is the undertaking with potential to cause effects to historic properties rather than the flood study.	Title block revised to reference "Recommended Plan"				Not sure if revision was made			
	pg. 2	Add: "and is an invited signatory…"	Moved to pp. 2	WHEREAS, the USACE has consulted with the Port pursuant to 36 CFR § 800.14 and has invited the Port to participate as an Invited Signatory to this Programmatic Agreement (PA) and the Port has accepted; and						
	pg. 2	For clarity and simplicity, it is recommended that the Port of San Francisco be referred to as the Port instead of NFS throughout the agreement.	Revised to reference Port of SF as Port, removed NFS							
	pg. 3	Signatories only here	Revised to remove Port							
	pg. 5	Please include date of letter in which ACHP declined to participate.	Revised to include date							
	pg. 6	Full signatories only here.	Revised to remove Port							
	I Scope of Undertaking, pg. 7	Rename section? This seems to be more "Administrative Provisions". The draft language provided speaks more to the scope of the PA than the undertaking, much of this information might be better placed in the preamble as a whereas clause.	Revised text							
	I Scope of Undertaking, pg. 7	It's unclear whether following aspects of the undertaking are captured in the highlighted statement: "structural measures, including berms, floodwalls, tide gates, and elevating structures and buildings, and nonstructural measures, including floodproofing or relocating buildings and structures, and property acquisition" Better perhaps to simply state "all actions and activities associated and or in support of the undertaking."	Revised text								
	I Scope of Undertaking, pg. 7	New stipulation or section of stipulation needed to address APE. Within that should be a process for Corps to determine APE, document it, and then consult on it, including timelines and recourse in the event of disagreement.	Revised text							
	I Scope of Undertaking, pg. 7	A couple of aspects of the undertaking were added here. Please make sure all project components including both structural and nonstructural are included in this stipulation.	Revised text							
	III Definitions, pg. 9	An explanation of the relevancy of these documents would be useful. More context should be provided here.	Revised text	Reference to documents removed.						
	II Identification of Historic Properties, pg. 10	This should be listed in the preamble as a whereas clause. It provides statements of fact and important context for the undertaking rather than stipulating anything.	Revised WhereAs clause							

	II Identification of Historic Properties, pg. 10	"made a reasonable and good faith effort to identify historic properties located within the APE": While the USACE made efforts to identify historic properties within the APE, those were preliminary to support early planning. There is an important distinction with that and the statement above which instead conveys a nuanced but significant difference. A reasonable and good faith effort to identify historic properties refers to an important step in consultation process with the SHPO in 36 CFR 800, in which the SHPO provides formal comment on the agency efforts to i.d. historic properties. There has been no such consultation. USACE stating that here can be misinterpreted that no further efforts to identify historic properties are necessary. In addition, as of this time the APE has not been determined and formally consulted on.	Revised text								
	II Identification of Historic Properties, pg. 10	Not certain that this statement is necessary. If so, it should be added as a whereas clause to the preamble given that it is a statement of fact and doesn't stipulate anything.	Removed								
	II Identification of Historic Properties, pg. 11	Unclear of whether the feasibility study has concluded with selection of the TSP. Please clarify.	Clarified in preamble								
	II Identification of Historic Properties, pg. 11	Efforts to identify historic properties need to be decided upon with firm commitments and definitive statements "shall" rather than "may".	Revised text								
	II Identification of Historic Properties, pg. 11	This likely belongs elsewhere, it doesn't seem appropriate as an identification stipulation. If this is pursuant to 800.4(a)(3), current wording should be clarified and should come before the previous sentence if it remains.	Moved to IV.B								
	II Identification of Historic Properties, pg. 11	The reason for the proposed start date should be introduced prior to this. It should likely be covered in the preamble as a whereas clause.	Revised WhereAs clause								
	II Identification of Historic Properties, pg. 11	This appears to be the first mention of there being multiple APEs. While 36 CFR 800 makes no mention of different APEs (there is only the APE), the intent is understood: that there will be different effects to consider. The intent behind this concept should be introduced before now in the document. This should be in a whereas clause stating the nature of the different types of potential effects and also within a new stipulation that provides a process to determine the APE in consultation.	Revised WhereAs clauses pp. 3	WHEREAS, efforts to identify and evaluate historic properties, determine effects of the undertaking, identify appropriate avoidance, minimization or mitigation, and related consultation shall occur in accordance with this PA as the design for each component of the undertaking is finalized and funded, which may occur over a period of multiple years; and WHEREAS, the Area of Potential Effect (APE) shall be established by the USACE in consultation with the SHPO, Port, and consulting parties to include all areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE shall be reviewed, and if necessary, refined for each Project Component of the undertaking, in consultation, as designs are finalized; and								
	II Identification of Historic Properties, pg. 11	Add 800.14(b) to the list of citations.	Added to citations								
	II Identification of Historic Properties, pg. 11	I believe this is incorrectly cited, perhaps it is meant to be 800.5(a)(3)?	Citations edited								
	II Identification of Historic Properties, pg. 11	The way this language reads, it suggests that due to there being additional NEPA considerations for adaptive second actions, that those might be also be considered as at least one separate Section 106 undertaking. This should be considered and clarified if not the case.	Clarified in Section I Scope of Undertaking.	Therefore, for the purposes of Section 106, the actions in both first and second measures are Project Components comprising the undertaking. Due to the scale, timing, and funding stream of the project, the USACE must defer and phase the identification of historic properties, assessments of effects, and resolution of the project's adverse effects to historic properties pursuant to 36 CFR § 800.4(b)(2) and 800.5(a)(4), in accordance with this PA. This will be done in a manner that allows for investigations and reviews to be conducted for each Project Component as they are sequenced, as detailed herein.								
	II Identification of Historic Properties, pg. 11	This agreement needs either a general stipulation that covers the process for consulting party review and comment, including timelines for review and process to finalize or it needs to specify the review timeline and process in instances where there is consultation, such as here in the determination of the APE.	Section IV								

	IV Timeframes and Review Proceedures, pg. 12	Considering the APE and the scale of the undertaking for each element can cause confusion. As written, this stipulation implies that this PA covers numerous discrete "undertakings", rather than one unifying & inseparable undertaking with multifaceted elements that are implemented in a phased manner (the proposed new construction, alterations, improvements, and maintenance of existing facilities of the Port of San Francisco Waterfront). This is especially important when considering effects to larger properties such as historic districts and cumulative effects. Regarding that, it should be clarified that the larger "Undertaking" will be composed of interconnected projects ("planned projects" which would be cumulatively/collectively considered the "Undertaking"), that would be constructed beginning in 2040? SHPO recommends language be incorporated here or as a Whereas clause.	Revised: Stipulations IV(A); V(A); V(B); referenced throughout and preamble	WHEREAS, the CFRM measures and NNBF features will be constructed and implemented over time as designs are finalized, and authorization and funding are acquired, they are hereinafter referred to as Project Components, and cumulatively/collectively as the project or undertaking; and WHEREAS, efforts to identify and evaluate historic properties, determine effects of the undertaking, identify appropriate avoidance, minimization or mitigation, and related consultation shall occur in accordance with this PA as the design for each component of the undertaking is finalized and funded, which may occur over a period of multiple years; and WHEREAS, the Area of Potential Effect (APE) shall be established by the USACE in consultation with the SHPO, Port, and consulting parties to include all areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE shall be reviewed, and if necessary, refined for each Project Component of the undertaking, in consultation, as designs are finalized; and						
	IV Timeframes and Review Proceedures, pg. 12	See earlier comment regarding timeline and process to distribute, modify, finalize documents.	Revised: Stipulation IV(b)								
	IV Timeframes and Review Proceedures, pg. 12	SHPO requests a consultation timeline that allows for an understanding of comments made by the other consulting parties prior to submitting comments. Suggest a 30-day concurrent timeline for SHPO and all parties, followed by an additional 10-day period following SHPO's receipt from USACE of any written comments submitted by other parties	Revised: Stipulation IV(b)								
	IV Timeframes and Review Proceedures, pg. 12	Add opportunity for SHPO or others to request additional time.	Revised: Stipulation IV(b)								
	VI NRHP Eligibility Determinations, pg. 16	See earlier comments regarding process and additional time for SHPO to consider comments from other consulting parties.	Revised: Stipulation IV(b)								
	VI NRHP Eligibility Determinations, pg. 16	Add opportunity for SHPO or others to request additional time.	Revised: Stipulation IV(b)								
	VII Assessment of Effects, pg. 17	Consultation process needs to be outlined	Revised: Stipulation IV(b)								
	VII Assessment of Effects, pg. 18	See earlier comments regarding process and additional time for SHPO to consider comments from other consulting parties.	Revised: Stipulation IV(b)								
	VII Assessment of Effects, pg. 18	Please add requests for additional time if needed.	Revised: Stipulation IV(b)								
	VIII Resolution of Adverse Effects, pg. 19	This would seem to limit the mitigation options.	Deleted text								
	VIII Resolution of Adverse Effects, pg. 19	SHPO would like to understand comments received by other consulting parties prior to providing comments. Also request the possibility to extend consultation if needed.	Comments from consulting parties and public will be provided to SHPO. Text to extend consultation added.	Revised: Stipulation IV(b)							
	X Curation and Disposition....., pg. 22	This seems out of place here in the curation section, perhaps it would be better in the resolution of effects stipulation or in an administrative section.	PA has been reorganized.	Now in Stipulation IV(b), as well as in Curation Section (deliverables submitted for curation in addition to artifacts- all to be cataloged).							
	XI Inadvertent Discovery of Burials and/or Human Remains, pg. 22	See Standard Language 1 tab for full comment									

	XI Inadvertent Discovery of Burials and/or Human Remains, pg. 22	Stipulation II?	Stipulation V(f)	PA has been rewritten.							
	XI Inadvertent Discovery of Burials and/or Human Remains, pg. 22	Timing is important here, this should clarify how far in advance of project implementation this plan should be finalized.	Stipulation V(f)	PA has been rewritten.							
	XI Inadvertent Discovery of Burials and/or Human Remains, pg. 22	The intent of this section is unclear. Please clarify if this stipulation handles NAGPRA compliance or Section 106, currently it seems to attempt to do both and would lead to confusion with earlier stipulations in the agreement.	PA has been reorganized and rewritten.	Sections clarified.							
	XI Inadvertent Discovery of Burials and/or Human Remains, pg. 22	Same comment as above regarding combining NAGPRA and 106	PA has been reorganized and rewritten.	Sections clarified.							
	XI Inadvertent Discovery of Burials and/or Human Remains, pg. 24	Dispute resolution stipulation instead									
	XI Inadvertent Discovery of Burials and/or Human Remains, pg. 24	Suggest standard language: NAGPRA language	Standard language provided by SHPO has been included in Stipulation XI								
	XI Inadvertent Discovery of Burials and/or Human Remains, pg. 24	This should be limited to 800.13 instances	Sections rewritten and reorganized for clarity.								
	XII Post Review Discoveries of CR or Unexpected Affects, pg 26	This likely should be covered in XI.A	Sections rewritten and reorganized for clarity.								
	XII Post Review Discoveries of CR or Unexpected Affects, pg 26	Changed language to what is found at 800.13 for clarity	Sections rewritten and reorganized for clarity.								
	XII Post Review Discoveries of CR or Unexpected Affects, pg 26	CFR § 800.13(b)(3) is meant for discoveries without prior planning. Given the nature of this undertaking: the time available for planning, the constraints on performing adequate efforts to identify archaeological properties in an urban environment prior to project implementation, the well developed historic and cultural context informed by numerous previous studies, the predictability of the nature of the historic significance of anticipated finds, the high likelihood of encountering resources during construction, and the desire to limit delays in construction, it is highly advised and recommended that USACE develop a very detailed post-review discovery plan in consultation before this agreement is executed.	USACE recognizes that this would be ideal, however funding and authorization will be in the PED phase of the project for this. We have stipulated in Stipulation V(F) that this is to be included in the Research Design that the contractor will submit, and which must be approved by USACE prior to any CR investigations.								

	XII Post Review Discoveries of CR or Unexpected Affects, pg 26	Recommended standard language: A post-review discovery is defined as the identification of previously unknown historic properties within the context of [AGENCY] activities other than those planned as archaeological excavations. Previously unidentified and unanticipated cultural resources discovered while conducting project activities shall be subject to the terms of the HPTP or Discovery Plan. Should any human remains or potentially significant cultural material (as defined in the HPTP) be discovered during project implementation, [AGENCY] shall implement the Post Review Discovery Plan included in the HPTP. The [AGENCY] may assume such resources to be NRHP eligible based on criteria specified in the HPTP.	This section has been rewritten and reorganized to ensure separation of historic properties and human remains/burials.								
	XII Post Review Discoveries of CR or Unexpected Affects, pg 26	Request that a provision for annual meetings be added following adequate time to review the annual report. The provision would include the option to cancel the meeting if parties agree it is unnecessary.	This is now included in Stipulation XIV(B)	B. The USACE shall coordinate a meeting of the Signatories and Consulting Parties to be scheduled within ninety (90) days of distribution of the Annual Report, or another mutually agreed upon date, to discuss activities carried out pursuant to this PA during the preceding year and activities scheduled for the upcoming year. This meeting, should it be deemed unnecessary, may be cancelled by mutual consent of the Signatory Parties.								
	XII Post Review Discoveries of CR or Unexpected Affects, pg 26	See Standard Language 2 tab for full comment	This is now included in Stipulation XIV(A)and (B)	A. The USACE shall prepare an Annual Report documenting actions carried out pursuant to this PA. The reporting period shall commence one year from the date of execution. The Annual Report shall be distributed to all consulting parties to this PA. The Annual Report shall address issues and describe actions and accomplishments over the past year, including, as applicable: (1) Historic property surveys and results; (2) Status of treatment and mitigation activities; (3) Ongoing and completed public education activities; (4) Any issues that are affecting or may affect the ability of the federal agency to continue to meet the terms of this PA; (5) Any disputes and objections received, and how they were resolved; (6) Any additional parties who have become Signatory or concurring parties to this PA in the past year.								
	XI PA Amendments, Disputes, and Termination	Recommend this standard language: Any party to this PA may propose that this PA be amended, whereupon all parties to the PA will consult for no more than thirty (30) days to consider such amendment. The [Agency] may extend this consultation period, if necessary. The amendment process shall comply with 36 C.F.R. § 800.6(c)(7). This PA may be amended only upon the written agreement of the Signatories and Invited Signatories and the [Agency] shall file a copy of the amended PA with the ACHP, as required by 36 C.F.R. § 800(c)(7). If the PA is not amended, it may be terminated by a Signatory or Invited Signatory in accordance with Section [X] of this PA.	Language now found at Stipulation XV(A)								
	XI PA Amendments, Disputes, and Termination	See Standard Language 3 tab for full comment	Language now found at Stipulation XV(B)								
	XI PA Amendments, Disputes, and Termination	See Standard Language 4 tab for full comment	Language now found at Stipulation XV(C)								

Suggested standard language: XI. INADVERTENT DISCOVERY OF BURIALS AND/OR HUMAN R

If human remains are inadvertently discovered, all construction, archaeological excavation, or other similar activities shall cease within 100 feet of the find and the [AGENCY] shall immediately notify the appropriate parties in accordance with the Post Review Discovery and Inadvertent Effect Plan in the Historic Properties Treatment Plan. Human remains and associated grave items shall be treated in accordance with the Post Review Discovery and Inadvertent Effect Plan. XI(C)

B.For purposes of this project, this PA adopts the definitions of "human remains" and "funerary objects" found at 43 CFR § 10.2(d)(1-2) in the implementing regulations for the Native American Graves and Repatriation Act (25 U.S.C. §§3001 – 3013) (NAGPRA) . Those definitions are as follows:

Human remains means the physical remains of the body of a person of Native American ancestry. The term does not include remains or portions of remains that may reasonably be determined to have been freely given or naturally shed by the individual from whose body they were obtained, such as hair made into ropes or nets. For the purposes of determining cultural affiliation, human remains incorporated into a funerary object, sacred object, or object of cultural patrimony, as defined below, must be considered as part of that item.

2. Funerary objects means items that, as part of the death rite or ceremony of a culture, are reasonably believed to have been placed intentionally at the time of death or later with or near individual human remains. Funerary objects must be identified by a preponderance of the evidence as having been removed from a specific burial site of an individual affiliated with a particular Indian tribe or Native Hawaiian organization or as being related to specific individuals or families or to known human remains. The term burial site means any natural or prepared physical location, whether originally below, on, or above the surface of the earth, into which, as part of the death rite or ceremony of a culture, individual human remains were deposited, and includes rock cairns or pyres which do not fall within the ordinary definition of gravesite. For purposes of completing the summary requirements in §10.8 and the inventory requirements of §10.9:

a. Associated funerary objects means those funerary objects for which the human remains with which they were placed intentionally are also in the possession or control of a museum or Federal agency. Associated funerary objects also means those funerary objects that were made exclusively for burial purposes or to contain human remains.
b. Unassociated funerary objects means those funerary objects for which the human remains with which they were placed intentionally are not in the possession or control of a museum or Federal agency. Objects that were displayed with individual human remains as part of a death rite or ceremony of a culture and subsequently returned or distributed according to traditional custom to living descendants or other individuals are not considered unassociated funerary objects.

C.The [AGENCY] shall ensure that Native American human remains, funerary objects, items of cultural patrimony, and sacred objects encountered during any activity for the Undertaking on Federal lands are treated by the Federal land management agency in accordance with the requirements with Section 3(c-d) of the Native American Graves Protection and Repatriation Act and its implementing regulations found at 43 CFR Part 10. [EDIT DEPENDING ON FEDERAL LAND]

1. Items of cultural patrimony means items having ongoing historical, traditional, or cultural importance central to the Native American tribe itself, rather than property owned by an individual tribal or organization member. These objects are of such central importance that they may not be alienated, appropriated, or conveyed by any individual tribal or organization member. Such objects must have been considered inalienable by the culturally affiliated Native American tribe at the time the object was separated from the group. Objects of cultural patrimony include items that have significance to the Native American tribe as a whole (43 CFR 10.2.d.4).

2. Sacred objects means items that are specific ceremonial objects needed by traditional Native American religious leaders for the practice of traditional Native American religions by their present-day adherents. While many items, from ancient pottery sherds to arrowheads, might be imbued with sacredness in the eyes of an individual, this definition is specifically limited to objects that were devoted to a traditional Native American religious ceremony or ritual, and which have religious significance or function in the continued observance or renewal of such ceremony (43 CFR 10.2.d.3).

D.The [AGENCY]shall ensure that [APPLICANT] treats Native American human remains, funerary objects, items of cultural patrimony, and sacred objects encountered during any activities for the Undertaking on non-federal lands in accordance with the requirements of Section 7050.5 of the California State Health and Human Safety Code, and Section 5097.98 of the PRC. The [APPLICANT] shall ensure that, to the extent permitted by applicable law and regulation, the views of the Most Likely Descendant(s) are taken into consideration when the [APPLICANT] makes decisions about the disposition of the Native American human remains and funerary objects and shall further ensure the respectful treatment of remains and funerary objects.

Recommend this standard language:

All language now included in Stipulation XIV. PA MONITORING AND REPORTING.

The [Agency] shall prepare an Annual Report documenting actions carried out pursuant to this PA. The reporting period shall commence one year from the date of execution. The Annual Report shall be distributed to all consulting parties to this PA. The Annual Report shall address issues and describe actions and accomplishments over the past year, including, as applicable:	Stipulation XIV(A)
Historic property surveys and results;	Stipulation XIV(A)(1)
Status of treatment and mitigation activities;	Stipulation XIV(A)(2)
Ongoing and completed public education activities;	Stipulation XIV(A)(3)
Routine activities for which no consultation occurred, pursuant to Attachment [X] of this PA;	Stipulation XIV(A)
Any issues that are affecting or may affect the ability of the federal agency to continue to meet the terms of this PA;	Stipulation XIV(A)(4)
Any disputes and objections received, and how they were resolved;	Stipulation XIV(A)(5)
Any additional parties who have become Signatory or concurring parties to this PA in the past year.	Stipulation XIV(A)(6)
The [Agency] shall coordinate a meeting of the Signatories and Consulting Parties to be scheduled within ninety (90) days of distribution of the Annual Report, or another mutually agreed upon date, to discuss activities carried out pursuant to this PA during the preceding year and activities scheduled for the upcoming year. This meeting, should it be deemed unnecessary, may be cancelled by mutual consent of the Signatory Parties.	Stipulation XIV(B)

This should be a standalone stipulation. Suggested standard language:

Included in STIPULATION XV(C) Dispute Resolution

Should any Signatory or concurring party to this PA object at any time to actions proposed or the manner in which the terms of this PA is implemented, [AGENCY] shall notify the other parties in writing and consult with the objecting party to resolve the objection. If [AGENCY] determines that such objection cannot be resolved, [AGENCY] will:

Forward all documentation relevant to the dispute, including the [AGENCY]'s proposed resolution, to the ACHP. The ACHP will provide [AGENCY] with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, [AGENCY] shall prepare a written response that takes into account any; timely advice or comments regarding the dispute form the ACHP, Signatories and concurring parties, and provide them with a copy of this written response. [AGENCY] will then proceed according to its final decision.
If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, [AGENCY] may make a final decision the dispute and proceed accordingly. Prior to reaching such a final decision, [AGENCY] shall prepare a written response that takes into account any timely comments regarding the dispute from the Signatories and concurring parties to the PA and provide them and the ACHP a copy of such written response.
AGENCY]'s response ability to carry out all other actions subject to the terms of this PA that are not the subject of the dispute remain unchanged.

Suggested standard language:

Only a Signatory or Invited Signatory may terminate this PA, If this PA is not amended as provided for in Section [X] of this stipulation, or a Signatory or Invited Signatory proposes termination of this PA for other reasons, the Signatory proposing termination shall, in writing, notify the other parties to this PA, explain the reasons for proposing termination, and shall consult with the other parties to this PA for no more than thirty (30) calendar days to seek alternatives to termination.

Stipulation XV(D)

Should such consultation result in an agreement, the parties shall proceed in accordance with the terms of that agreement and shall prepare any amendment to the PA, if needed, in accordance with the terms of Stipulation [X].

Stipulation XV(D)(1)

If this PA is terminated, and prior to work continuing on the Undertaking, [AGENCY] must either (a) execute new PA pursuant to 36 CFR § 800.6 or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. [AGENCY] shall notify the Signatories as to the course of action it will pursue.

Stipulation XV(D)(4)

Consultation shall not be required if the [Agency] proposes termination because the Undertaking no longer meets the definition set forth

at 36 CFR § 800.16(y).

Stipulation XV(D)(5)

From:	Smith, Holly C CIV USARMY CESWF (USA)
To:	calshpo.ohp@parks.ca.gov
Cc:	Greenaway, Brendon@Parks; Capone, Kelley (PRT); Paez, Mark (PRT); Mckinney, Taylor D CIV USARMY CESWF (USA)
Subject:	106 COE_2023_0209_001 PA USACE SF Waterfront, consulting parties comments
Date:	Thursday, June 26, 2025 8:45:00 AM
Attachments:	CP response re PA Amah Mutsun 5-20-25.pdf CP response Amah Mutsun General Recommendations 5-20-2025.pdf THD COMMENT LTR_5-20-25 Draft Sec 106 PA_6-3-25 clean.pdf 06-24-2025 SFWS_CP_Comments to SHPO.xlsx

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Good morning,

Please find attached comments received from Consulting Parties regarding the draft of the PA that is currently under review in your office. USACE and the Port had a very constructive meeting with Consulting Parties on June 9, 2025. A spreadsheet with CP comments, USACE responses, and meeting attendees is attached.

We look forward to receiving your review comments by July 14, 2025. Please reach out with any questions or to discuss.

Respectfully,

Holly

Holly C. Smith
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Commentor	Section	Page	Comment	USACE Response provided In CP meeting 06-09--2025	
Telegraph Hill Dwellers	PA		Reinstatement of review and comment status of Consulting Parties	Stipulation IV(B)	
Telegraph Hill Dwellers	PA		Reinstatement of Programmatic Historic Properties Management Plan. The January 2024 Draft PA proposed preparation of a Programmatic Historic Properties Management Plan. However, the August 2024 Draft PA replaced it with a Phased Identification, which has been retained in the May 2025 Draft PA. While we recognize and sympathize with the planning difficulties posed by significant funding and schedule uncertainties, we were, and continue to be, concerned, as stated in our September 2024 letter, that a phased identification would be less comprehensive and specific, deferring much planning to future project phases.	The PMP is the "Research Design" for the overall project. Due to inconsistencies in terminology, we have simplified it to "Research Design" and have defined the expectations. Section 106 is impact-based, and uncertainty regarding exactly how each section willbe implemented, and when (2027 vs. 2040 for example) necessitates phasing of investigations. The Research Design (by whatever name) is to include all previous research and investigations, their results, and how all types of properties willbe covered during the overall encompassing undertaking. For each phase of the project itself, once designs are refined a Work Plan will be submitted to USACE, coordinated with all consulting parties and the SHPO, and comments willbe incorporated. Iterations are anticipated. Only once the Work Plan has been accepted by USACEwill any field investigations move forward. Phased Identification is entirely separate and is referencing the investigations themselves.	This was discussed during a virtual Consulting Parties meeting, and the THO were satisfied.
Telegraph Hill Dwellers	PA		We again recommend that the requirement for an overall programmatic historic properties management plan, such as that called for in the January 2024 Draft PA, be reinstated.	Research Design	This was discussed during a virtual Consulting Parties meeting, and the THO were satisfied.
Telegraph Hill Dwellers	PA		Instead of such a plan, the May 2025 Draft PA places many project details in a series of loosely connected appendices, providing only abbreviated discussion. Development of a fuller and more integrated project overview is needed.	Unclear what this comment is addressing. There are two Appendices. One is the Project Summary, which is as thorough of a description as we can provide at this time. The other is the Culture History. We also included broad information about the project in the PA itself. When the Final Integrated Feasibility Report and EIS is completed, that will be available and have additional details.	Discussed in meeting.
Telegraph Hill Dwellers	PA		RECOMMENDATION: We strongly recommend ongoing efforts to provide Consulting Parties and the public with opportunities to participate in and assess project progress and to identify and resolve issues that may arise. -We recommend that a shorter time frame than annual (perhaps every6 months or quarterly for particularly active project phases) be implemented, especially once activity on the project has begun, including pre-construction design and construction phases. Perhaps the Port could be responsible for all or a portion of these more frequent interactions. We recommend that consultation be an ongoing process, with more frequent interactions, outreach, and for problem-identification and resolution.	During the design and construction phases, all plans, designs, Work Plans (which include presentation of every step in the investigation methodology- from start to Curation), and progress reports will all by reviewed by the Consulting Parties and the SHPO, as stated in Stipulation IV(B). Consultation includes the opportunity for written communication and meetings, phone calls, etc.	We discussed this in our CPmeeting and clarified.
Telegraph Hill Dwellers	PA		121We recommend formation of an ongoing advisory group to provide a focal point for project-related interaction. Such a group could include representatives of USACE, the Port, Consulting Parties, police and fire, affected businesses, project consultants, neighborhood organizations, and other interested parties.	For cultural resources investigations, this is the Consulting Parties. If you have additional recommendations for people to include as CP, please provide those so that we may invite them. The first responders and others you have listed here willhave opportunities to discuss the project as a whole in public meetings.	Discussed in meeting that there will be project level meetings for these purposes, with cultural resources being the smaller CP group.
AmahMutsun	PA		Provisions to Address Discovery of a Tribal Cultural Resource During Construction	Will consult specifically with Amah Mutsun	
Ramaytush	PA		Jonathan Cordero <jonathan@ramaytush.org> requested additional time to comment	Additional time to comment accepted.	

State of California • Natural Resources Agency
Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION
Armando Quintero, *Director*

Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

August 25, 2025

VIA EMAIL

In reply refer to: COE_2023_0209_001

Mr. Kenneth Shingleton
Chief, Cultural and Environmental Support Section
U.S. Army Corps of Engineers
Regional Planning and Environmental Center
2488 East 81st Street
Tulsa, Oklahoma 74137-4290

VIA EMAIL

RE: Programmatic Agreement regarding the San Francisco Waterfront Coastal Flood Study, San Francisco County Draft Two

Dear Mr. Shingleton,

The California State Historic Preservation Officer (SHPO) received your correspondence on June 2, 2025, continuing consultation for the above referenced Programmatic Agreement (PA) pursuant to Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. § 300101), as amended, and its implementing regulation, 36 CFR Part 800.

The PA has been reviewed, and comments have been included in track changes in the draft version attached to this letter. The comments aim to provide procedural clarity and standard template language has been offered for certain stipulations for your consideration.

I look forward to continuing consultation to develop the PA for the San Francisco Waterfront Coastal Flood Study. If you have any questions or concerns, please contact Senior State Archaeologist Brendon Greenaway at Brendon.Greenaway@parks.ca.gov.

Sincerely,



Julianne Polanco
State Historic Preservation Officer

From: Smith, Holly C CIV USARMY CESWF (USA)
To: calshpo.ohp@parks.ca.gov
Cc: Greenaway, Brendon@Parks
Subject: 106 COE_2023_0209_001 PA USACE SF Waterfront, revised Draft 3
Date: Tuesday, December 30, 2025 9:52:00 AM
Attachments: 12-30-25 PA_Revised_per_SHPO_Comments_recd_08-25-25.docx
12-30-25 USACE_to_SHPO_PA_Submission_3_signed.pdf
12-30-25 Comment Matrix DRAFT SFWS PA_CA SHPO comments recd 8-25-25.xlsx
12-22-25 REDLINE SHPO PA 2025-08-26 COMMENTS on 2025-05-20 draft sfws pa w appendices HCS.docx

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Good morning,

Please find attached for your review the revised programmatic agreement for the San Francisco Waterfront Coastal Flood Study Recommended Plan, San Francisco County (12-30-25 PA_Revised_per_SHPO_Comments_recd_08-25-25), accompanying consultation letter (12-30-25_USACE_to_SHPO_PA_Submission_3_signed), the redline version with comments (12-22-25 REDLINE SHPO PA 2025-08-26 COMMENTS), and the Comment Matrix (12-30-25 Comment Matrix DRAFT SFWS PA_CA SHPO comments recd 8-25-25).
USACE looks forward to finalizing and executing the PA.

Respectfully,
Holly

Holly C. Smith
Archaeologist, Environmental Branch
Cultural and Environmental Program Support Section

Southwestern Regional Planning and Environmental Center (RPEC)
US Army Corps of Engineers
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
2488 EAST 81ST STREET
TULSA, OKLAHOMA 74137-4290

December 30, 2025

Regional Planning and Environmental Center

Julianne Polanco
State Historic Preservation Officer
1725 23rd Street, Suite 100
Sacramento, CA 95816

RE: COE_2023_0209_001 Programmatic Agreement associated with the San Francisco Waterfront Coastal Flood Study, San Francisco County.

Dear Ms. Polanco,

The U.S. Army Corps of Engineers (USACE) received your letter dated August 25, 2025, regarding the subject Programmatic Agreement (PA). This letter is to continue consultation pursuant to Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. § 300101), as amended, and its implementing regulation, 36 CFR Part 800, for the Proposed Implementation of the San Francisco Waterfront Coastal Flood Study.

USACE appreciates your comments on the revised draft PA. Enclosed is the second revised draft, which reflects your feedback and edits, with particular attention to procedural clarity and recommended language. We hope all concerns are addressed and look forward to finalizing the agreement.

The enclosed PA is being shared with consulting parties for review concurrent with your 30-day review. At the end of this period, USACE will provide all comments from consulting parties to your office. An additional 15 days will be added to the SHPO review period to account for comments from consulting parties. Extensions may be requested if needed.

If you have questions or would like additional information, please reach out to Holly Smith, Archaeologist, at holly.c.smith@usace.army.mil or by phone at 918-699-9655.

Sincerely,

Robert M Morrow, PMP
Chief, Environmental Branch
Southwestern Regional Planning & Environmental Center

Enclosures: Programmatic Agreement, Appendices

cc: Kelley Capone, Port of San Francisco, kelley.capone@sfport.com
Devyani Jain, Port of San Francisco, devyani.jain@sfport.com
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Allison Vanderslice, City of San Francisco, allison.vanderslice@sfgov.org

page #	Section	Text	SHPO Comment	USACE Response
3	PREAMBLE	WHEREAS, the California Office of Historic Preservation which serves as the California State Historic Preservation Office (SHPO) pursuant to 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (54 U.S.C. § 306108) (Section 106); and	Suggest revising statement. I believe the intent is to define the role of the SHPO, if that is the case, it is recommended that 800.2(c)(1) be cited and language inserted here.	**REWORDED: WHEREAS,** in accordance with section 101(b)(3) of the NHPA, the SHPO reflects the interests of the State and its citizens in the preservation of their cultural heritage and advises and assists Federal agencies in carrying out their section 106 responsibilities to ensure that historic properties are taken into consideration at all levels of planning and development (36 CFR § 800.2(c)(1); and
3	PREAMBLE	WHEREAS, while the USACE proposes to follow the Secretary of the Interior's Standards for Rehabilitation & Guidelines on Flood Adaptation for Rehabilitating Historic Buildings, it is likely that the undertaking will impact ***cause effects to*** historic properties; and	Suggest change for consistency with 36 cfr 800 terminology.	concur
3	PREAMBLE	WHEREAS, efforts to identify and evaluate historic properties, determine effects of the undertaking, identify appropriate avoidance, minimization or mitigation, and related consultation shall occur in accordance with this PA as the design for each ***component*** of the undertaking is finalized and funded, which may occur over a period of multiple years; and	If Project Component is the terminology that is being used for the smaller separate actions/undertakings, then it should be used consistently throughout.	concur

3	PREAMBLE	WHEREAS, thirty-nine previously recorded archaeological sites are so far known to be located within or adjacent to the proposed project footprint, thirty two of which are historic-age, and seven of which are associated with Native American cultural material. Three of the archaeological sites are eligible for listing, or listed in, the National Register of Historic Places (NRHP). Of 2,846 parcels identified in or adjacent to the project area, ***there are thirty-two aboveground historic age archaeological resources, four are precontact age, and three are multicomponent with precontact and historic-age components*** .	Please clarify what above ground archaeological resources are.	misstated: REWORDED: WHEREAS, based on records searches conducted July 17, 2020, and March 2, 2023, a total of 39 previously identified archaeological resources are located in or adjacent to the project area as currently proposed. Of these, 32 are historic-age, four are precontact age, and three are multi-component with precontact and historic-age components. One historic site is listed on the NRHP. Two historic archaeological sites have been determined eligible for NRHP inclusion, and 3 have been determined not eligible. The remaining sites have yet to be evaluated for NRHP eligibility (undetermined). Aboveground historic properties include 9 historic districts and 32 individual historic properties listed on the NRHP, and an additional 6 individual properties and five districts that have been determined eligible for NRHP listing; and
3	PREAMBLE	***Three archaeological sites are eligible for listing in or listed in the NRHP*** . Nine NRHP listed historic districts, and one bridge are NRHP listed. Six above ground historical resources and five districts are eligible for the NRHP. There are 306 properties that have been determined not eligible for NRHP listing. The remainder of the previously identified archaeological and historic resources are unevaluated for listing on the NRHP; and	Verify please that this isn't redundant from the 3 listed above in this clause.	Verified by Allison Vanderslice
3	PREAMBLE	WHEREAS, the Port has completed five rehabilitation projects comprised of 16 individual contributing resources within the Embarcadero and Union Iron Works historic districts that were determined by the National Park Service as certified rehabilitation projects consistent with the SOIS and received Federal Rehabilitation Tax Credits; and	Please clarify the intent or need for this statement.	Port preference. Removed.

3	PREAMBLE	WHEREAS, the USACE may identify and invite additional consulting parties as the Section 106 consultation progresses and after the execution of this PA, in which case USACE shall provide them copies of documentation specified in ***36 CFR § 800.11(e)*** , subject to confidentiality provisions of 36 CFR § 800.11(c); and	800.11(e) is specific to documentation standards for findings of no adverse effect or adverse effect. Please clarify the reason for the specific reference to 11(e) only.	revised: the USACE may identify and invite additional consulting parties as the Section 106 consultation progresses and after the execution of this PA, in which case USACE shall provide them copies of documentation specified in 36 CFR § 800.11(a) and (e), 800.2(a)(4), 2(c)(5), and 800.6(a)(2), and subject to confidentiality provisions of 36 CFR § 800.11(c)(1); and

				all actions and activities associated with and/or in support of the undertaking, including new construction, improvements, and maintenance activities related to the undertaking for the duration of this agreement. Due to the scale, timing, and funding stream of the project, the USACE shall defer and phase the identification of historic properties, assessments of effects, and resolution of the project's adverse effects to historic properties pursuant to 36 CFR § 800.4(b)(2) and 800.5(a)(4), in accordance with this PA. **Moved most to preamble:** WHEREAS, a Project Component refers to any CFRM measure or NNBF feature, or a group of measures and/or features planned for concurrent construction or implementation, together with all associated and/or supporting actions (e.g., utility relocation or removal, construction of access roads, staging or storage areas, trenching, scraping, vegetation clearing, etc.); and
3	I. SCOPE OF UNDERTAKING	SCOPE OF UNDERTAKING	Most if not all of this stipulation provides information on the undertaking and doesn't stipulate anything. Statements made here should be compared to whereas clauses in the preamble. Statements made here that aren't currently found there should be moved and redundant information should be removed.	WHEREAS, due to the scale, timing, and funding stream of the project, the USACE shall defer and phase the identification of historic properties, assessments of effects, and resolution of the project's adverse effects to historic properties pursuant to 36 CFR § 800.4(b)(2) and 800.5(a)(4), in accordance with this PA. This will be done in a manner that allows for investigations and reviews to be conducted for each Project Component as they are sequenced, as detailed herein.

3	II. QUALIFICATIONS AND STANDARDS	USACE shall ensure that all work carried out pursuant to this PA shall be done by or under the direct supervision of the appropriate professionals who meet or exceed the Secretary of the Interior's Professional Qualifications Standards (36 § CFR 61) for the associated discipline. The USACE shall ensure that consultants retained for services pursuant to this PA meet these standards. The USACE shall ensure that all work conducted in conjunction with this PA is performed in a manner consistent with the Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716-44740; September 23, 1983), as amended, or the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR § 68), as appropriate. This shall include, but is not limited to, the identification of historic properties, assessment of effects, and development of necessary historic properties treatment plans (HPTPs) for mitigation of adverse effects.	Formatting adjustment needed here and elsewhere. These two paragraphs should be II.A and II. B respectively.	concur
3	III. DEFINITIONS	DEFINITIONS	Recommend that definitions be added as an attachment to this PA because this Stipulation isn't really stipulating anything.	concur- moved to Attachment and revised: A. USACE shall follow definitions set forth in 36 CFR § 800.16, which are incorporated herein by reference and apply throughout this PA. For ease of access, Attachment x contains the most salient definitions for Consulting Parties.

3	IV. TIMEFRAMES AND REVIEW PROCEDURES A. Timeframes (1) Research Design	Research Design: USACE	This stipulation seems better placed in Stipulation V	Moved Research Design to ; changed Stipulation title to **IV. REVIEW PROCEDURES.** Research Design is now Stipulation VI(B) (which previously was V).
3	IV. TIMEFRAMES AND REVIEW PROCEDURES A. Timeframes (2) Phasing of Investigations	Phasing of Investigations	This might also be better placed in Stipulation V for clarity in the process.	moved to preamble and Stipulation **V. AREA OF POTENTIAL EFFECTS (APE) AND PHASING OF INVESTIGATIONS**
3	IV. TIMEFRAMES AND REVIEW PROCEDURES A. Timeframes (2) Phasing of Investigations	Historic properties identifications shall be conducted by Project Component as designs are completed.	"Project Components" need to be clearly understood in this agreement so that all parties understand exactly how and when determinations and findings will be made by USACE. i.e., clearly stipulate the point at which consulting parties will be asked to consult, is it on an annual basis, related to project area, or phase? Clarify how "Project Component" is/will be defined for Section 106 consultation purposes.	**WHEREAS,** the CFRM measures and NNBF features will be constructed and implemented over time as designs are finalized, and authorization by Congress and funding are acquired, and compliance is achieved, they are hereinafter referred to as *Project Components,* and cumulatively/collectively as the *project* or *undertaking* ; ***WHEREAS,*** *a Project Component refers to any CFRM measure or NNBF feature, or a group of measures and/or features planned for concurrent construction or implementation, together with all associated and/or supporting actions (e.g., utility relocation or removal, construction of access roads, staging or storage areas, trenching, scraping, vegetation clearing, etc.); and*

3	IV. TIMEFRAMES AND REVIEW PROCEDURES A. Timeframes	Due to the scope and extent of the proposed project, it is preferred that architectural surveys/inventories be completed for the entirety of the APE rather than being completed by Project Component. At times, these inventories shall follow the sequence of proposed Project Components but should not be constrained by them when possible and practicable	This will potentially lead to issues later, this should be resolved now. Also, formatting. This should be IV.A.3	Stipulation is now **IV. REVIEW PROCEDURES;** after consideration, removed the text referenced here completely. Replaced with *(1) Identification efforts shall commence as early as practicable following project authorization and receipt of funding to support project design refinement and facilitate the avoidance and minimization of adverse effects to historic properties.*
3	IV. TIMEFRAMES AND REVIEW PROCEDURES B. Review Procedures.	For all ***documents and deliverables*** produced in accordance with the Stipulations of this PA, including associated findings and effects determinations, USACE shall coordinate with Consulting Parties as outlined herein.	Some additional detail needed below in the processes for "documents and deliverables". In the sub stipulations that follow, language should be inserted to clarify that the Corps will be determining National Register eligibility and assessing and making findings of effects.	concur, complete
3	IV. TIMEFRAMES AND REVIEW PROCEDURES B. Review Procedures. (1)	(1) Upon receipt of a deliverable (determination of National Register eligibility, finding of effects, report, maps, other documents) from the archaeologists performing the investigations, the USACE shall:	Clarify who is providing documentation to the Corps. If the Port is contracting the identification work, it is assumed that they would be providing to the Corps. Either way, "archaeologists performing the investigations" doesn't seem to be accurate, are archaeologists submitting architectural studies? Consideration needed here.	Addressed and reworded. WHEREAS, this PA shall be applicable to all actions and activities associated with and/or in support of the undertaking (all Project Components), and the USACE shall ensure compliance with Section 106 of the NHPA for the undertaking through the execution and implementation of this PA pursuant to 36 C.F.R. § 800.14(b)(3); WHEREAS, the Section 106 process is inherently governmental, and the USACE is stipulated herein as the responsible party for tasks identified in this PA, even when the stipulated work (i.e. field investigations) is conducted by others; and

3	IV. TIMEFRAMES AND REVIEW PROCEDURES B. Review Procedures. (1) (a)	(a) ***provide a draft document to the SHPO and Consulting Parties*** for review. The Consulting Parties shall have thirty (30) calendar days in which to review the document and provide a written response to USACE. Extensions of draft review times by fifteen (15) calendar days shall be granted upon request by a Consulting Party.	Suggest that the Corps review the draft document before providing to consulting parties	Concur. This is stanadard. The process is more clearly articulated in Stipulation **IV. REVIEW PROCEDURES.**
3	IV. TIMEFRAMES AND REVIEW PROCEDURES B. Review Procedures. (1) (c)	(c) Any written comments provided by the SHPO and Consulting Parties within their respective review timeframes, including within any approved review time extension, shall be considered in the revision of the document or deliverable. ***The USACE shall address comments, and document and report the written comments received for the document or deliverable, as well and how comments were addressed.***	This sentence isn't entirely clear and could use some editing.	concur
3	IV. TIMEFRAMES AND REVIEW PROCEDURES B. Review Procedures. (1) (d)	(d) USACE shall provide ***a revised draft final document*** or deliverable to the SHPO and Consulting Parties. The SHPO and Consulting Parties shall have thirty (30) calendar days from receipt to respond. Extensions of review times by fifteen (15) calendar days shall be granted upon request by a Consulting Party. It is anticipated that more than one iteration of draft reviews per deliverable may be needed.	Clarity needed here on what is in this final document, see comment above about Corps determining eligibility and making finding of effects.	Hopefully this is sufficiently clarified in revised text.

3	IV. TIMEFRAMES AND REVIEW PROCEDURES B. Review Procedures. (2)	(2) Should the SHPO ***object to the final document or deliverable*** submitted for review, USACE and SHPO shall consult for a period not to exceed fifteen (15) calendar days (or other agreed upon time period) following the receipt of the SHPO's written objection in an effort to come to agreement on the issues to which the SHPO has objected. Should the SHPO and USACE be unable to agree on the issues to which the SHPO has objected, the SHPO and USACE shall proceed in accordance with 36 CFR 800.5(c)(2) Stipulation XV(c) (Dispute Resolution). The timeframe to consult to resolve a disagreement or objection shall be extended by mutual consent of USACE and the SHPO.	Similar comment. SHPO doesn't object to the final document per se, but rather does not concur with determinations and disagrees with findings.	this has been clarified in revised text
3	V. TREATMENT OF HISTORIC PROPERTIES	TREATMENT OF HISTORIC PROPERTIES	Unclear on the intent and placement in the agreement of this stipulation. It seems as thought treatment of historic properties should follow NRHP evaluations.	text is reorganized- this was originally a very broad heading

3	V. TREATMENT OF HISTORIC PROPERTIES	***A. Area of Potential Effects (APE)*** . During PED, prior to finalization of engineering designs and refinement of locations, and prior to the initiation of project related construction and/or implementation activities, the USACE shall meet with the consulting parties to discuss anticipated sequencing for implementation of components of the undertaking (Project Components), and to define the undertaking's APE as defined in 36 CFR § 800.16. The APE will be based on feasibility-level design, and refined for each Project Component as designs are developed that may increase or decrease areas of direct and/or indirect effects.	Defining and refining the APE is recommended to be a stand alone stipulation. Below is standard MOA template language approved by CA SHPO. Recommend adjusting language to suit the needs of this undertaking, citing the specific stipulations for review/comment in this PA, and to reflect that the APE hasn't been determined yet. AREA OF POTENTIAL EFFECTS Example Stipulation A.1The [Agency] has determined and documented the APE for the Undertaking in consultation with the SHPO in accordance with 36 C.F.R. § 800.4(a). A map of the APE is attached in Appendix [X]. B.1The APE encompasses an area sufficient to accommodate all of the proposed Undertaking components under consideration as of the date of the execution of this PA. If the [Agency] determines that changes to the Undertaking require modifications to the currently defined APE, then the [Agency], in consultation with the SHPO and in coordination with the other	text has been revised. Now Stipulation **V. AREA OF POTENTIAL EFFECTS (APE) AND PHASING OF INVESTIGATIONS**

3	V. TREATMENT OF HISTORIC PROPERTIES	B. Refined APE. Each Project Component will require review and, when needed, refinement of the APE, which will be determined in consultation with the SHPO, Port, and other consulting parties, and will take into consideration the direct, indirect, and cumulative effects of the Project Component. **As currently proposed, the project is anticipated to have marine, terrestrial, auditory, vibratory, and visual effects**.	Recommend adjusting this language regarding examples of adverse effects to better align with 36 CFR Part 800. Suggest language from 36 CFR 800.5(a)(2)(i)-(vii) specifically, such as physical destruction of or damage to all or part of a property, alteration of a property, change in character of use, introduction of visual, atmospheric, or audible elements, etc.	concur; revised
3	C. Identification of Historic Properties.	Identification of Historic Properties.	Recommend ID of historic properties to be a standalone stipulation instead of a sub stipulation in Treatment of Historic Properties.	concur, reorganized

3	C. Identification of Historic Properties.	USACE shall make a reasonable and good faith effort to identify historic properties (sites eligible for listing in the NRHP individually or as a contributing element to an ***archaeological, historic, or other district)*** within the APE during PED, in accordance with Stipulation IV(A). Investigations shall commence as early as practical following project authorization and receipt of funding, to assist with design refinement in the avoidance and minimization of the undertaking's effects to historic properties. Investigations shall include, but are not limited to, background research, consultation, oral history interviews, seeking information from Consulting Parties and other individuals and organizations likely to have knowledge of, or concerns with historic properties in the area, field investigations, re-recording of previously recorded historic properties, as necessary, documentation, and monitoring.	Technically "historic district" encompasses both archaeological, historic, and cultural landscape.	concur, revised. *USACE shall make a reasonable and good faith effort to identify and inventory historic properties-defined as sites, buildings, structures, objects, districts, or contributing elements eligible for listing in the National Register of Historic Places (NRHP), within the APE during the PED phase in accordance with Stipulation V(A).*
3	C. Identification of Historic Properties.	***Inventories shall include all cultural resources*** , including archaeological sites (pre-contact and historic) and above-ground historic and architectural resources older than 45 years from the date of survey commencement (including, but not limited to, historical structures, buildings, historical engineering features, cemeteries, landscapes, viewsheds, and TCPs).	Suggest, "Efforts to identify historic properties shall inventory all cultural resources including sites, buildings, districts, objects, and structures."	revised

3	D. Level of Effort	D. Level of Effort. USACE shall determine the appropriate level of effort for identification of historic properties ***in consultation with Consulting Parties*** and in accordance with 36 CFR § 800.4(b). The USACE will take into account past planning and research studies and inventories, the magnitude of the project and Project Component, anticipated and potential effects to historic properties, and the types of historic properties likely to be identified. The USACE will take tribal, local, and state laws, standards, or guidelines into consideration.	Recommend providing information here on how this consultation will take place. Presumably it would follow review procedures in Stipulation IV.B, that should be noted here, along with what the deliverable is. i.e., what will the Corps use to convey it's proposed i.d. efforts to consulting parties, a memorandum, a report? And how will the consultation proceed? Is this a part of the research design below?	Clarified in text
3	E. Phasing of Investigations.	USACE shall phase the identification of historic properties, assessment of effects, and resolution of adverse effects within the APE, pursuant to 36 CFR § 800.4(b)(2) and ***800.5(a)(4)*** , and 36 CFR § 800.14(b). Historic properties identifications shall be conducted by Project Component.	Reiterating comment from draft 1, I believe this is incorrectly cited, perhaps it is meant to be 800.5(a)(3)?	Corrected in revised text which is now stipulation V(A).Due to the complexity of the project and yet to be determined sequencing of Project Components, decisions on more precise timing, confirmation of locations, and methods of construction and implementation of CFRM and NNBF cannot be made until designs are more finalized during PED. Therefore, USACE shall phase the identification of historic properties, assessment of effects, and resolution of adverse effects within the APE, ***pursuant to 36 CFR § 800.4(b)(2), 800.5(a)(3), and 800.14(b)(2), and in accordance with this PA.***
3	H. Monitoring	Monitoring	This is probably better placed in a stipulation that covers Post-Review Discoveries.	Monitoring is a technique used to identify historic properties in areas where other types of investigations/inventory are not possible due to urbanization or the nature of the project. For example, monitoring the removal of a road or building, in order to identify any buried historic properties that may be revealed in the process of removal.

3	I. Documentation	***At a minimum*** , documentation of architectural properties shall include measured drawings, large-format photographs, written history and description, and field records	Subsections of stipulations should be labeled I.1, I.2, etc.	concur
3	VI. NRHP ELIGIBILITY DETERMINATIONS	NRHP ELIGIBILITY DETERMINATIONS	The sections below should be labeled, VI. A, VI.B, VI.C, etc.	concur
3	VI. NRHP ELIGIBILITY DETERMINATIONS	If cultural resources are identified within the APE, the USACE shall determine their eligibility for inclusion in the NRHP in accordance with the process described in 36 CFR § 800.4(c), ***36 CFR § 800.5*** , the criteria established in 36 CFR § 60, and National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation. NRHP evaluations of cultural resources shall be conducted by individuals who meet or exceed the Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation (48 Fed. Reg. 44738-44739). Per 36 CFR § 800.4(c)(1), USACE acknowledges that Federally recognized and Non-Federally recognized Tribes possess special expertise in assessing the eligibility of historic properties that may possess religious and cultural significance to them and may be important to their communities, and will consult accordingly. In accordance with Stipulation IV (Timeframes and Review Procedures), USACE shall submit to Consulting Parties a completed inventory and evaluation for each Project Component.	36 CFR 800.5 pertains to effects rather than historic significance/eligibility for NRHP inclusion. This reference should likely be removed.	revised

3	VI. NRHP ELIGIBILITY DETERMINATIONS	Should the PA signatories agree that a cultural resource is or is not eligible, then such consensus shall be deemed conclusive for the purpose of this PA.	This should be limited to Corps and SHPO	revised
3	VI. NRHP ELIGIBILITY DETERMINATIONS	~~Any disagreement~~Should SHPO not concur with USACE's eligibility determinations, ~~shall be~~ the disagreement shall ***be resolved pursuant to the process in 36 C.F.R. § 800.4(c)(2).*** Should the PA signatories be unable to come to agreement regarding the eligibility of a cultural resource, the USACE shall obtain a determination of eligibility from the Keeper of the National Register pursuant to 36 CFR § 63. For cultural resources found not eligible for inclusion in the NRHP, no further protection or consideration of the site will be afforded for NHPA compliance purposes.	Prior to resolving per 800.4(c)(2), the dispute resolution in this PA should be followed.	revised
3	VII. ASSESSMENT OF EFFECTS	Pursuant to 36 CFR § 800.5, t~~T~~he USACE shall make a reasonable and good faith effort to ~~evaluate the effect~~assess adverse effects, as defined in 36 C.F.R. § 800.16(i)), of each Project Component on historic properties in the APE and will provide a detailed account of effects. The USACE will apply the criteria of adverse effect, pursuant to 36 C.F.R. § 800.5(a)(1), ***to all Historic Properties*** within the APE that will be affected by the Project, and consult on determinations of effects in accordance with Stipulation IV (Timeframes and Review Procedures).	To ensure there is agreement on this point, the SHPO understands that the criteria of adverse effects will be applied per Project Component to all historic properties within that particular APE, rather than having multiple findings per component on, property by property.	revised for clarity, now **VIII(A)**

3	VII. ASSESSMENT OF EFFECTS B. Historic properties affected	"Criteria of adverse effect: An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. 36 C.F.R. § 800.5(a)(1)."	This might be better placed in an appendix of definitions.	removed

3	VII. ASSESSMENT OF EFFECTS B. Historic properties affected	***To minimize harm to affected historic properties to the maximum extent possible pursuant to Section ll0(f) of the NHPA (54 U.S.C. § 306107) and 36 C.F.R. § 800.10*** , adverse effects from the undertaking will be avoided or minimized. The USACE will consider redesign of elements of the Planned Component or feature in order to avoid and/or minimize adverse effects to historic properties. If it is possible to modify the Project Component to avoid effects to historic properties, a finding of no adverse effect may be made and provided to the Consulting Parties for review in accordance with Stipulation IV(B). If effects to historic properties are determined to be adverse they will be resolved in accordance with Stipulation VIII below.	Section 110(f), and 36 CFR 800.10 pertain to National Historic Landmarks. Please clarify whether those sections are relevant for this agreement.	revised

3	VII. ASSESSMENT OF EFFECTS C. Disagreement with effect finding	C. Disagreement with effect finding. If, within the review period as established in Stipulation IV(B), a Signatory notifies the USACE in writing that it disagrees with an adequately documented finding and specifies the reasons for the disagreement in the notification, the USACE shall consult with the party to resolve the disagreement. ***If a resolution cannot be reached*** ~~, the USACE shall request the Council review the finding pursuant to 36 CFR. § 800.4(d)(1)(iv)(A) through (d)(1)(iv)(C). The USACE shall notify all other consulting parties of the submission and make the submission documentation available to the public consistent with the confidentiality requirements of 36 CFR 800.11(c) and Section 304 of the NHPA. USACE shall comply with Stipulations IV(B) and XV(C) of this PA.~~ ~~If, after consulting to resolve a dispute over adverse effects, the Consulting Parties of this PA determine that further consultation will not be productive, then procedures outlined in Stipulation XV(D) shall be followed.~~	Dispute resolution stipulation should be followed here	revised
3	VIII. RESOLUTION OF ADVERSE EFFECTS C. Disagreement	C. Disagreement	Deleted this section: Any disagreements in resolving adverse effects or for most other items in this agreement should follow the Dispute resolution stipulation	revised. Dispute Resolution is included, and is referenced throughout the PA.

	IX. MITIGATION MEASURES AND HISTORIC PROPERTIES TREATMENT PLAN	***Possible mitigation*** measures may include, but are not limited to, data recovery; HABS/HAER/HALS documentation; preservation of selected eligible archaeological sites and incorporating them into heritage tourism plans while allowing others to be lost; burying sites under fill or incorporating them into the undertaking; syntheses of existing information of similar archaeological properties, periods, or types in a region or area; educational programs; virtual or web-based reports or educational media that otherwise would not be produced; preservation plans; public education and outreach, including signage and museum exhibits; interpretive documents; the use of digital and other media technologies including films and scanning of resources and artifacts; inclusion of cultural landscape perspectives; use of paleoenvironmental data to develop landscape evolution models for both scientific and public information and/or to inform native planting or landscape plans as part of the undertaking; new historical contexts, including indigenous perspectives, of areas or regions; combinations of any of these or other mitigations as agreed upon by the Signatories and Consulting Parties.		
3	A. Mitigation		Separate paragraphs should be sub stipulations, IX.A.1, etc.	concur

	IX. MITIGATION MEASURES AND HISTORIC PROPERTIES TREATMENT PLAN	Possible mitigation measures may include, but are not limited to, data recovery; HABS/HAER/HALS documentation; preservation of selected eligible archaeological sites and incorporating them into heritage tourism plans ***while allowing others to be lost*** ; burying sites under fill or incorporating them into the undertaking; syntheses of existing information of similar archaeological properties, periods, or types in a region or area; educational programs; virtual or web-based reports or educational media that otherwise would not be produced; preservation plans; public education and outreach, including signage and museum exhibits; interpretive documents; the use of digital and other media technologies including films and scanning of resources and artifacts; inclusion of cultural landscape perspectives; use of paleoenvironmental data to develop landscape evolution models for both scientific and public information and/or to inform native planting or landscape plans as part of the undertaking; new historical contexts, including indigenous perspectives, of areas or regions; combinations of any of these or other mitigations as agreed upon by the Signatories and Consulting Parties.	Unclear how allowing resources to be lost would be an appropriate mitigation measure. Please clarify.	Removed text. This was in reference to in-kind mitigation of preserving an endangered property outside the APE in lieu of one considered less significant in the APE, as the one outside the project area not subject to federal action. Controversial, so removed from text.
3	A. Mitigation			

3	IX. MITIGATION MEASURES AND HISTORIC PROPERTIES TREATMENT PLAN A. Mitigation	HPTPs may be developed for ***individual or multiple historic properties*** and will include the agreed-upon methods for mitigating adverse effects. The use of a HPTP to resolve adverse effects shall not require the execution of an individual Memorandum of Agreement or PA. HPTPs will be provided for review and comment to Consulting Parties in accordance with Stipulation IV(B). Once approved and signed by the USACE approving official, the SHPO, and the appropriate Consulting Parties, the HPTP will be executed. Once the HPTP is fulfilled, all Consulting Parties will be provided the opportunity to provide comments on the resulting deliverable(s) in accordance with Stipulation IV(B).	HPTPs should be developed per Project Component	clarified in text
3	IX. CURATION AND DISPOSITION OF RECOVERED MATERIALS, RECORDS, AND REPORTS B. Reports	B. Reports. The USACE shall provide copies of final technical reports of investigations and mitigation to the SHPO, Tribes, and consulting parties, as well as additional copies for public distribution. ***All consulting parties shall withhold site location information or other data that may be of a confidential or sensitive nature pursuant to 36 CFR § 800.11(c) and Section 304 of the NHPA.***	If this is meant to stipulate that those parties who receive confidential information shall withhold it, this agreement might not be able to enforce. Separate MOUs might be required which can be stipulated here.	This is a standard stipulation used in our PAs, but I have revised the text.

3	XII. POST REVIEW DISCOVERIES OF CULTURAL RESOURCES OR UNEXPECTED AFFECTS	A post-review discovery is defined as the identification of previously unknown historic properties within the context of the undertaking other than those planned as archaeological excavations. Previously unidentified and unanticipated cultural resources discovered while conducting project activities shall be ***subject to the terms of the Post Review Discovery Plan for Cultural Resources included with the Research Design*** .	When is this due?	clarified in text: A post-review discovery is defined as the identification of previously unknown historic properties within the context of the undertaking other than those planned as archaeological excavations. Previously unidentified and unanticipated cultural resources discovered while conducting project activities shall be subject to the terms of the Post Review Discovery Plan for Cultural Resources, **drafted in consultation and** included with the Research Design **(Stipulation V(B)(2)), both of which will be initiated when the project is authorized and funding has been received, and executed prior to any project related activities.**

3	XII. POST REVIEW DISCOVERIES OF CULTURAL RESOURCES OR UNEXPECTED AFFECTS	***Pursuant to 36 CFR § 800.13(b)(3)*** , if cultural resources are discovered or unanticipated effects to historic properties are found after construction has commenced, the USACE shall stop construction in the affected area and notify the Consulting Parties within 48 hours of the discovery. The notification shall include the USACE assessment of the affected properties, an assessment of eligibility for inclusion in the NRHP, and, if the property is determined to be eligible or if eligibility cannot be determined, recommendations for additional actions. The USACE may assume concurrence with its eligibility determination unless otherwise notified by the Consulting Parties within 48 hours of notification. If, in consultation with the Consulting Parties the USACE determines an unanticipated adverse effect to an historic property cannot be avoided, the USACE shall develop a treatment plan to resolve any adverse effects. The USACE shall submit the draft treatment plan to the Consulting Parties for review and concurrence and shall provide documentation of all decisions and any actions taken, the results of any investigations, and final determinations when they are completed.	How do the prescribed actions that follow in this paragraph relate to the forthcoming Post Review Discovery Plan? As written, this stipulation might cause confusion as to the appropriate process to follow in the event of a post-review discovery.	concur, deleted most, leaving: Pursuant to 36 CFR § 800.13(b)(3), if cultural resources are discovered or unanticipated effects to historic properties are found after construction has commenced, the USACE shall stop construction in the affected area and implement the Post Review Discovery Plan.

3	XII. POST REVIEW DISCOVERIES OF CULTURAL RESOURCES OR UNEXPECTED AFFECTS	Pursuant to 36 CFR § 800.13(b)(3), if cultural resources are discovered or unanticipated effects to historic properties are found after construction has commenced, the USACE shall stop construction in the affected area and notify the Consulting Parties within 48 hours of the discovery. The notification shall include the USACE assessment of the affected properties, an assessment of eligibility for inclusion in the NRHP, and, if the property is determined to be eligible or if eligibility cannot be determined, recommendations for additional actions. The ***USACE may assume concurrence with its eligibility determination*** unless otherwise notified by the Consulting Parties within 48 hours of notification. If, in consultation with the Consulting Parties the USACE determines an unanticipated adverse effect to an historic property cannot be avoided, the USACE shall develop a treatment plan to resolve any adverse effects. The USACE shall submit the draft treatment plan to the Consulting Parties for review and concurrence and shall provide documentation of all decisions and any actions taken, the results of any investigations, and final determinations when they are completed.	Concurrence with proposed additional actions, i.e., mitigation or no action if ineligible, can be assumed if no response is received within 48 hours, however concurrence on eligibility cannot. In other words, the Corps can proceed but the property would remain unevaluated absent concurrence from SHPO.	removed

3	XIII. COMMUNICATIONS	***Electronic mail (email) may serve as the official correspondence method for all communications*** regarding this PA and its provisions. See Appendix C for a list of contacts and email addresses. Contact information in Appendix C may be updated as needed without an amendment to this PA. It is the responsibility of each party to the PA to immediately inform the USACE of any change in name, address, email address, or phone number of any point-of-contact. The USACE shall forward this information to all Signatories and Consulting Parties by email and will provide a hard copy via postal mail upon request.	Recommend formal correspondence by letter serve as the official means of communication instead of email in most instances. It is the Corps agency official that has legal and financial responsibility for Section 106 compliance and communication should come from them. This doesn't prevent such correspondence being delivered by email however.	email is recognized as official correspondence by the federal government. I edited to: Postal (letters) or letters conveyed by Eelectronic mail (email)
3	XV.AMENDMENTS, DISPUTES, AND TERMINATION B. Changes in the Undertaking.	Changes in the Undertaking.	This would most likely require an amendment to this agreement	revised
3	XV.AMENDMENTS, DISPUTES, AND TERMINATION B. Changes in the Undertaking.	. If construction or implementation of the undertaking has not commenced, and the USACE determines that it will not conduct the undertaking as originally coordinated, the USACE shall notify all Consulting Parties to this PA in writing of the proposed change in scope, provide maps illustrating the proposed changes to the undertaking, and	As noted, this would most likely require an amendment to the PA regardless of whether construction or implementation of the undertaking has commenced. Suggest deleting the following sections and stipulating that consultation on an amendment to the agreement would commence at this point.	revised

3	XV.AMENDMENTS, DISPUTES, AND TERMINATION B. Changes in the Undertaking.	DELETED	A change in project scope would require an amendment to the PA regardless of additional adverse effects	revised

3	XV.AMENDMENTS, DISPUTES, AND TERMINATION C. Dispute resolution.	C. Dispute resolution. Disputes regarding the completion of the terms of this agreement (any actions proposed or the manner in which the terms of this PA are implemented) shall be resolved by the signatories. If the signatories cannot come to an agreement regarding a dispute, any one of the signatories may request the participation of the Council in resolving the dispute in accordance with the procedures outlined in 36 CFR § 800.9. The USACE shall forward to the Council and all consulting parties within fifteen (15) days of such a request all documentation relevant to the dispute, including the USACE's proposed resolution of the dispute. If USACE determines that such objection cannot be resolved, and further consultation will not yield further results, the USACE shall: (1) Forward all documentation relevant to the dispute, including the USACE's proposed resolution, to the ACHP. The ACHP shall provide the USACE with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Fifteen (15) day extensions of this timeframe shall be granted upon request. Prior to reaching a final decision on the dispute, the USACE shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP and/or	Suggesting this standard template language used frequently by CA SHPO: Should any Signatory or concurring party to this MOA/PA object at any time to actions proposed or the manner in which the terms of this MOA/PA is implemented, [AGENCY] shall notify the other parties in writing and consult with the objecting party to resolve the objection. If [AGENCY] determines that such objection cannot be resolved, [AGENCY] will: A. 1Forward all documentation relevant to the dispute, including the [AGENCY]'s proposed resolution, to the ACHP. The ACHP will provide [AGENCY] with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, [AGENCY] shall prepare a written response that takes into account any; timely advice or comments regarding the dispute form the ACHP, Signatories and concurring parties, and provide them with a copy of this written response. [AGENCY] will then proceed according to its final decision. B. 1If the ACHP does not provide its	The Standard Documentation is the same as the quoted section.

3	XV.AMENDMENTS, DISPUTES, AND TERMINATION D. Termination of PA.	D. Termination of PA. If, within the review period, or extension of the review period, an amendment cannot be reached, or the Signatory or Invited Signatory proposes termination of this PA for other reasons, the Signatory proposing termination shall, in writing, notify the other parties to this PA, explain the reasons for proposing termination, and consult in accordance with Stipulation IV(b) to seek alternatives to termination. (1) Should such consultation result in an agreement, the parties shall proceed in accordance with the terms of that agreement and shall prepare any amendment to the PA, if needed, in accordance with the terms of Stipulation XV(A). (2) Should no agreement be reached, and the PA not amended as provided for in Stipulation XV(A), the PA may be terminated. (3) If this PA is terminated, and prior to work continuing on the Undertaking, USACE must either (a) execute new PA pursuant to 36 CFR § 800.6 or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. USACE shall notify the Signatories as to the course of action it will pursue. (4) Once the PA is terminated, and prior to work	Suggest the following CA SHPO recommended template stipulation language: TERMINATION Example Stipulation A. 1Only a Signatory or Invited Signatory may terminate this MOA/PA, If this MOA/PA is not amended as provided for in Section [X] of this stipulation, or a Signatory or Invited Signatory proposes termination of this MOA/PA for other reasons, the Signatory proposing termination shall, in writing, notify the other parties to this MOA/PA, explain the reasons for proposing termination, and shall consult with the other parties to this MOA/PA for no more than thirty (30) calendar days to seek alternatives to termination. B. 1Should such consultation result in an agreement, the parties shall proceed in accordance with the terms of that agreement and shall prepare any amendment to the MOA/PA, if needed, in accordance with the terms of Stipulation [X]. C. 1If this MOA/PA is terminated, and prior to work continuing on the Undertaking, [AGENCY] must either (a)	The Standard Documentation is the same as the quoted section.

From: OHP, CALSHPO@Parks
To: Smith, Holly C CIV USARMY CESWF (USA)
Subject: [Non-DoD Source] RE: 106 COE_2023_0209_001 PA USACE SF Waterfront, revised Draft 3
Date: Tuesday, December 30, 2025 1:16:23 PM

Hi Holly,

We have received the consultation update, and the reviewer has been notified.

Thank you,

Brandon Gardner

Staff Service Analyst
California Office of Historic Preservation
916-894-5596
Brandon.Gardner@parks.ca.gov

From: Smith, Holly C CIV USARMY CESWF (USA) <Holly.C.Smith@usace.army.mil>
Sent: Tuesday, December 30, 2025 7:57 AM
To: OHP, CALSHPO@Parks <CALSHPO.OHP@parks.ca.gov>
Cc: Greenaway, Brendon@Parks <Brendon.Greenaway@parks.ca.gov>
Subject: 106 COE_2023_0209_001 PA USACE SF Waterfront, revised Draft 3

Good morning,

Please find attached for your review the revised programmatic agreement for the San Francisco Waterfront Coastal Flood Study Recommended Plan, San Francisco County (12-30-25 PA_Revised_per_SHPO_Comments_recd_08-25-25), accompanying consultation letter (12-30-25_USACE_to_SHPO_PA_Submission_3_signed), the redline version with comments (12-22-25 REDLINE SHPO PA 2025-08-26 COMMENTS), and the Comment Matrix (12-30-25 Comment Matrix DRAFT SFWS PA_CA SHPO comments recd 8-25-25).
USACE looks forward to finalizing and executing the PA.

Respectfully,
Holly

Holly C. Smith
Archaeologist, Environmental Branch
Cultural and Environmental Program Support Section

Southwestern Regional Planning and Environmental Center (RPEC)
US Army Corps of Engineers
Attn: Holly Smith
CESWF-PEE-E
2488 E 81st Street
Tulsa, OK 74137-4290

Email: Holly.C.Smith@usace.army.mil
Mobile: 918-699-9655

CONSULTING PARTY AND TRIBAL (NON-FEDERALLY RECOGNIZED TRIBES) CONSULTATION

From:	Murphey, Joseph S CIV USARMY CESWF (USA)
To:	cpf@californiapreservation.org
Cc:	Capone, Kelley (PRT); Campbell, John A CIV USARMY CESWF (USA); Fisher, Melinda CIV USARMY CESWF (USA)
Subject:	USACE Section 106 Invitation to Consult regarding the San Francisco Waterfront Coastal Flood Study
Date:	Thursday, February 9, 2023 11:26:30 AM
Attachments:	Ca Pres Foundation CONSULT LETTER.pdf

Dear Sirs,

The attached letter with enclosure serves as the formal invitation to consult regarding the Port of San Francisco and the U.S. Army Corps of Engineers San Francisco Waterfront Coastal Flood Study effects on cultural resources under Section 106 of the National Historic Preservation Act.

As mentioned in the letter, please respond to me at this email address should your organization choose to participate.

Regards,

Joseph Scott Murphey, Historical Architect
Regional Planning and Environmental Center/ CESWF-PEE-E
Currently teleworking. Available by phone/text: (817) 229-1956 or
email: joseph.s.murphey@usace.army.mil

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

Feburary 8, 2023

California Preservation Foundation
Cindy Heitzman, Executive Director
101 The Embarcadero, Suite 120
San Francisco, CA 94105

Dear Ms. Heitzman:

The U.S. Army Corps of Engineers (USACE), in partnership with the Port of San Francisco, have resumed the San Francisco Waterfront Coastal Flood Study, California (the Study) and are initiating Section 106 consultation in accordance with the National Historic Preservation Act (NHPA) of 1966, as amended. This letter is to invite the California Preservation Foundation as a consulting party in the Section 106 process regarding effects on historic properties and seeking ways to avoid, minimize or mitigate adverse effects.

The San Francisco bayside shoreline is at risk of flooding from bay water during coastal storms, extreme tides, and future sea level rise. Flooding along the waterfront could cause extensive damage to the cultural, social, and economic character of the entire waterfront community. The risk is expected to increase with time as sea levels rise in the bay. The Study and the associated Environmental Impact Statement (EIS) conducted under the National Environmental Policy Act (NEPA) will involve investigation and analysis to determine the feasibility of reducing flood risks through a range of alternatives for 2040 through 2140. The enclosure, San Francisco Waterfront Costal Flood Study gives more detail on the Study, alternatives under consideration and a timeline.

The Study initially began in 2018 under the USACE San Francisco District, South Pacific Division, and after an extended pause, this effort is being resumed by the USACE Tulsa District, Southwestern Division. Due to the complexities of the Study, including consideration of seismic risks that introduce flood vulnerability and the diversity of the geographic regions and stakeholders, the Study has been approved for an additional four years of study time for a total of seven years.

The Study will investigate several alternatives plus a no action alternative with milestones of 2040, 2090, and 2140. The San Francisco bayside shoreline is rich in previously identified National Register listed and eligible cultural resources, including National Historic Landmarks. Given the magnitude of the Study in such an area rich in historic properties, adverse effects to some properties are expected in the NEPA Tentatively Selected Plan (TSP).

Through Section 106 consultation, the USACE seeks to develop a Programmatic Agreement (PA) of an initial 15-year duration to programmatically address ways to identify architectural and archeological historic properties and seek ways to avoid, minimize or mitigate adverse effects from long-term implementation of the TSP.

USACE is currently inviting the following parties to consult:

- Advisory Council on Historic Preservation
- Amah Mutsun Tribal Band of Mission San Juan Bautista
- Association of Ramaytush Ohlone
- California Office for Historic Preservation
- California Preservation Foundation
- Costanoan-Rumsen Carmel Tribe
- Dogpatch Neighborhood Association
- Indian Canyon Mutsun Band of Costanoan
- Muwekma Ohlone Indian Tribe of the San Francisco Bay Area
- National Park Service
- National Trust for Historic Preservation
- Ohlone Indian Tribe
- Port of San Francisco (non-federal sponsor)
- San Francisco Architectural Heritage
- San Francisco Historic Preservation Commission
- South Beach Rincon Mission Bay Neighborhood Association
- Telegraph Hill Dwellers Neighborhood Association
- Wuksache Indian Tribe/Eshom Valley Band

We are tentatively planning our first Section 106 consultation meeting on a weekday in March 2023. To accept the invitation or if you would like additional information, please contact Joseph Murphey, historical architect at the joseph.s.murphey@usace.army.mil. We look forward to your response to our invitation to become a consulting party.

Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs Support Section
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P.O. BOX 17300
FORT WORTH, TX 76102-0300

March 8, 2023

Irene Zwierlein
Chairperson
Amah Mutsun Tribal Band of Mission San Juan Bautista
3030 Soda Bay Road
Lakeport, CA 95453

Dear Ms. Zwierlein:

The U.S. Army Corps of Engineers (USACE), in partnership with the Port of San Francisco, has resumed the San Francisco Waterfront Coastal Flood Study, California (the Study) and are initiating Section 106 consultation in accordance with the National Historic Preservation Act (NHPA) of 1966, as amended. This letter invites the Amah Mutsun Tribal Band of Mission San Juan Bautista as a consulting party in the Section 106 process regarding effects on historic properties and seeking ways to avoid, minimize or mitigate adverse effects.

The San Francisco bayside shoreline risks flooding from bay water during coastal storms, extreme tides, and rising sea levels. Flooding along the waterfront could cause extensive damage to the entire waterfront community's cultural, social, and economic character. The risk is expected to increase as sea levels rise in the bay. The Study and the associated Environmental Impact Statement (EIS) conducted under the National Environmental Policy Act (NEPA) will involve investigation and analysis to determine the feasibility of reducing flood risks through various alternatives for 2040 through 2140. The enclosure, San Francisco Waterfront Coastal Flood Study, gives more detail on the Study, options under consideration, and a timeline.

The Study began in 2018 under the USACE San Francisco District, South Pacific Division. After an extended pause, this effort is being resumed by the USACE Tulsa District, Southwestern Division. Due to the complexities of the Study, including consideration of seismic risks that introduce flood vulnerability and the diversity of the geographic regions and stakeholders, the Study has been approved for an additional four years of study time for a total of seven years.

The Study will investigate several alternatives plus a no-action alternative with milestones of 2040, 2090, and 2140. The San Francisco bayside shoreline is rich in previously identified National Register listed and eligible cultural resources, including National Historic Landmarks. Given the magnitude of the Study in such an area rich in historic properties, adverse effects on some properties are expected in the NEPA Tentatively Selected Plan (TSP).

Through Section 106 consultation, the USACE seeks to develop a Programmatic Agreement (P.A.) of an initial 15-year duration to programmatically address ways to identify architectural and archeological historic properties and seek ways to avoid, minimize or mitigate adverse effects from long-term implementation of the TSP.

We are planning our first Section 106 consultation meeting on a weekday in March 2023. To accept the invitation or for additional information, please contact John A. Campbell by phone at (409) 766-3878 or by email at john.a.campbell@usace.army.mil. We look forward to your response to our invitation to become a consulting party.

Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs Support Section
Regional Planning and Environmental Center

Enclosure

From: Smith, Holly C CIV USARMY CESWF (USA)

To: jonathan@ramaytush.org; glcastro@pacbell.net; DPH-gregg; vlopez@amahmutsun.org; aerieways@aol.com; vjltestingcenter@aol.com; rumsenama@gmail.com; amahmutsuntribal@gmail.com; amtbinc21@gmail.com; chochenyo@AOL.com; dirwin0368@yahoo.com; vincent.d.medina@gmail.com; rumsen@aol.com; carlamarieohlone@gmail.com; ohlonesisters@gmail.com; ams@indiancanyon.org; kanyon@kanyonkonsulting.com; indiancanyon.kanyon@gmail.com; admin@kanyonkonsulting.com; cnijmeh@muwekma.org; monicavarellano@gmail.com; Muwekma@muwekma.org; MuwekmaOhloneTribe@gmail.com; marellano@muwekma.org; kwood8934@aol.com; DPH-jonathan; president@thd.org; hello@thd.org; info@dogpatchna.org; Dualan, Dale; info@savingplaces.org; Matsuda, Diane (CPC; sbrmbna@gmail.com; Ellen Johnck; Woody LaBounty; Cc: Paez, Mark (PRT; Vanderslice, Allison (CPC; Barata, Luiz (PRT; Crippen, Leslie A CIV USARMY CESWF (USA); Smith, Holly C CIV USARMY CESWF (USA); Fisher, Melinda CIV USARMY CESWF (USA); Capone, Kelley (PRT

Subject: Consulting Party Meetings USACE & Port of SF Flood Study, NHPA Section 106

Date: Friday, August 30, 2024 3:19:00 PM

Attachments: image001.png
20240802_SFWS_DRAFT_PA (004).pdf
SFWS_PA_Project Summary20240830.pdf
AVAILABILITY CONSULTING PARTY MTG SEPT 2024.xlsx

Good afternoon,

The U.S. Army Corps of Engineers (USACE) is continuing to seek your views and participation as a Consulting Party in the Section 106 process for the San Francisco Waterfront Coastal Flood Study. A revised draft Programmatic Agreement (attached) was distributed to Consulting Parties on August 20, 2024. Meetings with Consulting Parties are held to give you an opportunity to provide input and receive updates as we continue working through the National Historic Preservation Act (NHPA) Section 106 consultation process. We are setting up virtual meetings in September, and would like to know if you wish to continue as a Consulting Party to the PA, and, if so, whether you would be able to attend a virtual meeting during any of the times proposed below.

We have identified a variety of timeframes to hold meetings in an attempt to accommodate all participants. Please review the potential meeting dates and times and let us know what will work for you. All times are Pacific Time Zone. A spreadsheet is attached for your convenience- please fill out your availability and return the sheet to me and I will collate responses and let everyone know meeting dates/times.

Monday		Wednesday	Thursday	Friday
9/9 11am-12pm		**9/11** 1pm-2pm	**9/12** 10am-11am	**9/13** 11am-12pm
9/16 12pm-1pm 4pm-5pm 6pm-7pm		**9/18** 10am-11am 12pm-1pm 6pm-7pm	**9/19** 10am-11am 6pm-7pm	**9/20** 11am-12pm 12pm-1pm
9/23 11am-12pm 12pm-1pm 3pm-4pm 6pm-7pm		**9/25** 12pm-1pm 3pm-4pm 6pm-7pm	**9/26** 10am-11am 12pm-1pm 3pm-4pm 6pm-7pm	**9/27** 9am-10am 11am-12pm 12pm-1pm

The port can also schedule a tour of the project area if folks are interested. If you have any questions or concerns, please contact Holly Smith at holly.c.smith@usace.army.mil or the Port of SF's Kelley Capone at kelley.capone@sfport.com .

Thank you for your continued participation in the NHPA Section 106 process.

Respectfully,

Holly Smith

Holly C. Smith
Archaeologist
Environmental Branch |Cultural and Environmental Program Support Section
SWD Regional Planning and Environmental Center (RPEC)
Mobile: 918-699-9655
Holly.C.Smith@usace.army.mil

Mailing address:
US Army Corps of Engineers
Attn: Holly Smith
CESWF-PEE-E
2488 E 81st Street
Tulsa, OK 74137-4290

September 17, 2024

U.S. Army Corps of Engineers
Attn: Holly Smith
CESWF-PEE-E
2488 E. 81st Street
Tulsa, OK 74137-4290
ATTN: RPEC-SFWS
(Via email: Holly.C.Smith@usace.army.mil)

TELEGRAPH HILL DWELLERS

RE: Comments and Recommendations on Revised Section 106 Programmatic Agreement

Dear Ms. Smith,

On behalf of the Telegraph Hill Dwellers ("THD"), as a consulting party and in advance of the meeting of consulting parties on September 23rd, we offer here several comments and recommendations regarding the August 2, 2024 revised version (REV 3) of the proposed Programmatic Agreement ("Revised PA") prepared under Section 106 of the National Historic Preservation Act ("NHPA").

We understand from the Revised PA that "because effects on historic properties cannot be fully determined or resolved prior to the approval of the undertaking, it is advisable to develop this programmatic agreement (PA) for the purpose of identifying and evaluating potential effects on historic properties related to the undertaking." A draft version of the PA ("Draft PA") was published in January 2024 as Attachment D-3-1 to Appendix D-3 of the San Francisco Waterfront Coastal Flood Study Draft Integrated Feasibility Report and Environmental Impact Statement. Subsequently, the revised draft version of the PA cited above has been circulated.

Although we have requested a redline version showing additions and deletions to ensure adequate review by the parties, based on our own review of the Revised PA and comparison of it to the Draft PA, we offer the following comments and recommendations:

- Reinstatement of Programmatic Historic Properties Management Plan. Sec. II(A) of the Draft PA was revised to eliminate preparation of a Programmatic Historic Properties Management Plan ("PHPMP"), replacing it in the Revised PA with a Phased Identification. We are concerned that such a revision would be less comprehensive and specific, deferring much planning to future phases without an overall plan and context stated for the full project.
    - RECOMMENDATION: We recommend that preparation of a Programmatic Historic Properties Management Plan, such as that proposed in Sec. II(A) of the Draft PA, be required in order to provide a "roadmap" for the overall project, context for the various phases, and public transparency.
        - The plan should be prepared and reviewed by the USACOE, the Port, consulting parties, the public, and other interested parties before initial construction begins, and should include, though not be limited to, items such as those listed in Sec. II(A)(4) of the Draft PA.
        - The plan should be adaptive, revisited periodically and modified if needed to reflect evolving conditions.

- Reinstatement of review and comment status of consulting parties. Sec. II(B) of the Revised PA changed "SHPO, Tribes, and all consulting parties" to "PA signatories." We understand that "PA signatories" includes the USACOE, the SHPO, and the Port of San Francisco. We are concerned that this change eliminates the requirement to address comments by consulting parties on draft reports of the "results of investigations." Such a change is also made elsewhere in Sec. III of the Revised PA, which eliminates the requirement to address comments of consulting parties on "draft reports of NRHP site testing or other NRHP investigations."
    - RECOMMENDATION: We recommend that the review and comment status of consulting parties be affirmed and reinstated, ensuring that such comments will be included and addressed.
- Increased time allowed for review and comment. The time allowed for important actions, including review of findings of Adverse Effect and No Adverse Effect, remains at 30 calendar days in both the Draft PA and Revised PA. As we stated in our comment letter of March 24, 2024, we remain concerned that this is insufficient time for reviewing such important actions and providing a written response, especially for consulting parties who rely on volunteers.
    - RECOMMENDATION: We recommend that the time allowed for important actions be changed to 45 calendar days or 30 business days at a minimum, with perhaps as long as 60 days in particularly important instances.
- Use of qualified professionals. The NHPA requires federal agencies to demonstrate their responsible care of historic properties by a commitment to use professionals qualified in the field of historic preservation in carrying out their projects.
    - RECOMMENDATION: We recommend that the PA include a commitment to use qualified preservation professionals in the evaluation of additional historic resources, in the detailed design process and assessment of effects on historic resources, and in the development of the Programmatic Historic Properties Management Plan and any necessary Treatment Plan required for mitigation or avoidance of impacts on historic resources.
- Procedures for monitoring, consultation, and reporting on PA implementation. Given the duration and complexity of PA implementation, we are concerned that the PA include a process that will ensure that consulting parties and the public will have adequate opportunities to participate in and assess the progress of USACE's fulfilment of its responsibilities under the NHPA.
    - RECOMMENDATION: We recommend that the PA include procedures for monitoring, consultation, and reporting, especially during the Preconstruction Engineering and Design Phase and the preparation of the PHPMP and any Treatment Plan, in order to provide the consulting parties and the public an opportunity to participate in and assess project progress.

* * *

Thank you very much for the opportunity, as a consulting party, to provide our comments and recommendations. Note that, given limits on the available review time and the extensive length and complexity of the documents, we reserve the right to expand or supplement our comments as appropriate.

Sincerely,

Stan Hayes Nancy Shanahan

Telegraph Hill Dwellers

cc: Supervisor Aaron Peskin, District 3 (aaron.peskin@sfgov.org)
Elaine Forbes, PRT Executive Director (elaine.forbes@sfport.com)
Brad Benson, PRT (brad.benson@sfport.com)
Mark Paez, PRT (mark.paez@sfport.com)
Mike Buhler (mike@fortmason.org)
Woody LaBounty (wlabounty@sfheritage.org)

June 3, 2025

U.S. Army Corps of Engineers
Attn: Holly Smith
CESWF-PEE-E
2488 E. 81st Street
Tulsa, OK 74137-4290
ATTN: RPEC-SFWS
(Via email: Holly.C.Smith@usace.army.mil)

RE: Comments and Recommendations on May 20, 2025 Draft Section 106 Programmatic Agreement

Dear Ms. Smith,

On behalf of the Telegraph Hill Dwellers ("THD"), as a Consulting Party and in advance of a pending meeting of Consulting Parties, we offer here several comments and recommendations regarding the May 20, 2025 draft of the proposed Section 106 Programmatic Agreement ("May 2025 Draft PA") prepared under Section 106 of the National Historic Preservation Act.

We understand from the May 2025 Draft PA that "because effects on historic properties cannot be fully determined or resolved prior to the approval of the undertaking, it is necessary to develop this programmatic agreement (PA) for the purpose of identifying and evaluating historic properties, assessing adverse effects, and resolving adverse effects on them."

A draft version of the PA was published in January 2024 ("January 2024 Draft PA") as Attachment D-3-1 to Appendix D-3 of the San Francisco Waterfront Coastal Flood Study Draft Integrated Feasibility Report and Environmental Impact Statement. Subsequently, a revised draft version of the PA dated August 2, 2024 ("August 2024 Draft PA") was circulated. THD submitted comments and recommendations on that version to the U.S. Army Corps of Engineers ("USACE") in a letter dated September 17, 2024 ("THD September 2024 Letter") seeking:

- Reinstatement of Programmatic Historic Properties Management Plan
- Reinstatement of review and comment status of Consulting Parties
- Increased time allowed for review and comment
- Use of qualified professionals
- Procedures for monitoring, consultation, and reporting on PA implementation

While we would have preferred a redline-strikeout version of the May 2025 Draft PA showing additions and deletions to ensure adequate review by the parties, based on our best-effort review and comparison of it to the August 2024 Draft PA, we offer the following comments and recommendations:

- Reinstatement of Programmatic Historic Properties Management Plan. The January 2024 Draft PA proposed preparation of a Programmatic Historic Properties Management Plan. However, the August 2024 Draft PA replaced it with a Phased Identification, which has been retained in the May 2025 Draft PA. While we recognize and sympathize with the planning difficulties posed by significant funding and schedule uncertainties, we were, and continue to be, concerned, as stated in our September 2024 Letter, that a phased identification would be less comprehensive and specific, deferring much planning to future project phases.

We again recommend that the requirement for an overall programmatic historic properties management plan, such as that called for in the January 2024 Draft PA, be reinstated. Instead of such a plan, the May 2025 Draft PA places many project details in a series of loosely connected appendices, providing only abbreviated discussion. Development of a fuller and more integrated project overview is needed.

- RECOMMENDATION: We repeat our recommendation that preparation of an overall project management plan be required in order to provide a "roadmap" for the overall project, context for the various phases, and public transparency.
  - The plan should be prepared and reviewed by the USACE, the Port, consulting parties, the public, and other interested parties before initial construction begins.
  - The plan should be adaptive, revisited periodically, and modified as needed to reflect evolving conditions.

- Reinstatement of review and comment status of Consulting Parties. In our THD September 2024 Letter, we recommended that the status of Consulting Parties with respect to their review and comment role be clarified and reinstated. Stipulation IV(B), Review Procedures, has been added to the May 2025 Draft PA, stating that "for all documents and deliverables…including associated findings and effects determination…USACE will coordinate with Consulting Parties." Such coordination will include provision of draft documents, conduct of review and comment, provision of written comments from Consulting Parties to the State Historic Preservation Officer ("SHPO"), reporting of comments of Consulting Parties and the SHPO and how they were addressed, and provision of a revised draft final document or deliverable to Consulting Parties and the SHPO for review and comment.
  - RECOMMENDATION: We support these modifications. As a core principle, we encourage ongoing substantive, meaningful, and timely outreach, engagement, and involvement of Consulting Parties and the public.

- Increased time allowed for review and comment. To ensure more adequate time for review and comment by the parties, we recommended in our THD September 2024 Letter that the time allowed for important actions be increased from 30 days to 45 days, with perhaps as long as 60 days in particularly important instances. Although the May 2025 Draft PA retains the 30-day review period, Stipulation IV(B)(1)(a) allows an additional 15 days – for a total of 45 days – upon request by a Consulting Party.
  - RECOMMENDATION: We are satisfied with this modification, though we continue to recommend that the time allowed in particularly important instances be as long as 60 days.

- Use of qualified professionals. In our THD September 2024 Letter, we recommended that the PA include a commitment to use qualified preservation professionals, including in the evaluation of additional historic resources, in the detailed process and assessment of effects on historic resources, historic properties planning and management, and in the development of treatment plans for mitigation or avoidance of impacts on historic resources. Stipulation II, Qualifications and Standards," of the May 2025 Draft PA states that "all work…shall be done by or under the direct supervision of the appropriate professionals who meet or exceed the Secretary of the Interior's Professional Qualifications Standards."
  - RECOMMENDATION: We are satisfied with this statement, although we recommend that care be exercised when deciding when and what constitutes the term "under the direct supervision of." We note that the NHPA requires federal agencies to demonstrate their

responsible care of historic properties by a commitment to use professionals qualified in the field of historic preservation in carrying out their projects.

- Procedures for monitoring, consultation, and reporting on PA implementation. In our THD September 2024 Letter, we recommended that the PA include a process that will ensure that Consulting Parties and the public will have adequate opportunities to participate in and assess the progress of the project. Stipulation XIV of the May 2025 Draft PA states that USACE will "prepare an Annual Report documenting actions carried out pursuant to this PA." The Annual Report will address issues and describe actions and accomplishment over the past year, including issues that may have arisen, status of treatment and mitigation, and disputes and objections received and how they were resolved.
    - RECOMMENDATION: We strongly recommend ongoing efforts to provide Consulting Parties and the public with opportunities to participate in and assess project progress and to identify and resolve issues that may arise.
        - We recommend that a shorter time frame than annual (perhaps every 6 months or quarterly for particularly active project phases) be implemented, especially once activity on the project has begun, including pre-construction design and construction phases. Perhaps the Port could be responsible for all or a portion of these more frequent interactions.
        - We recommend that consultation be an ongoing process, with more frequent interactions, outreach, and for problem-identification and resolution.
        - We recommend formation of an ongoing advisory group to provide a focal point for project-related interaction. Such a group could include representatives of USACE, the Port, Consulting Parties, police and fire, affected businesses, project consultants, neighborhood organizations, and other interested parties.

* * *

Thank you once again for the opportunity, as a Consulting Party, to provide our comments and recommendations. Note that, given limits on the available review time and the extensive length and complexity of the documents reviewed, we reserve the right to expand or supplement our comments and recommendations as appropriate.

Sincerely,

Stan Hayes Nancy Shanahan

Telegraph Hill Dwellers

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Subject:	RE: Programmatic Agreement, SF Waterfront Coastal Flood Study
Date:	Monday, June 9, 2025 4:41:00 PM
Attachments:	05-22-25 SHPO comments response TABLE.xlsx 2025-05-02_REDLINE_SHPO_PA - Copy.docx San Francisco Waterfront Coastal Flood Risk Management 06-09-2025.pptx

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Good afternoon,

It was wonderful to discuss the PA with those of you who were able to make it to the meeting today. We greatly value your participation. For those unable to make today's meeting, please let me or Mark know if you would like to meet. The slides from today are attached, but are minimal. The meeting was question and answer and discussion of comments received to date from attending parties.

Also attached is a table of SHPO comments received on the previous draft that were addressed in the Revised Draft you are currently reviewing. I'm attaching a redline version of the PA, but the extent of revisions resulted in a mostly red document- hence the table of SHPO comments.

Please send any comments or questions, including any you wish to discuss with us before submitting your formal comments. The review deadline is June 20th, but extensions may be granted upon request.

Thank you,
Holly

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

SUB-APPENDIX D.4
CLEAN WATER ACT COMPLIANCE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.4.1
CLEAN WATER ACT SECTION 404(B)(1) ANALYSIS

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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1.0 Introduction

The U.S. Army Corps of Engineers (USACE) and the Port of San Francisco (non-Federal sponsor) are conducting the San Francisco Waterfront Coastal Flood Study (SFWCFS) feasibility study to investigate and identify ways to reduce coastal flood risk along 7.5 miles of the San Francisco Waterfront by evaluating alternatives to meet current and future coastal flood risk management needs. To evaluate potential environmental impacts, USACE prepared an integrated feasibility report and environmental impact statement (IFR/EIS).

This document presents the Clean Water Act (CWA) Section 404(b)(1) evaluation for the study pursuant to Section 404 of the CWA. This document addresses the substantive compliance issues of the Clean Water Act 404(b)(1) Guidelines (40 Code of Federal Regulations [C.F.R.] § 230.12(a)) and Public Interest Factors (33 C.F.R. § 320.4 as reference). The measurements outlined in this document are based on feasibility level design, which will undergo further design and analysis in the design phase. This analysis would be updated as design is refined pursuant to any changes that may occur. Additionally, a wetland delineation would occur during the design phase. This document evaluates the USACE's Recommended Plan First Actions as described below in Section 2.2 – Description of the Recommended Plan. In the future, if USACE gets authority and appropriations to implement any of the proposed Subsequent Actions features, USACE will evaluate those features in a separate CWA Section 404(b)(1) evaluation.

1.1 Study Overview

Low-lying assets and economic activity along the San Francisco Waterfront are at risk of flooding from coastal storms, extreme high tides, and relative sea level change (RSLC). Consequently, the study area is also at risk from potential failure of the century-old San Francisco seawall, which could result from structural instability, land subsidence, or an earthquake. Without Federal action, it is expected that future RSLC will increase the frequency and depth of tidal flooding along the shoreline, thereby increasing economic damages and coastal storm risk to one of the nation's most iconic waterfronts.

This study is being conducted under the authority of Section 110 of the Rivers and Harbors Act of 1950 and Section 142 of Water Resources Development Act (WRDA) 1976, as amended by Section 705 of WRDA 1986, and Section 203 of WRDA 2020. The purpose of the study is to investigate and identify ways to reduce coastal flood risk along 7.5 miles of the San Francisco Waterfront by evaluating alternatives to meet current and future coastal flood risk management needs.

The non-Federal sponsor (NFS) for the study is the Port of San Francisco (Port). The Port oversees the administration of the public trust for the State of California under the Burton Act, ensuring that public trust uses such as maritime, public access, historic resources, visitor-serving uses, and water-related and dependent uses are preserved and maintained along the waterfront.

1.1.1 Study Area

The study area extends approximately 7.5 miles from Aquatic Park in the northeast to just past Heron's Head Park in the south. The study area is divided into four reaches and fifteen sub-reaches for conducting and evaluating coastal process and economic analyses (**Figure D.4.1-1**). These reaches were selected based on hydrologic separability, identified geographic references, specific wave action within each reach, and major differences in physical structural inventory within the reach.



Figure D.4.1-1: San Francisco Waterfront Coastal Flood Study Area, Reaches 1-4

1.1.2 Study Scope

The study scope includes an assessment of existing and future without project conditions under a range of RSLC scenarios for a 100-year period of analysis (2040 to 2140). The study evaluated alternatives that meet current and future coastal flood risk management needs. The Project Delivery Team (PDT) is using a 100-year period of analysis because of the long-lived infrastructure, the sensitivity to RSLC, the level of disruption that may be required for adaptation in a highly urbanized locale, and the need for flexibility, adaptability, and scalability in the alternatives to address uncertain timing of increased flood risk due to RSLC.

1.1.3 Revisions from the Draft to Final IFR/EIS

In preparing the final IFR/EIS, USACE evaluated and considered all public and agency comments received on the draft IFR/EIS, as well as refinements the PDT considered after release of the draft report. This resulted in changes to the configuration of the Tentatively Selected Plan (TSP) presented as the preferred alternative in the draft IFR/EIS; however, it did not result in any changes in the conclusions of the draft IFR/EIS regarding the significance of impacts. USACE incorporated the following changes in this final IFR/EIS, consistent with modifications made to the TSP in the draft IFR/EIS, and other clarifications requested by comments on the draft IFR/EIS:

- Based on the PDT evaluation and input, USACE revised the TSP to include four of the seven independent measures for consideration which increased the footprint of NNBFs and incorporated targeted defense in small sub-reaches.
- Revisions to the descriptions of the environmental consequences with the refinements made to the TSP (i.e., impacts of the independent measures are no longer separate, rather incorporated into the analysis).
- Revisions to the descriptions of the affected environment and environmental consequences, including updated analyses, based on public and agency comments.
- Replacement of the tables in the draft IFR/EIS with written descriptions of the affected environment (Section 2) and environmental consequences (Section 4) as suggested during public and agency reviews.
- Added information about the public involvement and agency consultation processes following publication of the draft IFR/EIS.
- Added the following sub-appendices and annexes:
    - Sub-Appendix D.5, Coastal Zone Management Act Compliance
    - Sub-Appendix D.6, Endangered Species Act and Magnuson-Stevens Fishery Management and Conservation Act Compliance
        - Annex D.6.1 – U.S. Fish and Wildlife Service (USFWS) Biological Assessment

        - Annex D.6.2 – National Marine Fisheries Service Biological Assessment and Essential Fish Habitat Assessment
        - Annex D.6.3 – USFWS Concurrence Letter
        - Annex D.6.4 – NMFS Biological Opinion and EFH Concurrence
    - Sub-Appendix D.7, Fish and Wildlife Coordination Act Compliance
    - Sub-Appendix D.8, Marine Mammal Protection Act Compliance
        a. Annex D.8.1, HQ Memorandum
- Incorporated minor technical corrections and clarifications throughout the final IFR/EIS and appendices to improve document readability and to respond to comments received.

1.2 Purpose and Need

This study is being conducted in partial response to the study authority, investigating 7.5 miles of the San Francisco Bay shoreline. San Francisco faces multiple flood and other hazards (including seismic) now and over the next 50 to 100 years threatening its economy, communities, infrastructures, and environment. The purpose of the feasibility study is to frame those multiple risks and make specific recommendations for providing a resilient coastline that could withstand the uncertainties of changing physical conditions. The project area is at risk of flooding from bay water during coastal storms, extreme tides, and future RSLC. Flooding along the waterfront could cause extensive damage to public infrastructure and private property, loss of life and deterioration of public health and safety, degradation of the natural environment, and adverse changes to the social and economic character of the waterfront community. The risk is expected to increase over time as sea levels rise in the bay. Additionally, the study area is in a high seismic hazard region and coastal flood risk measures will be designed in accordance with USACE seismic criteria.

2.0 Proposed Action Alternatives

In accordance with the National Environmental Policy Act (NEPA), and USACE regulation and policy, the final range of alternatives was developed, utilizing concepts from a variety of sources, including the NEPA scoping process and coordination with stakeholders. This final range of alternatives were formulated to reduce the risk of flooding along the waterfront by considering the three USACE sea level rise curve scenarios (low, intermediate, and high), alignment of the line of defense relative to the existing shoreline, and adaptability of the scale of the measures to address higher sea level risks in the future. The array of alternatives are distinctly different alternatives and formulated using three strategies – accommodate, defend, or combination of accommodate and defend/hybrid – to address the problems. The defend strategy is designed to minimize risk at the current shoreline or set back slightly from the shoreline, while accommodate would include measures that allow flood waters to breach the shoreline with people and assets at risk moved out of the way of water. The alternatives

include structural, nonstructural, and Natural and Nature-Based Features (NNBFs) where appropriate and possible. The adaptability of each measure was considered to establish the first increment of scale and timing of construction to ensure performance over the period of analysis.

The final range of alternatives includes the following five alternatives:

- **No Action (NED Low Curve)**: No action is taken by USACE to reduce flood risks beyond projects that have already been implemented or are approved for implementation along the San Francisco waterfront.
- **Alternative B (NED Intermediate Curve)**: Proposes nonstructural measures such as relocation, raise in place, floodproofing, and zoning in areas identified with frequent flooding.
- **Alternative F**: Uses a combination of structural, nonstructural, and NNBFs to defend at the existing shoreline, except for some managed retreat inland along the southern waterfront and tide gates at the mouths of Islais and Mission creeks. Additional retreat and adaptations are proposed as the rate of RSLC increases.
- **Alternative G (NED High Curve)**: Uses a combination of structural, nonstructural, and NNBFs to defend against the high rate of RSLC. This alternative concedes the largest area for managed retreat and incorporates more nonstructural and NNBF measures.
- **Total Net Benefits Plan (Recommended Plan):** Hybridized plan that relies on defend measures, scaled to perform under a lower initial risk and to adapt to risk of a higher rate of RSLC as a potential end point. Initial actions are proposed to delay expenditures and add height or adapt measures as risk increases over later years. This alternative hybridizes nonstructural, structural, and NNBF from multiple action alternatives. The independent measures for consideration from the draft IFR/EIS were integrated into this alternative for the final IFR/EIS.

As described in Section 3 of the final IFR/EIS and *Appendix A: Plan Formulation*, following the evaluation of the final range of alternatives, the PDT selected the Total Net Benefits Plan (TNBP), a hybridized plan, as the Recommended Plan (Section 2.2), based on how well the measures met the purpose and need statement and study objectives, with consideration of environmental, economic, and social effects. The Recommended Plan includes the independent measures from the draft IFR/EIS. This CWA Section 404(b)(1) evaluation is for the preferred alternative, also called the Recommended Plan.

Additional details on the plan formulation process, alignments and measures developed for the action alternatives can be found in *Appendix A: Plan Formulation*.

2.1 Availability of Less Environmentally Damaging Practicable Alternatives to Meet the Project Purpose

As stated earlier in this section, the feasibility analysis was conducted using the formulation process for Civil Works projects to identify the Recommended Plan. The analysis was also performed on a regional basis to aid with the identification and comparison of project measures across the project area. The following section documents the analysis which resulted in the identification of the least environmentally damaging practicable alternative (LEDPA).

Alternative A -No Action was eliminated because it would not meet the purpose and need statement and would not meet the project objectives. The action alternatives identified as the final array all performed well in terms of costs and benefits, meeting the study goals and objectives, and meeting the purpose and need. Each are considered practicable and reasonable. From these alternatives, the PDT determined that the LEDPA is Alternative B- Nonstructural Plan. This plan avoids any beneficial or adverse impacts to aquatic habitats and waters of the U.S. since there would be no in-water work or bay fill. Alternative B was not selected for recommendation because while reasonable and practicable, there would still be life safety risks and disruptions to the daily use of the waterfront (e.g., impacts to the transportation system, movement of people and goods, availability of services, tourism, and recreational opportunities; ability of emergency services to render aid) by allowing floodwaters to enter the study area, with defense occurring on a structure-by-structure basis. The remaining three final array alternatives (TNBP, Alternative F, and Alternative G) all minimize life safety risks, but each have varying levels of aquatic impact.

The PDT reviewed the next least environmentally damaging plan, which was identified as the TNBP. The TNBP has the least aquatic impacts of the plans that defend the waterfront from floodwaters and minimize life safety risks. This alternative avoids and minimizes aquatic impacts to the greatest extent possible by aligning the flood defenses landward of the existing shoreline. The TNBP has approximately 9 acres of unavoidable adverse impacts with bayfill; however, the other two practicable alternatives each have greater unavoidable impacts. Additionally, the TNBP incorporates NNBFs into the design which would improve the quality and increase the quantity of aquatic habitats in the study area over the long-term.

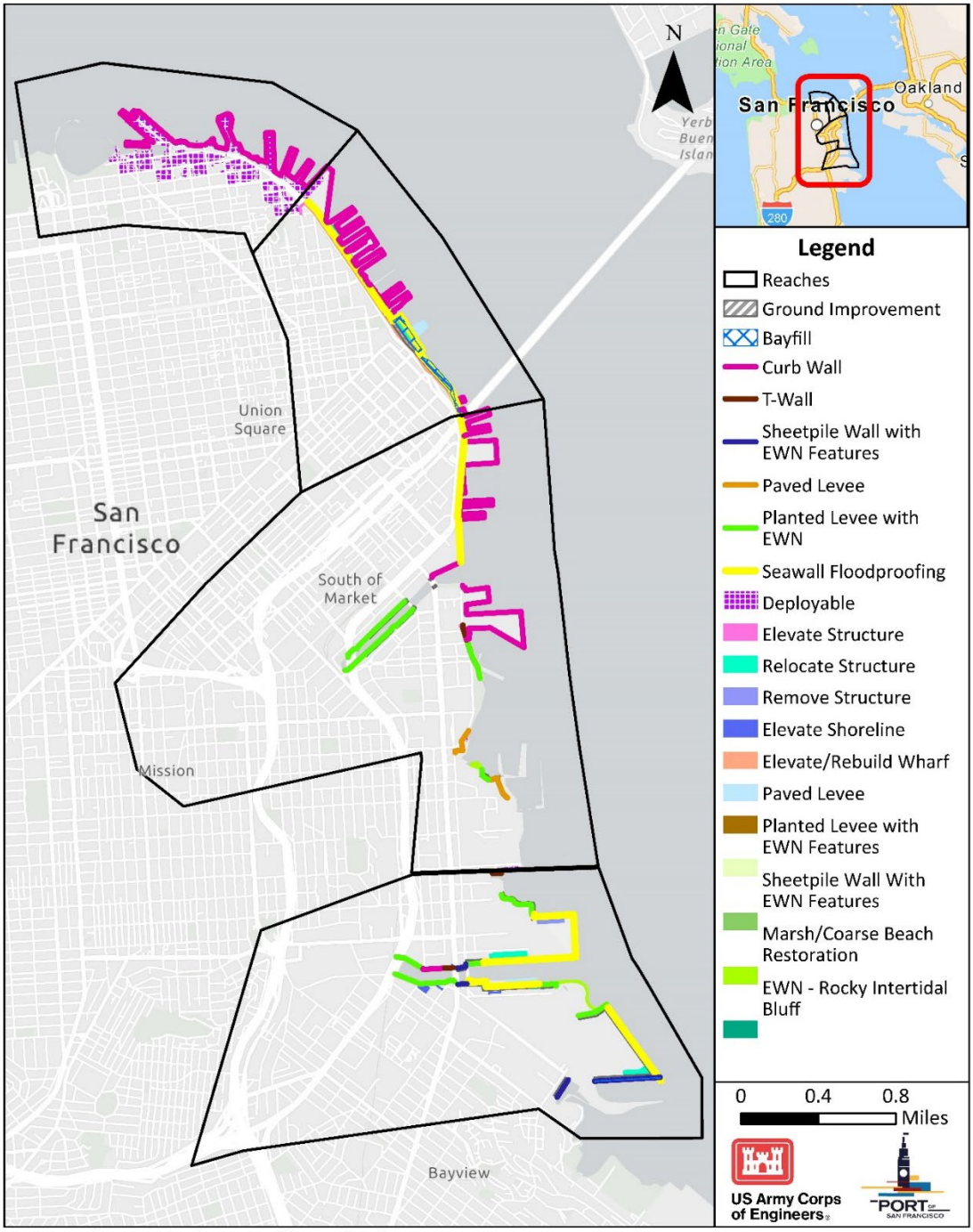
2.2 Description of the Recommended Plan

As mentioned previously, the preferred alternative, the Recommended Plan, includes a combination of measures: nonstructural methods (i.e., floodproofing, retreat, building demolition); raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. **Table D.4.1-1** provides a summary of the measures proposed within each reach of the Recommended Plan.

Table D.4.1-1: Measures Within Each Reach of the Recommended Plan

Measure	Reach 1	Reach 2	Reach 3	Reach 4
Floodproofing	●	●	●	
Deployable		●	●	●
Elevate Structures		●	●	●
Relocate Structures				●
Remove Structures				●
Curb Wall	●	●	●	
Elevate Shoreline		●	●	
Seawall		●	●	●
T-wall			●	●
Elevate/Rebuild Wharf		●	●	●
Paved Levee			●	
Planted Levee with NNBFs		●	●	●
Sheet Pile Wall with NNBFs				●
NNBF – Marsh/Coarse Beach Restoration			●	●
NNBF – Rocky Intertidal Bluff		●		
NNBF – Living Seawalls		●	●	●
Bay Fill		●		
Ground Improvements		●	●	●

The project map provides an overview of where proposed features would occur along the San Francisco waterfront, simplified to polygons of the construction footprint (**Figure D.4.1-2**). Detailed maps are provided in Sections 2.2.1 through 2.2.4 that define the measures occurring in each reach, with anticipated construction footprint. Section 2.2.5 includes a detailed description of measures, their anticipated construction methodology, and expected construction duration where available.



San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Figure D.4.1-2: Overview of footprint for the Recommended Plan

Approximate spatial extent (e.g., linear feet, acres) for the construction footprint are provided in **Table D.4.1-2**. A general description of the construction methods and equipment, as well as anticipated duration for construction is provided below.

Table D.4.1-2: Recommended Plan Measure Quantities

Measure	Linear Feet (LF)	Square feet (ft^2)	Acres
Floodproofing	--	2,835,000	65
Deployable	--	50,000	1
Elevate Structures	--	750,000	17
Relocate Structures	--	175,000	4
Remove Structures	--	195,000	4
Curb Wall	51,200	--	--
Elevate Shoreline	11,500	1,030,000	24
Seawall	21,000	--	--
T-wall	1,000	--	--
Elevate/Rebuild Wharf	10,900	660,000	15
Paved Levee	1,800	80,000	2
Planted Levee with NNBFs	11,800	865,000	20
Sheet Pile Wall with NNBFs	2,900	20,000	0
NNBF – Marsh/Coarse Beach Restoration	--	225,000	5
NNBF – Rocky Intertidal Bluff	--	85,000	2
NNBF – Living Seawalls	TBD	--	--
Bay Fill	--	395,000	9
Ground Improvements	38,400	--	--

**Note: Linear feet (LF) are rounded to the nearest 100 feet, square feet (ft^2) are rounded to the nearest 5,000 ft^2, and acres are rounded to the nearest whole number. Values denoted as "—" indicate the measurement was not calculated or applicable.*

There are common construction techniques that would be applied across an array of measures, thus, are summarized here to avoid repetitive descriptions:

- **Cast-in-place concrete** is poured into removable forms (or castings) erected on site and cured in the concrete's finished position. Temporary forms or castings would be constructed on site and would be reinforced with steel. Most formwork would be composed of steel, aluminum, and wood. Ready mixed concrete would

be delivered via large cement trucks and poured into the castings with a truck chute, bucket, or pump. The concrete is left to cure in the castings before removal. Once cured, casting materials would need to be removed and reused for another measure or hauled off and disposed of.

- **Cofferdams** are an enclosure that allows water to be pumped out to establish a dry working environment. A cofferdam would be constructed from steel sheet piles with interior bracing. Sheet piles would be driven into the sediment in the bay through hydraulic or pneumatic tools, braced internally with waler beams and compression struts to keep the wall from collapsing. Braces would be installed using heavy machinery from work barges in the bay. Inside of the cofferdam would be un-watered and dewatered with a combination of surface pumps/sumps and deep wells as necessary to create a dry and stable work environment. Once construction completes, the cofferdam would be disassembled and removed. For simplicity, it was assumed cofferdams would be installed across 50 linear ft at a time.

Sections 2.2.6 and 2.2.7 outline proposed avoidance and minimization measures, and Best Management Practices (BMPs).

2.2.1 Reach 1

Reach 1 focuses on nonstructural measures that move people and assets away from the flood risk. Nonstructural measures reduce consequences of flooding and allow water to disperse naturally rather than constructing traditional structural solutions. In Fisherman's Wharf, the Recommended Plan relies on floodproofing buildings and infrastructure and installing curb walls to floodproof the piers (**Figure D.4.1-3**).



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Figure D.4.1-3: Recommended Plan Reach 1

2.2.2 Reach 2

Along the Embarcadero, the Recommended Plan elevates the shoreline in place by raising and reconstructing the bulkhead seawalls and pile-supported wharves north of the Bay Bridge to a finish elevation of 15.5 feet NAVD88, while gradually transitioning down from the new shoreline elevation back to the existing city grade to retain visual and physical access to the waterfront (**Figure D.4.1-4**). The plan includes reconstruction of the full Embarcadero roadway right-of-way – surface design of the Embarcadero roadway and promenade would be determined in future project phases. The Ferry Building and bulkhead buildings are raised in place following construction of new pile supported foundations (wharves). Piers are floodproofed with concrete curbs around the perimeter to reduce flood risk. NNBFs have been incorporated into some of the designs to support the long-term resiliency of the structural measures proposed while providing natural features to enhance the aquatic habitats.

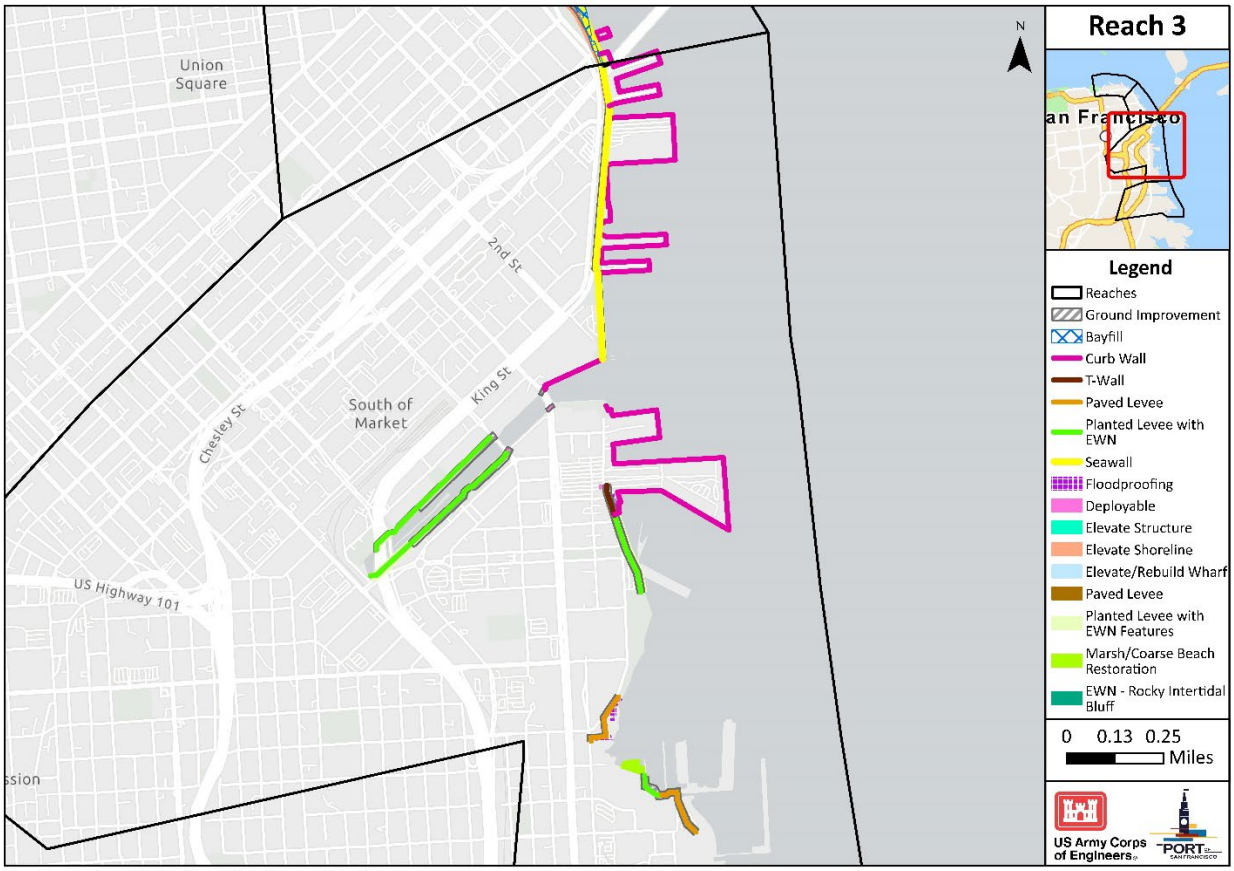


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Figure D.4.1-4: Recommended Plan Reach 2

2.2.3 Reach 3

In the Mission Creek / Mission Bay geography, the Recommended Plan defends existing city and community assets in place by elevating the creek and Bay shorelines to a finished elevation of 13.5 feet NAVD88 with raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls, natural and nature-based features, and closure structures (**Figure D.4.1-5**). The coastal defense will tie into existing and planned high ground at Bayfront, Agua Vista, and Crane Cove Parks, and at the Mission Rock and Pier 70 development areas. The plan also includes partial reconstruction of the Embarcadero roadway south of the Bay Bridge to manage elevation change in this constrained urban area.



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Figure D.4.1-5: Recommended Plan Reach 3

2.2.4 Reach 4

In the Islais Creek / Bayview geography, the Recommended Plan defends the existing shoreline to retain residential and commercial land uses in place, including Port land uses and maritime facilities. The flood defenses consist of raising the shoreline using bulkhead seawalls, levees, natural and nature-based features, floodwalls, closure structures, and tying into existing or planned high ground, near Potrero Power Station and behind the Pier 94 Wetlands (Port backlands). This area of the waterfront contains large parcels independent of the combined sewer system, such that the elevated shoreline will require modification to handle stormwater in a safe and effective manner (**Figure D.4.1-6**).

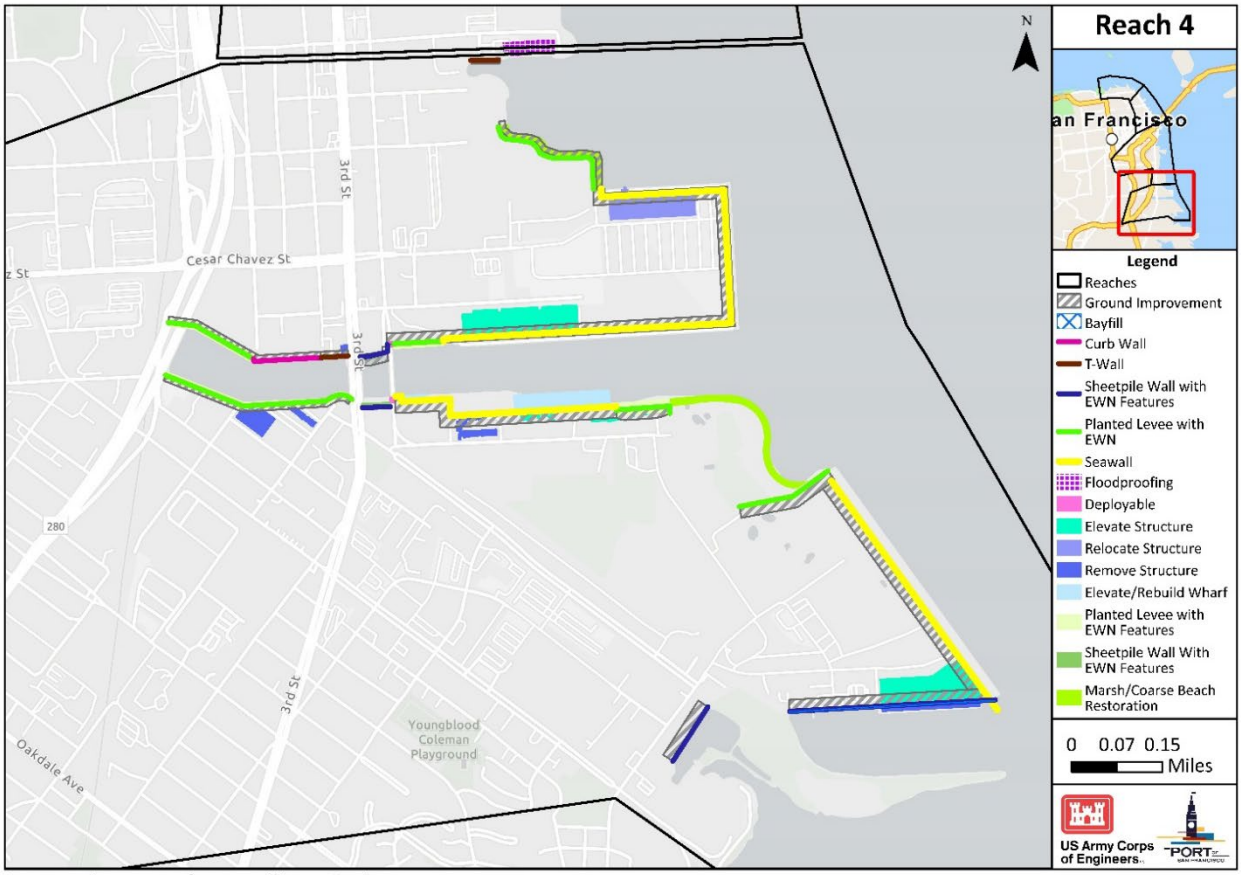


Figure D.4.1-6: Recommended Plan Reach 4

2.2.5 Measure Descriptions

2.2.5.1 Floodproofing

There are two types of floodproofing – wet and dry floodproofing. As the name implies, wet floodproofing allows floodwaters to enter the structure, while, in contrast, dry floodproofing prevents the entry of floodwaters. Dry floodproofing is proposed for industrial and commercial properties and critical infrastructures and wet floodproofing is proposed for residential structures.

Wet floodproofing measures involve permanent or temporary measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure. Generally, this includes properly anchoring the structure, using flood resistant materials below the Base Flood Elevation, relocating and/or protecting mechanical and utility equipment, and use of openings or breakaway walls to avoid structural damage due to hydrostatic pressure and to allow flows to enter and exit the structure. Wet floodproofing is practical only for portions of a

structure that are not used for living spaces, such as basements, elevated structures, crawlspaces, or attached garages.

Floodproofing activities would be completed in phases based on flooding frequency over a given period. Those with imminent risk would be completed first and properties where the risk rises as sea levels rise would be floodproofed when appropriate. The type of floodproofing would be structure dependent. Each structure would be evaluated independently of the others for what would be the most appropriate and least invasive method of flood protection possible that would still retain the integrity of the structure.

Many of the properties in the study area are considered historic and are eligible or listed on the National Register of Historic Places under the National Historic Preservation Act. For these historic structures, the National Park Service's "Guidelines on Flood Adaptation" will be used to aid in identification of appropriate measures to increase flood resiliency while meeting the Secretary of the Interior's Standards for Rehabilitation and preserving the property's historic features, spaces, materials, site, and setting.

2.2.5.2 Deployables

Deployable gates would be used to close the openings at bridges and where additional tie into high ground is needed during high water events, while allowing continued vehicular, pedestrian, and rail access at all other times. A range of potential deployables may be used depending on the location, type of access needed, frequency of use, anticipated flooding conditions, operation and maintenance needs, etc. and may include swing gates, roller gates, flip up barriers, or other removable deployables (**Figure D.4.1-7**).

Permanent deployables are designed for temporary deployment during storm events or king tides. Typically, they are constructed of structural steel elements with a steel plate skin and tied into the adjacent flood protection measures (i.e., levee or vertical wall). Swing gates are attached to a reinforced column of a flood wall with hinges on one side, while rolling gates rest and roll on a ground wheel carrier or track along the gate sill.

When closed, compressible seals along the bottom and sides of the gate seal against the wall and sill to resist water infiltration. Depending on the height and width, additional bracing can be placed on the dry side of the gate to help it withstand the pressure of the water. Gates can have the option for a manual cranking system to close depending on size, but many times a motorized opening/closing device is required. Traffic control measures would be added to the bridges to warn of gate deployment when activated.



Figure D.4.1-7: Example of Permanent Deployable Flood Gates

2.2.5.3 Elevated Structures

Structure elevation involves raising each structure to a higher elevation to reduce the risk of flooding during high-water events. To do this, the structure is separated from its foundation and temporarily raised in place with hydraulic jacks. The new foundation system, such as fill, columns, posts, piers, or raised foundation walls, would be constructed and then the structure lowered into place on the new foundation system. The goal is to ensure the lowest habitable floor is at or above the base of flood elevation or higher. Selection of proper elevation method depends on flood characteristics such as flood depth or velocity.

2.2.5.4 Relocate/Remove Structures

Structures may be removed from the existing location to eliminate the potential flood risk or to make room for the proposed flood protection system. Structures identified for relocation will be physically relocated or rebuilt in another location off-site to be determined during the preconstruction, engineering, and design phase (PED). Structures identified for removal will be permanently removed and not rebuilt in place or elsewhere.

For structures being relocated, the structure may be transported in whole or disassembled and then reassembled at the new location. For whole structure transport, the structure is typically done by attaching a temporary steel framework under the structure to support it, then lifted off the foundation using a network of hydraulic jacks placed under the framework and controlled by a unified jacking system. Once the structure is at a sufficient height, hydraulic dollies or a flatbed trailer(s) are placed under the supporting framework. These are used to move the structure to the new location. After the move, the steps are reversed, and the structure is lowered.

In some instances, buildings being relocated would require modifications to allow for moving, and to make structural improvements to meet current building codes and standards once re-established on their new foundation. This is most likely to apply to historic bulkhead and shed building structures that are part of the Embarcadero Historic District.

For structures being permanently removed, the material would need to be removed and disposed of. This will require heavy machinery such as wrecking balls, excavators, and

bulldozers. Additionally, the building debris will need to be hauled off using large trucks or barges to an appropriate disposal facility.

2.2.5.5 Curb Wall

A curb wall is a short wall, approximately two feet tall and no more than one-foot wide, made of reinforced concrete that will be connected to existing gray infrastructure (e.g., wharfs, piers, seawalls) to minimize floodwater entry into adjacent structures (**Figure D.4.1-8**). The curb wall will be fixed to a concrete deck or capping beam along the perimeter of the main structure. For the feasibility study, the curb wall was assumed to be constructed of either cast-in-place concrete or precast concrete elements which are attached mechanically, both of which would include some type of water stop integrated to ensure an acceptable seal against seepage. During the design phase, other elements such as glass or clear polymer panel that would provide similar functionality may be considered to minimize visual impacts from the land or Bay.

If cast-in-place concrete is used it would be constructed by pouring concrete into removable forms (or castings) erected on site and cured in the structure's finished position. Temporary forms or castings would be constructed on site and would be reinforced with steel. Most formwork would be composed of steel, aluminum, and wood. Ready mixed concrete would be delivered via large cement trucks and poured into the castings with a truck chute, bucket, or pump. The concrete is left to cure in the castings before removal. Once cured, casting materials would be removed and reused for another location or measure or hauled off for disposal.

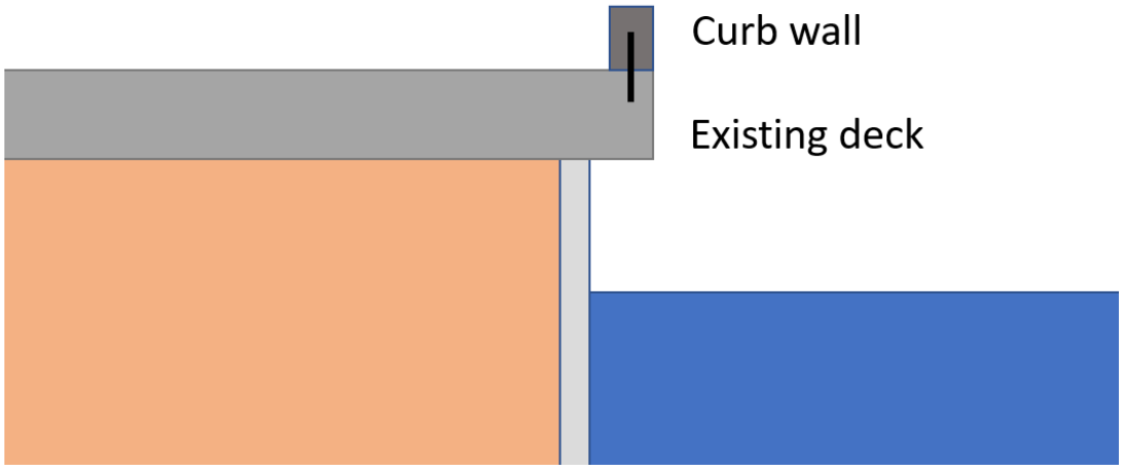


Figure D.4.1-8: Example Curb Wall

2.2.5.6 Bulkhead Seawall

A seawall, synonymous with bulkhead wall, is a retaining wall structure that supports earthen fill on one side and protects against erosion caused by a waterbody on the

other side. The seawall is the defined line of defense for the protection system. The design height of each seawall is the basis for how high the wharf or shoreline must be raised.

Seawalls are subdivided into two categories, 1) seawalls less than 30ft in vertical height from the seafloor, and 2) seawalls greater than 30ft in vertical height from the seafloor. The two different height groups roughly correspond to the anticipated maritime use along the wall but also require different means of construction due to their scale and access for construction along the shoreline. Seawalls greater than 30 feet in height generally will require shoreline raises and/or wharf reconstruction and elevation if they are present, while seawalls less than 30 feet in height will typically only need the seawall itself to function as designed and not impeded the existing land uses (**Figure D.4.1-9** and **Figure D.4.1-10**). Shoreline elevation and wharf elevation and rebuilding are described in further detail in subsequent sections.

In general, it was assumed that all seawalls are constructed of concrete. The seawall is either constructed of precast concrete piles driven along the wall alignment at close spacing, then subsequently followed by driven square piles to fit within the interstitial space to fill the voids and create space for a grout pocket or forms would be constructed and filled with concrete. Voids would be grouted to create a low permeability wall that would retain soils and resist erosion of the shoreline. The need for additional anchorage or tiebacks at the top of the wall using steel rods or soil anchors may be needed; however, the best technique for installation will be determined during the design phase.

Construction of the seawall is assumed to be completed from land by using secant pile or diaphragm wall designs. However, if other measures at the location require construction of a cofferdam and dewatering or construction in the “wet”, then the seawall may also employ similar techniques to avoid multiple moves of equipment or additional disruptions.

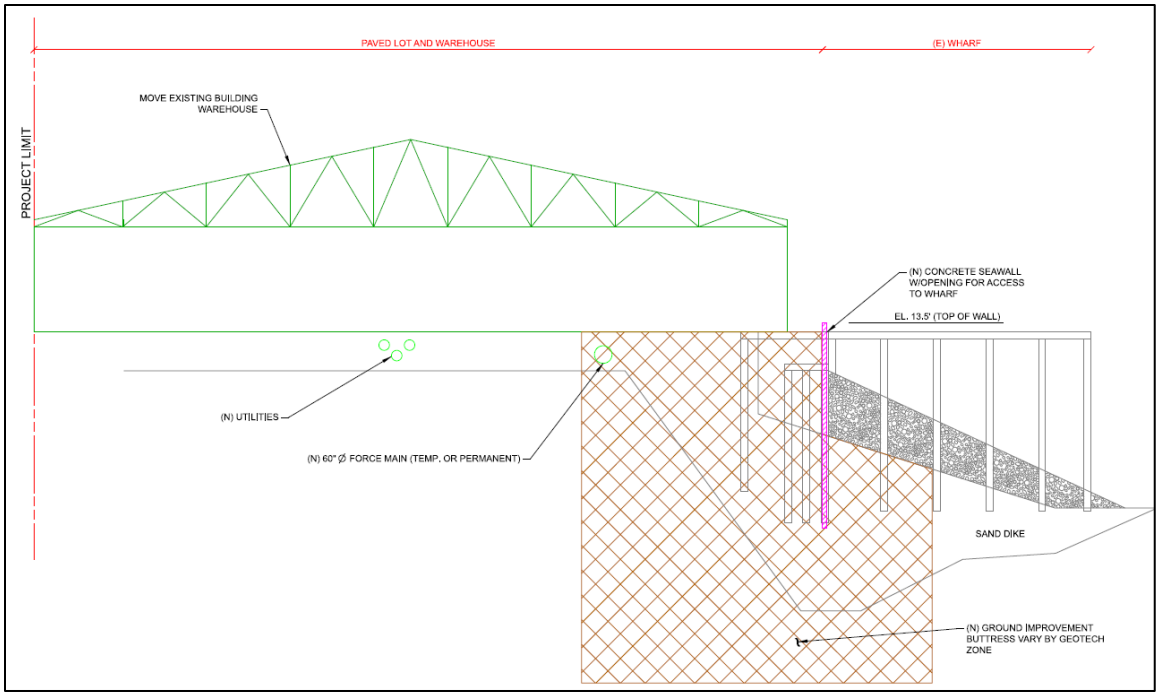


Figure D.4.1-9: Example Cross-Section of a Seawall <30 Feet Tall Where no Wharf or Shoreline Elevation is Needed (e.g., Pier 80).

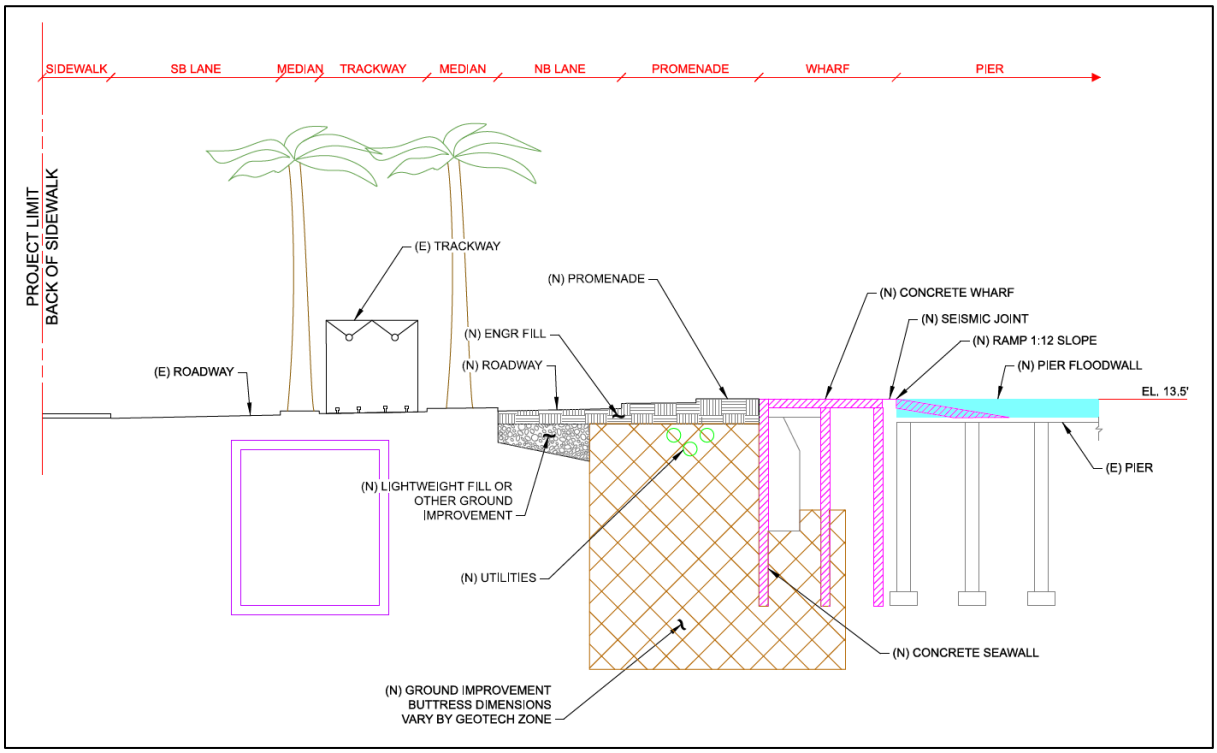


Figure D.4.1-10: Example Cross-Section of a Seawall >30 feet Tall where Wharf and Shoreline Elevation are Needed (e.g., Pier 28)

2.2.5.7 Ferry Building Seawall

At the Ferry Building, the complicated foundation condition and confluence of buried infrastructure warrant a bayward line of defense. A new seawall would be constructed to follow the perimeter of the Ferry Building Structure (**Figure D.4.1-11**). This will require approximately 4.6 acres of bay fill to back fill voids between the new and existing seawall. Fill materials would be imported material.

To construct the new seawalls, a cofferdam around the work area would be constructed and the area landward would be dewatered. Cofferdams are an enclosure that allows water to be pumped out to establish a dry working environment. A cofferdam would be constructed from steel sheet piles with interior bracing. Sheet piles would be driven into the sediment in the bay through hydraulic or pneumatic tools, braced internally with waler beams and compression struts to keep the wall from collapsing. Braces would be installed using heavy machinery from work barges in the bay. The area inside the cofferdam would be dewatered with a combination of surface pumps/sumps and deep wells as necessary to create a dry and stable work environment. Once construction is completed, the cofferdam would be disassembled and removed.

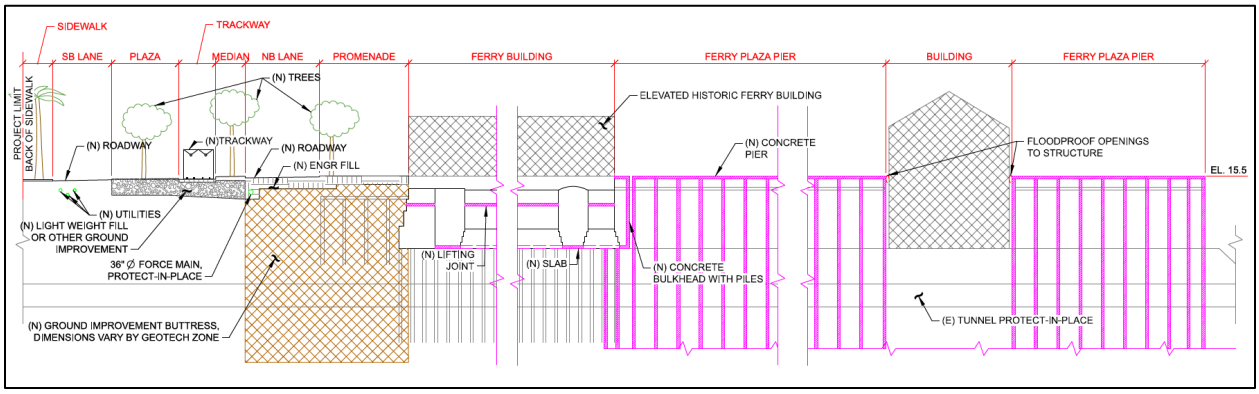


Figure D.4.1-11: Proposed Cross-Section of the Seawall, Shoreline Elevation, and Wharf Raise at the Ferry Building

2.2.5.8 Rincon Park Seawall

At Rincon Park, a new seawall needs to be constructed approximately 60 feet into the bay to mitigate disruption to below grade transit infrastructure and the surface transit corridor in this area (**Figure D.4.1-12**). The Rincon Park seawall will require approximately 4.0 acres of bay fill to fill the void between the new and existing seawall. Construction at this location would be similar to what is described for the Ferry Building and require cofferdam construction.

Additional NNBFs have been added in front of the seawall to provide a natural solution to protecting the new seawall from high tidal energies at this location. The rocky intertidal bluff feature is described further below.

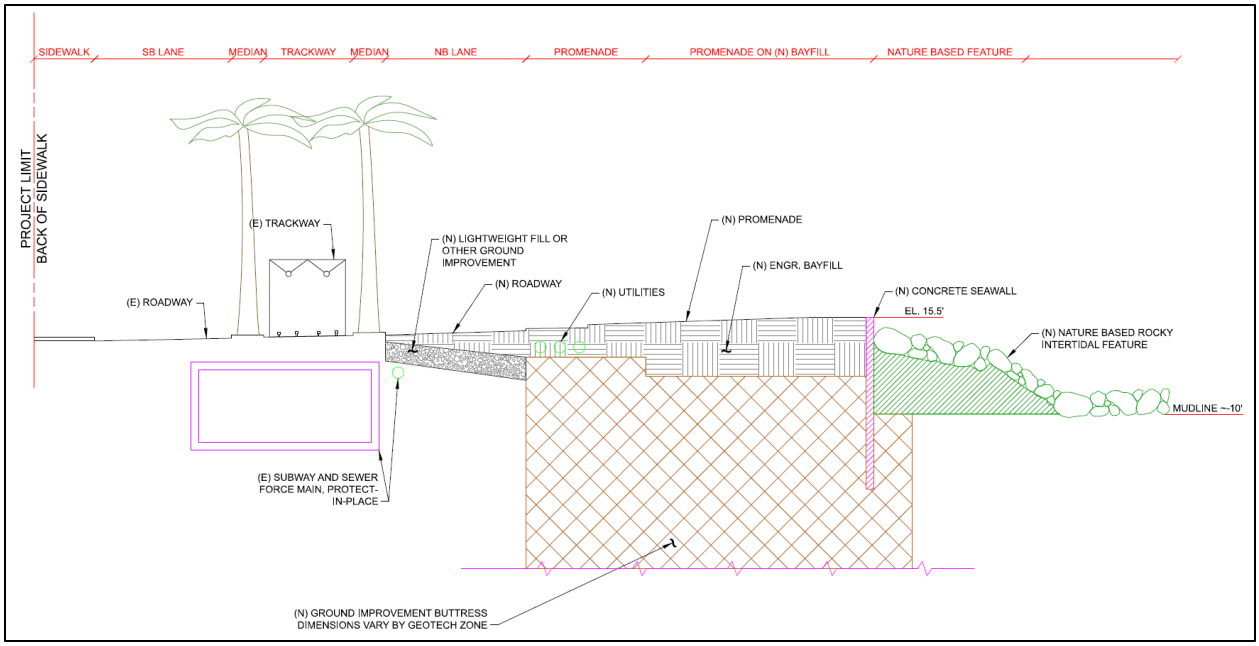


Figure D.4.1-12: Proposed Cross-Section for the Seawall and Shoreline Elevation at Rincon Park

2.2.5.9 T-wall

A T-wall has a cross-section of an inverted “T”, and as designed for this project, is configured with a horizontal base (**Figure D.4.1-13**) and is also the basis for the line of defense where this measure is employed. In some areas, a new pile-supported T-wall would be constructed landside of the existing or integral to a new seawall. At this design level, the T-walls are assumed to be founded on deep foundations consisting of either steel H-piles or pipe piles which could be driven either vertically or battered depending on the design loads and underground site constraints. A steel sheet pile cutoff, extending 20-30 feet vertically beneath the wall base, will be installed to reduce under seepage and uplift pressures on the structure. The pile foundations are assumed to consist of two rows of piles which are 50 feet in length and placed on 5-foot centers along the wall length. The panel height of each t-wall is dependent upon the existing elevation. The base of each t-wall is constructed wider than typical for the designed panel height to accommodate anticipated adaptability for future height increase. These design estimates will be refined in the design phase.

After the T-Wall is complete, the area landward of the T-wall would be regraded using imported fill material. After grading, the fill material would be paved to create sidewalks and landscaping added.

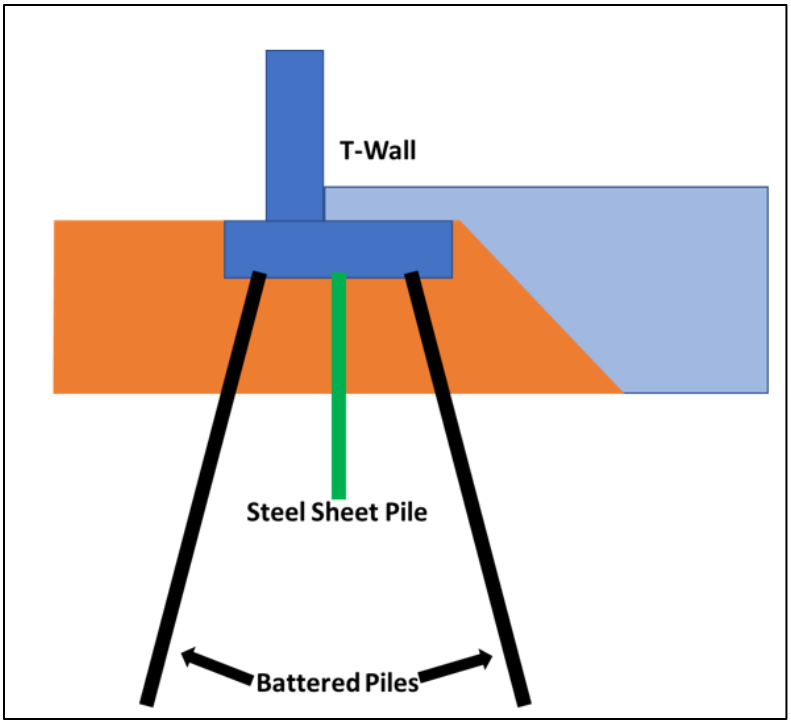


Figure D.4.1-13: Typical T-Wall Cross-Section

2.2.5.10 Elevated Shoreline

Where the existing shoreline elevation is lower than the top of design elevation of the new seawall or T-wall, the shoreline may need to be elevated or raised 3.5 to 7.5 feet to defend against 3.5 feet of sea level rise (13.5 or 15.5 feet NAVD88 top design elevation) (**Figure D.4.1-14**). To raise the shoreline, the area landward of the seawall would be filled with imported material, compacted down, and regraded over sufficient space to facilitate grade transitions, transit, vehicular and multi-modal access along the urban waterfront edge. Roadway, trackway, and promenade configurations are assumed to be generally the same as existing configuration; however, the exact surface configuration will be determined during the design phase.

Shoreline elevation would be constructed using standard earth moving equipment such as graders, bulldozers, dump trucks, etc., after all ground improvement measures have been completed. Any utilities that would be affected would also be relocated or modified to function with the new shoreline design.

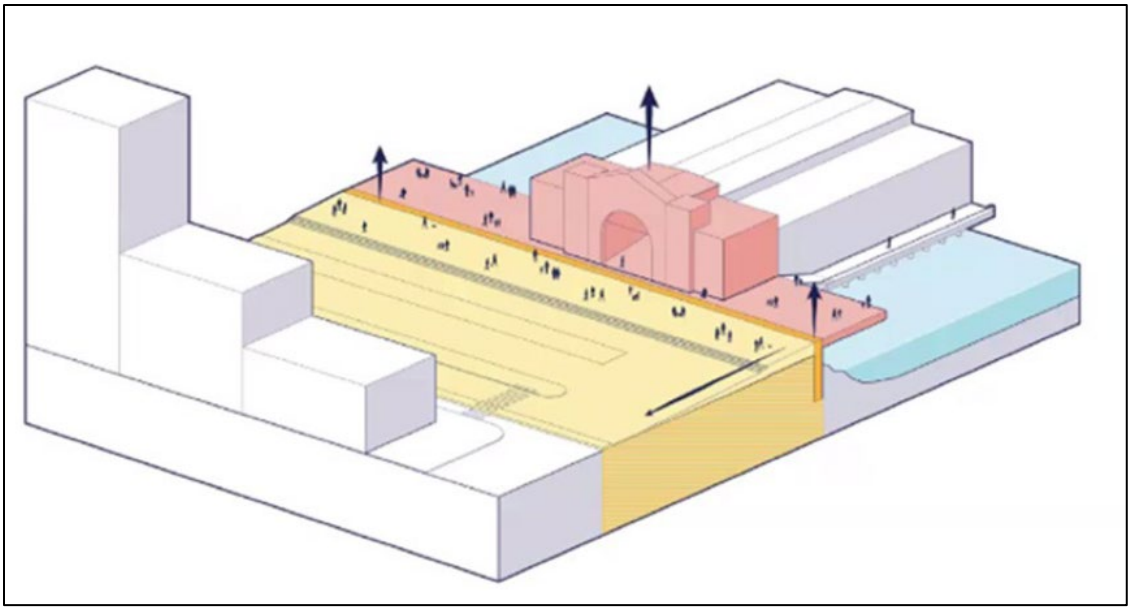


Figure D.4.1-14: Example of Shoreline Elevation (yellow), Seawall Construction (orange), and Wharf Elevation (red)

2.2.5.11 Elevate/Rebuild Wharf

In places where the shoreline is being elevated, the existing bulkhead wharf, typically 50 feet wide running parallel to the shoreline, would also be elevated (**Figure D.4.1-15**). The bulkhead wharf would be replaced with a new elevated reinforced concrete wharf structure with the top of the deck at specified flood defense design elevation.

To construct the new wharf, the existing wharf would be demolished, material removed, hauled away, and disposed of at an appropriate and approved facility. This would entail pulling out old pilings and existing concrete deck and surfacing (concrete or asphalt). The new wharf would then be constructed in the place of the old wharf. First, the 24-inch octagonal reinforced concrete or steel piles, approximately 100 feet long spaced on a 15-foot by 15-foot grid, would be driven through the rock dike down to competent soils using marine equipment and impact or vibratory pile driving techniques. Then, an approximately 12-inch-thick reinforced concrete deck (flat slab) made of pre-case elements or using cast-in-place construction, extending approximately 50 ft over the bay in all locations, except at the Ferry Plaza, would be constructed on top of the newly placed piles. At the Ferry Plaza, the reconstructed, reinforced concrete deck extends approximately 650’ into the bay to provide emergency egress and vehicular access for the Bay Area Rapid Transit system (**Figure D.4.1-11**). During the design phase the design is likely to be refined (e.g., spacing and thickness may vary depending on load bearing, materials used, increase in height, etc.) and additional features may be incorporated such as glass blocks in the decking to allow for light penetration to the water below.

Reinforced concrete ramps would be constructed to allow pedestrian and vehicular access from the elevated wharf to the finger piers, since the finger piers that stretch out into the bay would remain at the existing elevation, unless otherwise noted.

With the new wharf design, less bay fill from pile material is anticipated when compared to the existing bay fill from existing piles; however, the change cannot be quantified at this time due to uncertainty in the number and size of existing piles at each wharf.

Wharf raising may be constructed in the wet using marine or land-based equipment if the wharf raise is not being completed in conjunction with a measure that would require a temporary cofferdam. If a cofferdam is intended to construct other measures at the location, it is anticipated that the cofferdam would not be breached until after all construction is complete including the wharf elevation and rebuild.

For wharves that supports structures, each would be removed, relocated and/or replaced (see description for relocating/removing structures above). For buildings requiring relocation and replacement back on the wharf, it is assumed that these buildings would be either braced and moved to a temporary location (on land or to floating barge) or carefully dismantled and stored until the new wharf is constructed. Once the new wharf is constructed the structure(s) would be moved back or reassembled.

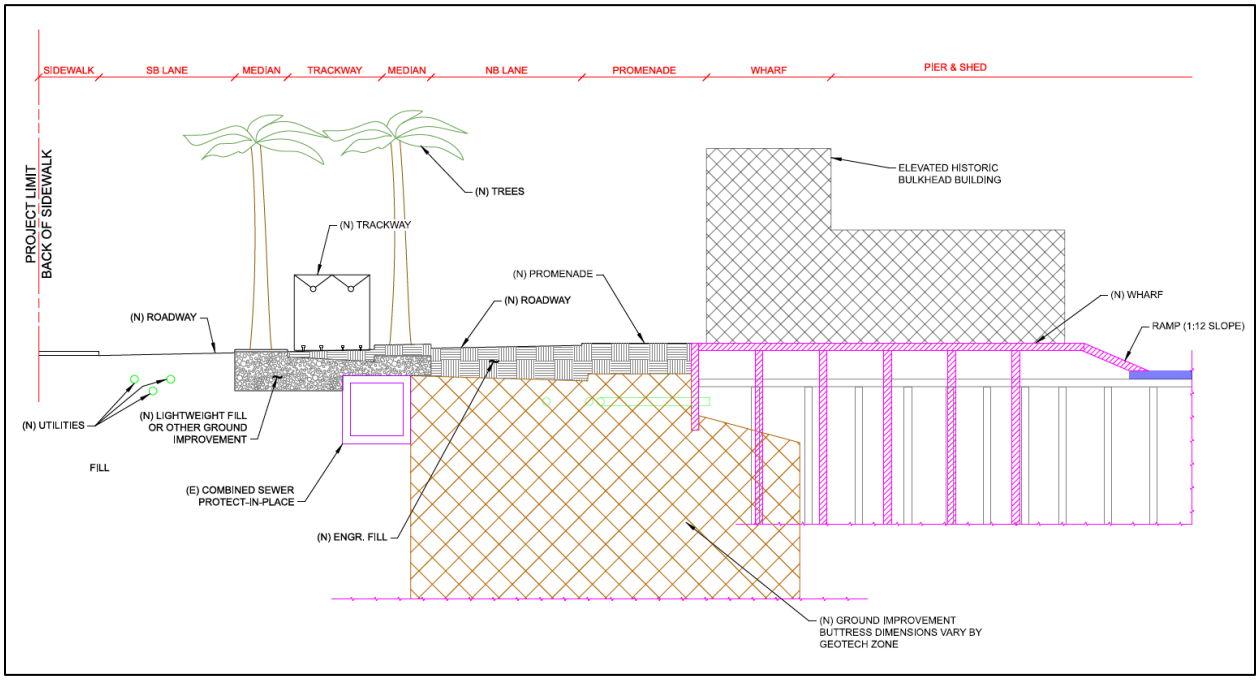


Figure D.4.1-15: Example Cross-Section with an Elevated Shoreline, Elevated and Rebuilt Wharf, Elevated Structures, and a Ramp Down to the Existing Finger Pier (e.g., Pier 3)

2.2.5.12 Paved Levee

The levees would be designed as a raised earthen bank with a trapezoidal cross-section with a wider base that slopes up to a narrower crest to fortify against flooding risks (**Figure D.4.1-16**). For this phase of the study, the side slopes were assumed to be no steeper than 3H:1V. It is likely that in locations where vehicle passage is necessary the slopes may range from 5H–10H:1V and on piers the slopes may be 12H:1V to accommodate Americans with Disabilities Act (ADA) accessibility requirements. The required levee height and width is dependent on local existing elevations and the final flood side design side slope and configuration. The height of the levee could range from one to 10 feet to achieve the target design elevation of 13.5 feet in reach 2. The crest width of the levee may range from 10 to 20 feet.

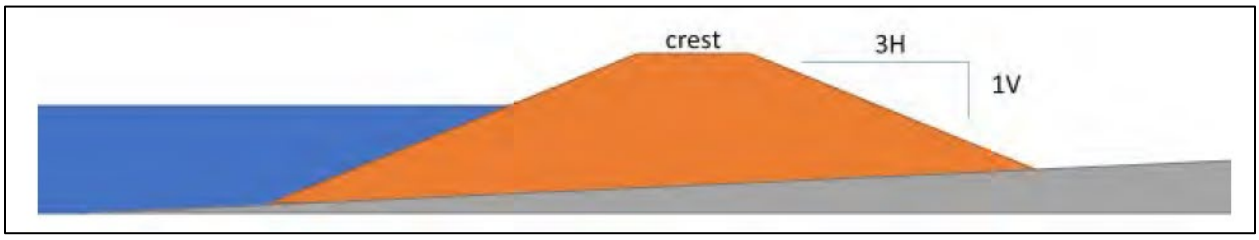


Figure D.4.1-16: Typical Cross Section of a Levee

To construct the levees, first any existing vegetation, structures, roadways or parking lots along the proposed alignment would be removed and all material disposed of offsite. If utilities are within the alignment, they would need to be relocated prior to construction beginning. The project site would then be prepared for the levee foundation, which may include but is not limited to grading/stripping earthwork, adding or removing subgrade materials, drainage improvements, ground improvements, etc. The levees would be constructed of imported impervious earthen fill material, assumed to be procured from a commercial source near San Francisco and delivered to each site via dump truck. Fill would be placed in layers and compacted to reach the desired strength, width and height. For levees with a crest height ≥ 4 ft, a 20-foot-deep continuous vinyl sheet pile seepage barrier would be installed along the centerline of the structure using a vibratory or impact hammer to prevent undermining of the levee. Once complete, the levee would be dressed in a combination of commercially sourced bedding stones, rip rap/armoring stones, concrete, and/or pavement depending on the location of the structure and long-term use (**Figure D.4.1-17**). Any existing bike lanes, bay trails, or roadways disrupted by the new structure would be relocated or built into the overall design of the structure (e.g. crest may be converted to a paved bike path or walking trail), which will be determined during the design phase (**Figure D.4.1-18**).

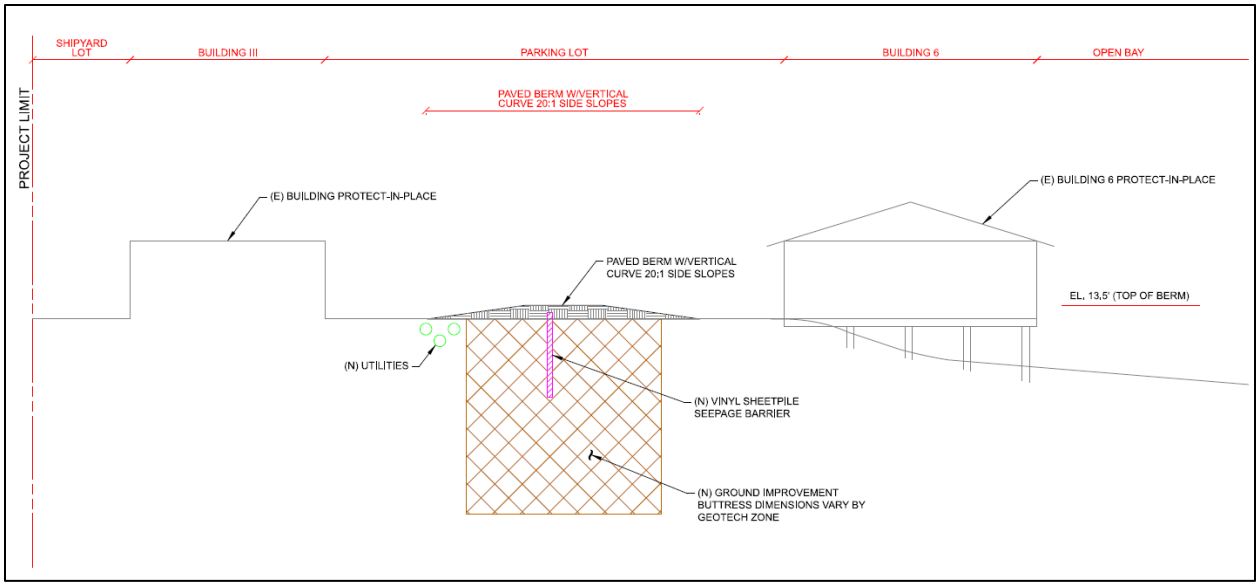


Figure D.4.1-17: Example Cross-Section of a ≥ 4 ft Levee with a Paved Surface (e.g., Shipyard)

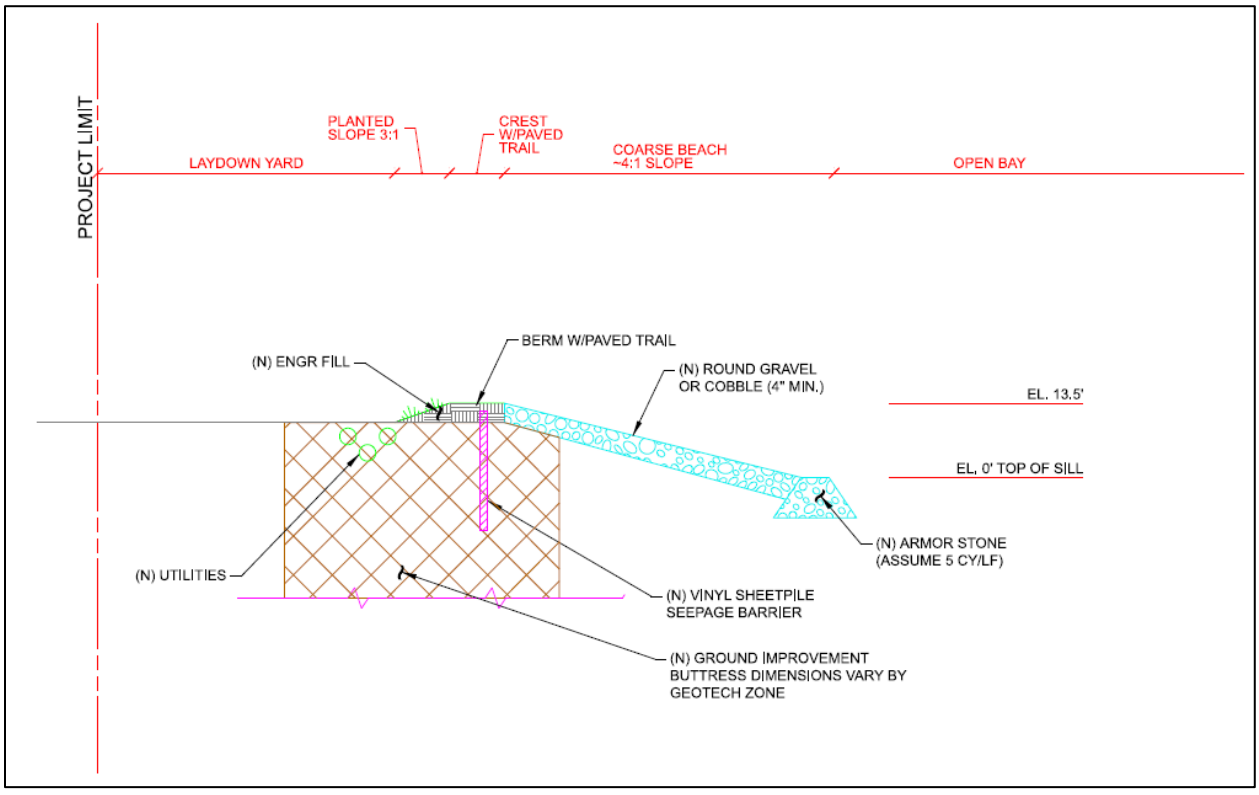


Figure D.4.1-18: Example Cross-Section of a ≥ 4 ft Levee with a Paved Trail on the Crest and Armoring Stones on the Bayward Slope (e.g., Warm Water Cove)

2.2.5.13 Planted Levees with NNBFs

The planted levees would be constructed in the same manner as the Paved Levees measure except that the levee surface would be dressed in more native materials and pervious type surfaces and the side slopes may have gentler slopes to incorporate NNBFs. This style levee typically connects the levee to terrestrial or aquatic habitat and can provide high quality transition zone habitat when vegetated with native plants. The slopes of these structures will typically vary between 10H:1V in space constrained areas to 30H:1V in isolated areas where real estate is not restrictive.

Each levee would be constructed of commercially sourced imported impervious earthen fill material same as the paved levee, but the topsoil would need to be specified based on the vegetation type anticipated to cover the slope. The final design of the planted levee and the type of NNBF incorporated at each location will be dependent on site-specific conditions including real estate constraints, adjacent habitat types that can be connected, desired species composition and recruitment, and long-term use of the area. Each of the design would provide erosion control and stabilization of slopes using biological, mechanical and ecological concepts while providing floodable area in storms and extreme tides. The additional NNBFs may be constructed of many different materials and textures to create a layered approach that can be refined to suit site and design needs. Additionally, each designs considered avoids introducing material into open water areas to avoid bay fill, but over the long-term would increase available aquatic habitats as RSLC occurs.

For space constrained locations, such as areas along the lower creek banks of Islais and Mission Creeks, creek enhancements can fit within the footprint of traditional levees and may include features such as habitat shelves or terraces, planted edges, live crib walls, and other measures that increase surface complexity (**Figure D.4.1-19**).

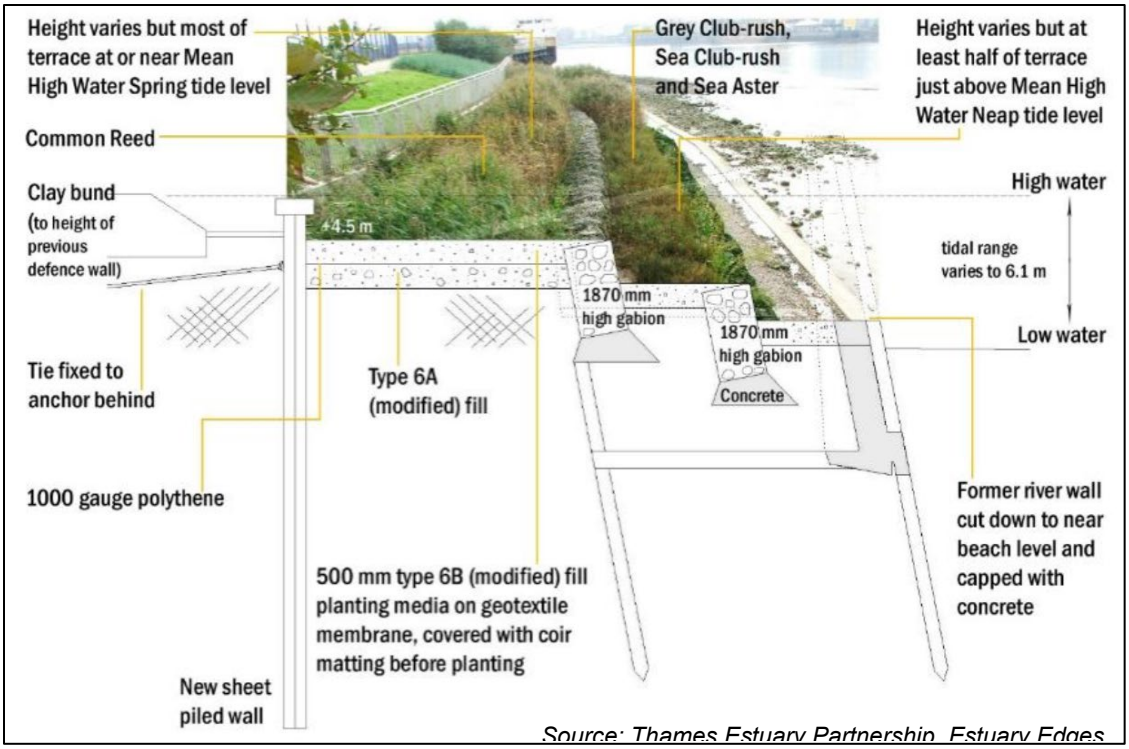


Figure D.4.1-19: Example Creek Enhancements on the Thames Estuary

Where space is available, a gentle slope may be graded to support multiple transition zones and may feature a levee with side slopes greater than 10H:1V. At the crest upland habitat would be created and transition to riparian, marsh and/or beach habitat to open water on the bayward side slope (**Figure D.4.1-20** and **Figure D.4.1-21**). For levee with a steeper grade slope, vegetated riprap may be incorporated while gentler slopes may rely entirely on native materials.

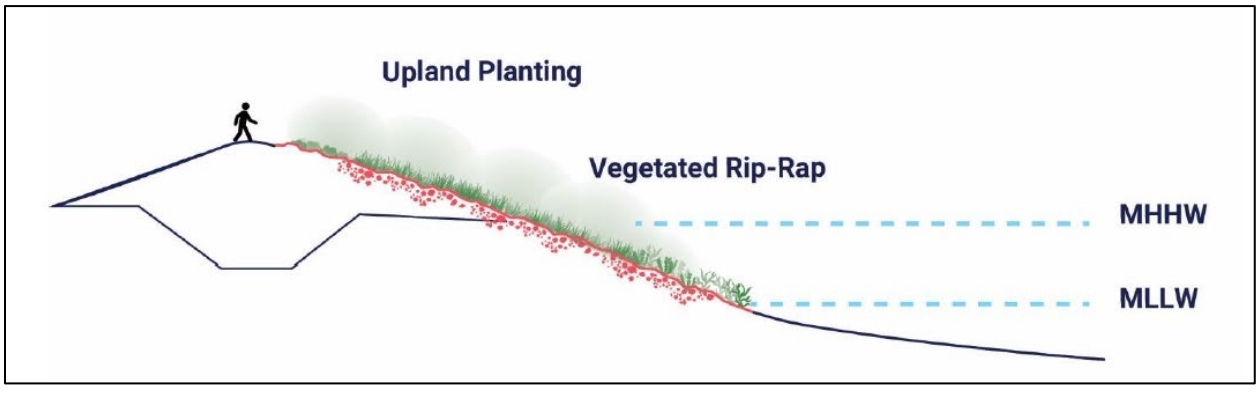


Figure D.4.1-20: Example Cross-Section of a Planted Levee Where a Moderate Amount of Space is Available (~10H:1V slope).

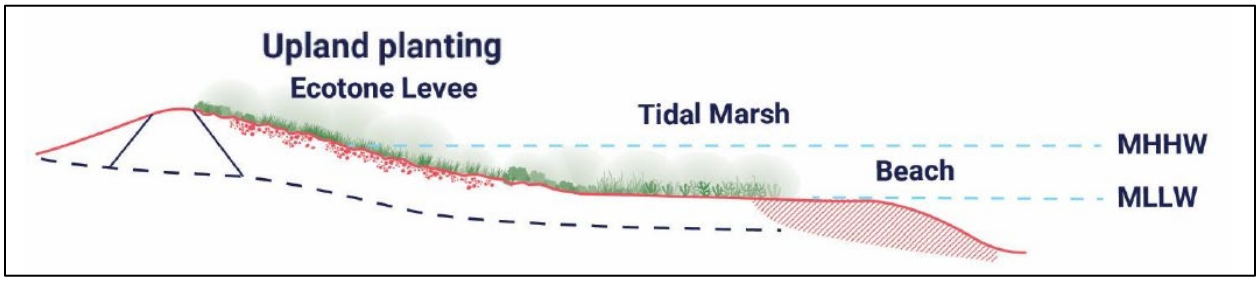


Figure D.4.1-21: Example Cross-Section of a Planted Levee Where Considerable Space Available (~ 30H:1V slope).

Vegetated riprap, or ecological armoring, is armoring a direct replacement for traditional riprap that aims to replicate the natural processes and functions of rocky, intertidal habitat. Interlocking layered armored protection units or differently shaped riprap, sometimes with integrated tide pools, are designed to mimic natural intertidal conditions and create microhabitats, including vegetation establishment (**Figure D.4.1-22**). Units can be stone (riprap), concrete, or other precast materials. In suitable environments, the units may be vegetated by filling in voids with soil and planted with upland, riparian or intertidal species.



(Source: Courtesy of ECOncrete Tech, Ltd.)

Figure D.4.1-22: Example of Ecologically Engineered Articulated Concrete Block Mattress Used as Ecological Armoring

2.2.5.14 Sheet Pile Wall with NNBFs

At locations identified for Sheet Pile Wall with NNBFs, a standalone sheet pile wall would be constructed as a floodwall, unlike in other measures where a sheet pile wall would be constructed in combination with another feature (e.g., levee or seawall). A sheet pile wall is a construction feature involving driving interlocking sheets of material into the ground to act as a barrier to contain water, for bank stabilization, and to prevent water from overflowing into vulnerable areas. The measure may be constructed using steel and/or cast-in place concrete materials using the same techniques described previously. The sheet pile wall would be constructed using land-based equipment.

As part of this measure, NNBFs that would be used in space constrained locations would be incorporated into the overall design to provide additional protection to the floodwall (**Figure D.4.1-23**). The NNBFs would be constructed as described in the Planted Levees description.

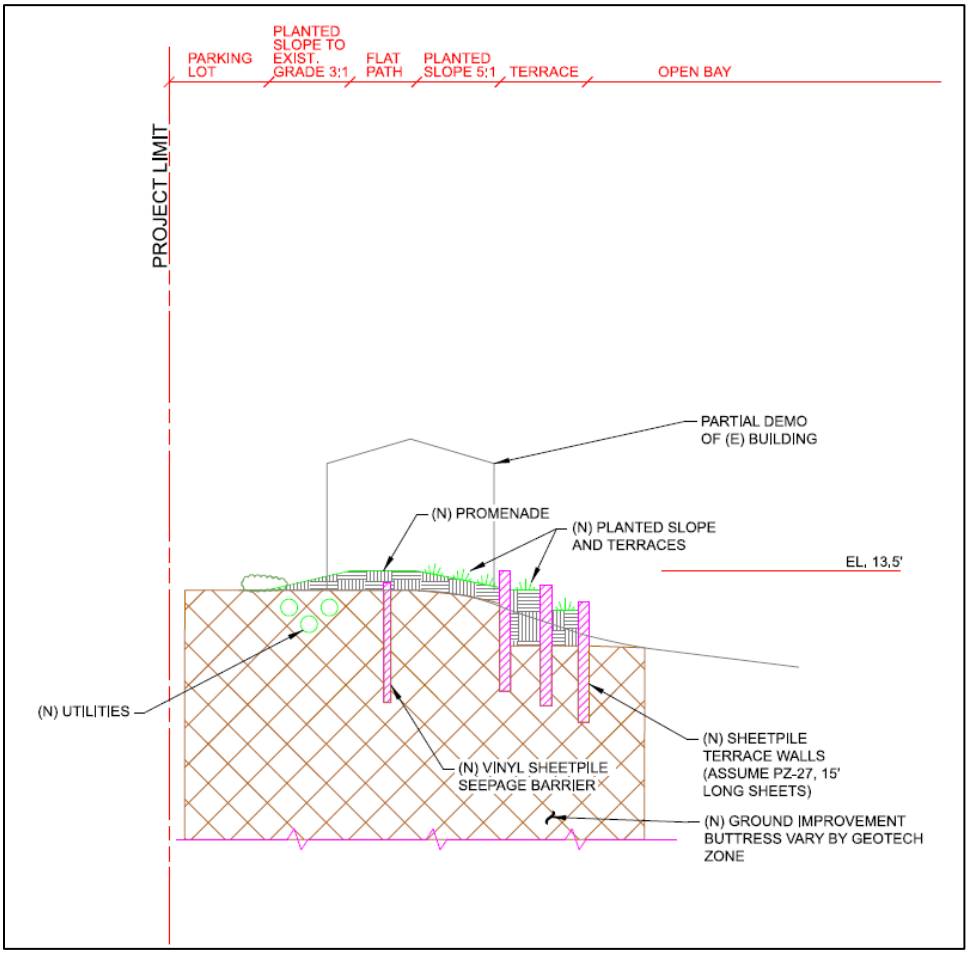


Figure D.4.1-23: Example Cross-Section Using Sheet Pile Walls and NNBFs (e.g., Mission Creek North)

2.2.5.15 NNBF -- Marsh/Coarse Beach Restoration

Marsh and coarse beach restoration involves the restoration of degraded existing coastal wetlands (e.g., salt, brackish, and tidal freshwater marshes), mudflats, and/or coarse beach found in the proposed measure location. To restore the target habitat type at each location, sediment and other natural materials (cobble, gravel, larger rock size) would be introduced to the site to reach a target design elevation that will support the long-term viability of the desired habitat (**Figure D.4.1-24**).

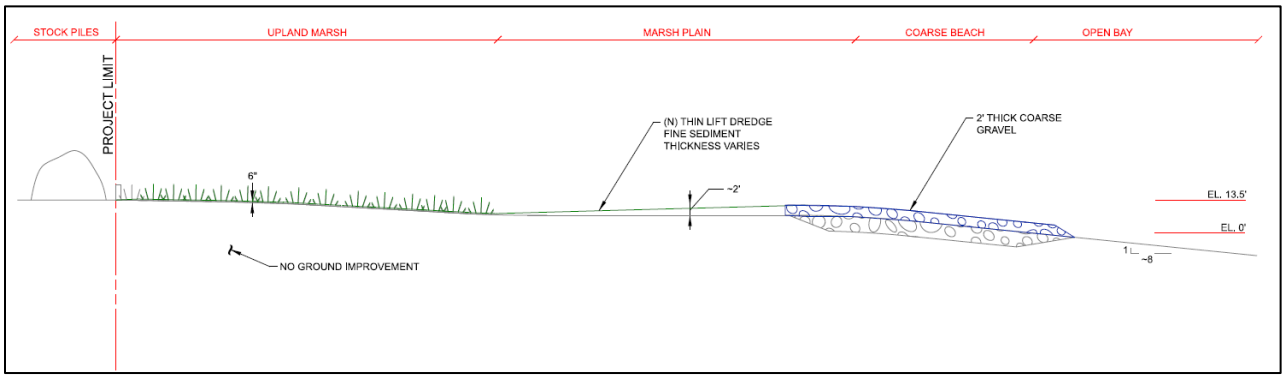


Figure D.4.1-24: Example Cross-Section of Marsh and Coarse Beach Restoration Proposed at Pier 94 Wetlands

It is assumed material used to augment or nourish the marsh or beach would come from a commercially sourced material or from dredged material removed during normal operations and maintenance cycles (i.e. no new dredging would be pursued to implement this measure). The source of material would be determined during the design phase, but in any case, material placed at the site must have similar properties to the existing marsh or beach or meet the conditions of the target habitat type, if being created rather than restored.

To construct the marsh or beach, the material would be dumped in place (commercially sourced material) or pumped through a series of pipelines (dredged material) into the site until the surface profile is built up to the target elevations, which will be determined during the design phase and based on the target species, salinity and flooding regime and site conditions. Heavy machinery would be used to move sediment and facilitate construction which could include bulldozers, front-end loaders, track-hoes, marsh buggy, and backhoes. As necessary, temporary containment dikes would be constructed from in-situ material around the nourished areas to minimize material movement and to delineate work areas. The dikes would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages deemed appropriate for the site.

It is assumed that work would begin in an individual cell and continue until that cell is completed, with attempts made to not place material in more than one cell at a time to

minimize the disturbance to existing marsh processes. **Figure D.4.1-25** shows an example of marsh restored at Heron's Head and **Figure D.4.1-26** shows an example of coarse beach restored in San Francisco that both would be suitable reference sites for restoration targets.

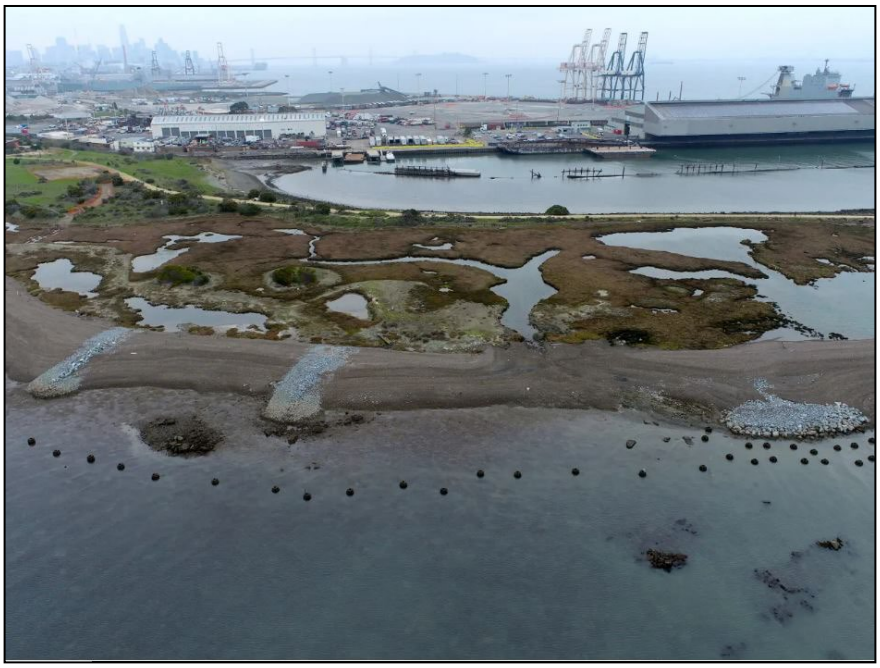


Figure D.4.1-25: Tidal Marsh at Heron's Head in San Francisco, CA. Source: Port of San Francisco



Figure D.4.1-26: Example Coarse Beach Restoration in San Francisco

2.2.5.16 NNBF -- Rocky Intertidal Bluffs

Rocky Intertidal Bluffs would only be constructed at Rincon Park just south of the Ferry Building. This particular NNBF integrates an engineered rocky tidal habitat into the shoreline elevation and bulkhead seawall design as a way to minimize wave runup and promote greater biodiversity along a steep shoreline rather than relying on traditional riprap or other engineered armoring to protect the new bulkhead seawall (**Figure D.4.1-27**). Approximately 2.0 acres of new intertidal and subtidal habitat would be constructed bayward of the new seawall.

To construct the rocky intertidal bluff, a foundation of compacted sediment would be placed along the mudline/bay bottom and built up to achieve a target profile that slopes from the new seawall to the mudline. On top of this foundation, a combination of sand, gravel, rock, and/or pre-cast material like ecological armoring of varying sizes would be placed using cranes and heavy machinery to create tidepools and bluff areas to increase surface complexity (grooves, crevices, nooks, etc.). After construction is complete, the cofferdam would be removed, and the area would be subject to inundation. Minor refinements and adjustments to material in the rocky intertidal bluff post-construction, such as moving, replacing or adding more stone or other materials, is anticipated to be needed to meet the design goals.

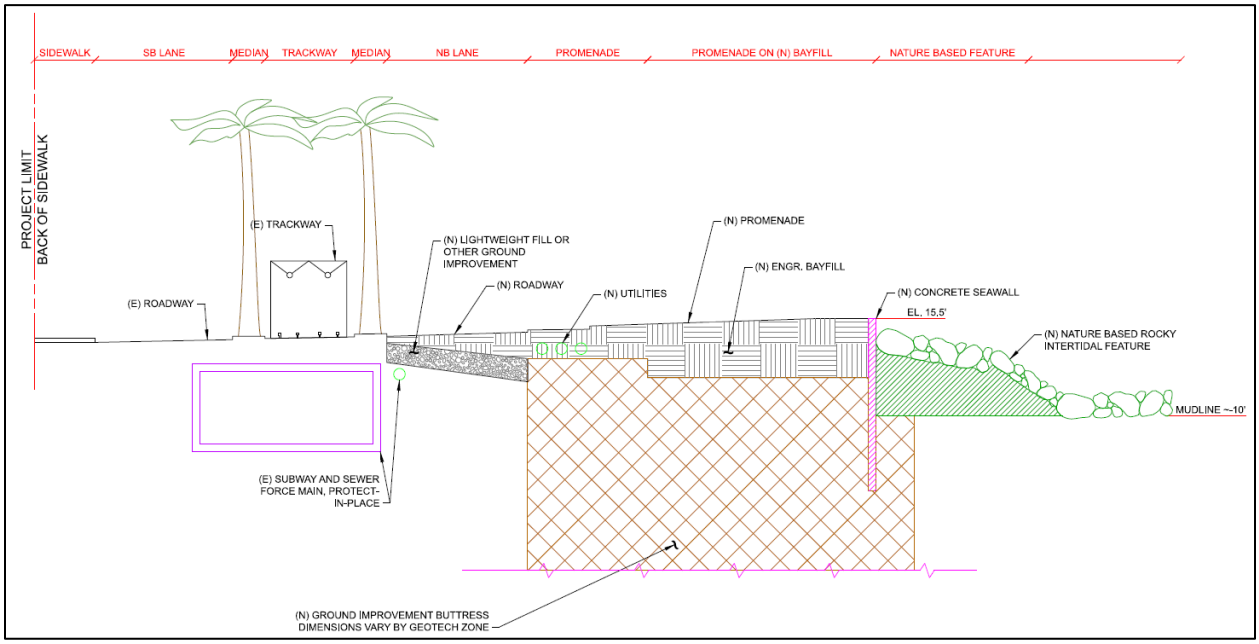


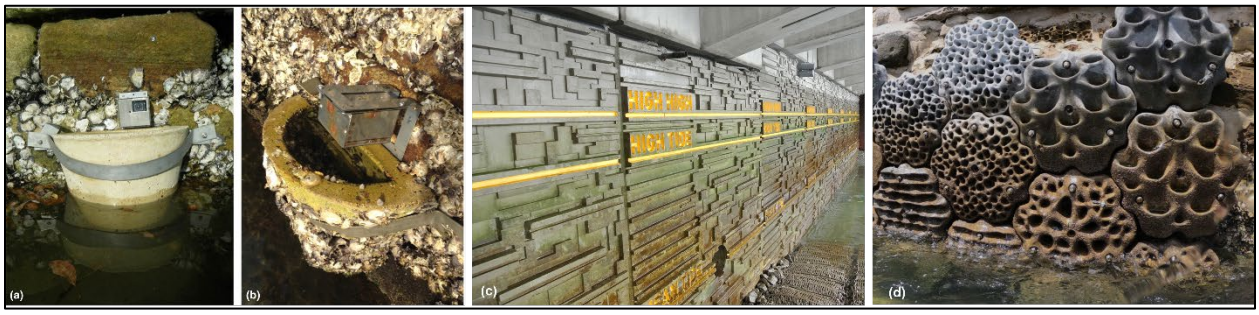
Figure D.4.1-27: Cross Section of Intertidal Rocky Bluff at Rincon Park

2.2.5.17 NNBF -- Living Seawalls

Living seawalls consist of structural elements combined with traditional seawalls that create varied micro-habitat conditions through surface relief and material composition

(**Figure D.4.1-28**). The introduction of surface complexity (e.g., surface texture, grooves, crevices, and nooks) to traditionally smooth surfaces promote vegetation growth, provides foraging habitat, and creates shelter from predation.

Living seawalls would be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design would incorporate textures to increase surface complexity). These elements would be incorporated as part of the pre-cast or cast-in-place forms used to construct the walls or piles. No additional specialized equipment or methodology is necessary to incorporate this added NNBF and should not increase the construction duration.



Source: Morris et al. 2017; Waterfront Seattle; van Remortel 2022.

Figure D.4.1-28: Examples of Living Seawall/Vertical Enhancements That Could Be Installed on Vertical Shorelines. These Could Consist of Pre-Cast Pots as Shown In (a), (b), or (d) and Pre-Cast Panels (c)

2.2.5.18 Ground Improvements

Ground improvements are proposed to be incorporated into several of the structural measures to address both static and seismic loading conditions because of poor soil conditions and the increased weight of the new construction. A deep soil mixed (DSM) stabilization buttress with a 1:1 height to depth ratio (50 feet by 50 feet for Zone 1 and 100 feet by 100 feet for Zone 2) is currently assumed to be sufficient to stabilize the foundation and shoreline soil but will be further refined during the design phase when site-specific conditions are known. The DSM process forms columns of cemented material in the ground by mechanically mixing the in-situ soil with an introduced binder agent such as cement or lime. The binder can be introduced either by injection of a wet slurry or dry binder systems through the mechanical mixing tool. A grid of individual or overlapping soil mixed columns will make up the buttress.

The installation of DSM columns involves the introduction of a rotating auger into the subsoil which disrupts the existing soil structure and mixes it with the injected binder. Typically, one to six augers are mounted to a drilling rig and each auger consists of a drilling rod and cross bars. The soil mixing process is aided by injecting the cement binder through nozzles located at the end of the drilling rod. The column formation stage

starts after reaching the target depth, which is usually divided into several stages where the auger is lifted and lowered to ensure adequate mixing of the soil with the binder and to form a homogeneous column. The width of the column is unknown at this time but could range from 2 to 9 feet wide.

2.2.6 Avoidance and Minimization Measures

This section outlines avoidance and minimization measure and conservation measures proposed by the USACE in order to avoid and minimize potential project effects.

USACE will minimize impacts on fish, including protected species, by implementing the following measures:

- Prevent fish entrapment and entrainment during dewatering, such that fish rescue operations will occur where dewatering and resulting isolation of fish may occur. Fish rescue and salvage operations will occur prior to and during dewatering. If the enclosed area is wadable (less than 3 ft deep), fish can be herded out of the enclosure by dragging a seine (net) through the enclosure, starting from the enclosed end and continuing to the opening. After completing fish herding, the net or an exclusion screen will be positioned at the opening to prevent fish from reentering the enclosure. Screens will be checked periodically and cleaned of debris to permit free flow of water.
- Sheetpiles, block nets, or other temporary exclusion methods (e.g., silt curtains) could be used to exclude fish or isolate the construction area prior to a fish removal process.
- A dewatering plan will be submitted as part of the SWPPP and Water Pollution Control Program, detailing the location of dewatering activities, equipment, and discharge point. Dewatering pump intakes will be screened to prevent entrainment of fish in accordance with the NMFS screen criteria.
- A qualified fish biologist or fish rescue team will be onsite during the dewatering process to minimize the number of fish that become trapped in isolated areas or impinged on pump screen(s) or isolation nets.
- Prior to any in-water construction that would require pile driving, a NMFS-approved sound attenuation monitoring plan to protect fish and marine mammals, and the approved plan will be implemented during construction.
- All in-water construction will be conducted within the environmental work window between June 1 and November 30, designed to avoid potential impacts to fish species.
- A soft start technique (release of pile-driving hammer without hydraulic pressure) to impact hammer pile driving shall be implemented, at the start of each workday or after a break in impact hammer driving of 30 minutes or more, to give fish and marine mammals an opportunity to vacate the area.

- During in-water installation of piles, when feasible, vibratory hammers should be used in place of impact hammers, as well as cushion blocks should be used.
- During in-water installation of piles, when feasible, bubble curtains will be considered for use with impact hammers to reduce impacts to fish.
- Functional grating or glass prisms will be considered in the design for new wharf decking to maximize light transmittance in nearshore zones (first 10-15 feet from the bulkhead).
- During construction near the water, artificial light should be directed away from sensitive habitats and species, to include shielding and/or downward-directed, to prevent disruption to aquatic species.
- Ecological armoring features will be designed to the extent feasible to include tide pools or water-retaining shapes over flat textured panels where practicable to increase surface area for invertebrate prey colonization.
- Rocky intertidal bluffs will be designed to the extent feasible include variable slopes, rather than uniform, to create micro-habitats and velocity refugia for fish.

USACE will minimize impacts on waters of the U.S. and waters of the state, including wetlands, by implementing the following measures:

- The Recommended Plan shall be designed to avoid, to the extent practicable, work within wetlands and/or waters under the jurisdiction of the USACE, the regional waterboard, the California Department of Fish and Wildlife, and the Bay Area Conservation and Development Commission. If applicable, permits or approvals will be sought from the regulating agencies as required. Where wetlands or other water features must be disturbed, the minimum area of disturbance necessary for construction will be identified and the area outside avoided.
- Prior to construction within 50 feet of any wetlands and drainages, appropriate measures will be taken to ensure protection of the wetland from construction runoff or direct impact from equipment or materials, such as installation of a silt fence, and signs indicating the require avoidance. No equipment mobilization, grading, clearing, or storage of equipment or machinery, or similar activity, will occur until a qualified biologist has inspected and approved the fencing installed around these features. The contractor will ensure the temporary fencing is maintained until construction activities cease.
- Where disturbance to jurisdictional wetlands or waters cannot be avoided, any temporarily affected areas will be restored to pre-construction conditions or better at the end of construction, in accordance with regulating agencies.

2.2.7 Best Management Practices

This section outlines BMPs proposed by USACE in order to avoid and minimize potential project effects during construction. These are typical BMPs for construction activities to minimize potential short-term impacts. During the design phase, site specific BMPs would be developed, as appropriate.

BMPs would be used to manage sediment and erosion during the construction of any of the alternatives. Construction period preparedness and weather condition BMPs control erosion and sediment through management and monitoring that includes:

- Ensuring the contractor has the appropriate equipment and materials available at the start of construction to complete the project within the planned time frame.
- All disturbed areas are treated with erosion control measures.
- Coordination between vegetative planting and grading is in place prior to construction.
- Daily weather monitoring for possible precipitation events and a plan in case of significant rainfall.
- Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP)to control erosion, storm water runoff, sedimentation, and other construction-related pollutants during all phases of construction, until the construction is complete and all disturbed areas are permanently stabilized throughout the project area.
- The short-term increase in sediment would be reduced by implementing the following erosion control measures during construction:
- All soils would be stabilized within 14 days of completed work.
- Construction equipment would be limited to the actual area being disturbed and vehicles may not travel in areas outside of designated staging areas or access routes.
- Short-term staging of soil material (less than 1 week) would be surrounded by a silt fence, fiber rolls, or other perimeter.
- Long-term staging of soil material (longer than 1 week) would be placed away from surface waters, vegetated, and surrounded by a berm perimeter to control runoff and erosion.
- Excavation would be limited to the extent practicable. All excavated material that is not relocated to another portion of the project area will be completely removed to a disposal site located outside the study area.
- Existing vegetation would be left in place to the maximum extent possible.
- Bare ground would be monitored for dryness and watered, if necessary, to reduce wind and water erosion.

- The contractor would be required to conduct water quality tests specifically for increases in turbidity and sedimentation caused by in-water construction activities. Water samples for determining background levels would be collected in San Francisco Bay in the vicinity of the construction site. Testing to establish background levels would be performed at least once per day when construction activity is in progress. The contractor would monitor turbidity and settleable solids at least daily and turbidity at least hourly when a turbidity plume is visible. If turbidity limits are exceeded, the contractor would slow the rate of earthwork or use other means to comply with the requirements, including stopping construction activities until the plume has cleared.
- Sediment barriers would be installed on graded or other disturbed slopes, as needed, to prevent sediment from leaving the project sites and entering nearby surface waters.
- The contractor would have a designated vehicle and equipment maintenance staging area that is self-contained to protect groundwater, surface water, and soils from contamination.
- Construction traffic would be restricted to predetermined routes.
- Traffic during wet weather or within the wet zone would be minimized.
- Pivoting excavators would be used within the wet zone to prevent rutting and excess erosion.
- A spill prevention and containment countermeasure plan that addresses all potential mechanisms of contamination would be developed. Suitable containment materials would be on site in the event of a spill. All discarded material and any accidental spills would be removed and disposed of at approved sites.
- Equipment and vehicles operated within the floodway would be checked and maintained daily to leaks of fuels, lubricants, and other fluids to surface waters. Hardened armoring would be used in areas susceptible to high erosion rates as identified by hydrologic and sedimentation modeling.

In order to avoid and/or minimize potential impacts to waters of the U.S. and state, water quality, and biological resources, the following minimum construction BMPs would be implemented as part of the proposed project. These minimum measures would be subject to modification and additions based upon regulatory and resource agency review.

- No debris, trash, creosote-treated wood, soil, silt, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products will be placed in a location where it would be subject to erosion by rain, wind, or waves and allowed to enter jurisdictional waters, including as a result of fueling activities and storage of hazardous materials.

- No fresh concrete or concrete washings will enter into jurisdictional waters. Fresh concrete will be isolated until it no longer poses a threat to water quality using appropriate measures, including exclusion of poured concrete from jurisdictional waters, such as open San Francisco Bay waters. Contractor(s) will use only designated concrete transit vehicle cleanout stations for cleanout.
- Protective measures will be utilized to prevent accidental discharges to waters during fueling, cleaning, and maintenance.
- Floating booms will be used to contain debris discharged into waters and any debris will be removed as soon as possible, no later than the end of each workday.
- Machinery or construction materials not essential for project improvements will not be allowed at any time in the intertidal zone. The construction contractor will be responsible for checking daily tide and current reports.
- Well-maintained equipment will be used.
- A spill prevention contingency plan for hazardous waste spills into San Francisco Bay will be prepared for review and approval. The plan will include, at a minimum, floating booms, and absorbent materials to recover hazardous wastes.
- Contractors will prepare an anchoring plan that applies to all ships, barges, and other open water vessels and describes procedures for deploying, using, and recovering anchorages.

BMPs for construction water-handling procedures and requirements for dewatering discharges in the study area include:

- Dischargers will not violate any discharge prohibitions contained in applicable Basin Plans or statewide water quality control panels.
- The discharge does not cause or contribute to a violation of any water quality standard.
- The discharge is not prohibited by the applicable Basin Plan.
- The discharger has included and implemented specific BMPs required by their permit to prevent or reduce the contact of the non-stormwater discharge with construction materials or equipment.
- The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants.
- The discharge is monitored and meets the applicable numeric action levels.
- Best practices to minimize construction noise include the following:
- Limiting heavy equipment use to daytime hours not regulated by San Francisco, between 7:00 a.m. and 8:00 p.m.

- Limiting pile driving to times of day that would be least disruptive to residences, hotels, motels, hospitals, or convalescent homes.
- Locating stationary equipment (e.g., generators, pumps, cement mixers, idling trucks) as far as possible from noise-sensitive land uses.
- Requiring that all construction equipment powered by gasoline or diesel engines have sound-control devices, such as exhaust mufflers, that are at least as effective as those originally provided by the manufacturer and that all equipment be operated and maintained to minimize noise generation.
- Using equipment powered by electric motors instead of gasoline- or diesel-powered engines.
- Preventing excessive noise by shutting down idle vehicles or equipment.
- Using noise-reducing enclosures around noise-generating equipment.
- Using noise-reducing shrouds for impact pile drivers, where feasible.
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (e.g., terrain, structures) to block sound transmission to noise-sensitive land uses. The barriers should be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment.

The following list of BMPs recommended by the Bay Area Air Quality Management District to reduce construction-generated criteria pollutant emissions:

- All exposed surfaces (e.g., unpaved parking and staging areas, soil piles, graded areas, and unpaved access roads) will be watered two times per day, except during rainy days.
- All haul trucks transporting soil, sand, or other loose material off-site will be covered.
- All visible mud or dirt track-out onto adjacent public roads will be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads will be limited to 15 miles per hour (mph).
- All roadways, driveways, and sidewalks to be paved will be completed as soon as possible. Building pads will be laid as soon as possible after grading unless seeding or soil binders are used.
- All excavation, grading, and/or demolition activities will be suspended when average wind speeds exceed 20 mph.
- All trucks and equipment, including their tires, will be washed off prior to leaving the active site.

- Unpaved roads providing access to sites located 100 feet or more from a paved road will be treated with a 6- to 12-inch layer of compacted wood chips, mulch, or gravel.
- Publicly visible signs will be posted with the telephone number and name of the person to contact at the lead agency regarding dust complaints. This person will respond and take corrective action within 48 hours. The air district's general air pollution complaints number will also be visible to ensure compliance with applicable regulations.
- Limit the simultaneous occurrence of excavation, grading, and ground-disturbing construction activities.
- Install wind breaks (e.g., trees, fences) on the windward side(s) of actively disturbed areas of construction. Wind breaks should have a maximum of 50 percent air porosity.
- Plant vegetative ground cover (e.g., fast-germinating native grass seed) in disturbed areas as soon as possible and water appropriately until the vegetation is established.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than 1 percent.
- Minimize the amount of excavated material or waste materials stored at the site.
- Hydroseed or apply non-toxic soil stabilizers to construction areas, including previously graded areas, that are inactive for at least 10 calendar days.

3.0 Significant Degradation, Either Individually or Cumulatively, to the Aquatic Environment of the Recommended Plan

3.1 Impacts on Ecosystem Function

Only one structural measure (wharf raise/rebuild) and four NNBFs (ecotone levees, marsh enhancements, coarse beach and living seawall) in the Recommended Plan include the discharge of dredged or fill material into waters of the U.S. All other measures were designed and would be constructed landward of the existing shoreline to avoid discharge of fill materials and impacts to waters of the U.S. The Recommended Plan has been developed in accordance with the 404(b)(1) Guidelines.

For the wharf raise/rebuild measures old pier pilings (creosote covered wood or concrete and rebar) and decking (wood, concrete, and rebar) would be removed and replaced with new pilings (concrete) and decking (rebar, concrete, grates, etc.) that would facilitate a higher elevation wharf. There would be no increase in the footprint of the wharf and fewer piles would be necessary per square foot than currently exists resulting in a net decrease in bay fill and overall benefit from removal of old materials

(e.g., creosote piles) that contribute to poor water quality and are toxic to marine life. Since the decking footprint would not change, it is anticipated that at a minimum the current light and temperature of the intertidal and subtidal habitat would remain the same. During the design phase, the designs will be refined to incorporate features that allow additional light and air flow, where appropriate, than the current wharf allows, which would also be a long-term benefit to the marine environment.

For the ecotone levees, coarse beach NNBFs, fill materials would primarily involve natural materials free of any contaminants or eco-friendly concrete that supports vegetative growth. Fill material would be placed between the Mean Lower Low Water and Mean Higher High Water (MHHW) lines to achieve the target elevation that would support the desired community, such as tidal marsh or beach. Any existing fringe wetland or intertidal habitat would be filled with material and then restored. The length between loss and restoration is dependent on how long construction takes at the immediate site, type of plants used, and growing conditions, but is anticipated to reach pre-construction conditions or better within one to three growing seasons after a one-year period of construction (approximately two to five years). At each of these NNBF locations, the purpose of the measure is to support the overall performance of the flood defense feature using natural processes. As a result, these features also provide habitat enhancements that result in a net increase in quantity and quality of intertidal, beach, and marsh habitats and overall benefit to the waters of the U.S. over the life of the project.

For the living seawall NNBF, the fill material (most likely concrete) would be placed directly onto the existing seawall by bolting on, or building into, the design of another feature (e.g., new seawall) to create surface complexity (e.g., surface texture, grooves, crevices, nooks) to replace traditionally smooth surfaces. The living seawall is a relatively flat form of fill that would be placed from the bay bottom elevation to MHHW. This NNBF would increase habitat diversity to the intertidal and sub-tidal environments where only open water currently exists, resulting in an overall net benefit.

One measure (pier demolition) will remove approximately 1.0 acre of fill previously placed in waters of the U.S. including historic piles, bay fill, and pier decking and allow the area to restore to higher quality open water and subtidal habitat.

3.2 Impacts on Recreational, Aesthetic, and Economic Values

The proposed project would not affect water-related recreation in the long-term; however, during the construction period, people recreating at Aquatic Park would experience construction-related noise and air emissions from operation of equipment. The construction-related activities would have temporary visual and audible impacts intrusive to the surrounding viewscape during construction (multi-year). Long-term presence of the elevated structures and new features (naturalized or embankment shorelines and pump stations) would change the viewscape; however, design elements of each feature incorporate the use of materials and architecture that blends with the surrounding landscape and with what was historically present, where appropriate (e.g., historic districts, along the Embarcadero). Some coastal views may be impacted or diminished but would still be available from other vantage points along the waterfront.

With the design elements, the impacts are to be less than significant over the long-term. There is an expected positive economic impact on the community from the reduction of coastal flooding.

3.3 Findings

USACE has determined that there would be no major adverse effects to aquatic ecosystem functions and values throughout the study area from the Recommended Plan. The Recommended Plan would not cause significant degradation, either individually or cumulatively to the aquatic environment.

4.0 Appropriate and Practicable Measures to Minimize Potential Harm to the Aquatic Ecosystem

4.1 Impact Avoidance and Minimization Measures

The Recommended Plan, the preferred alternative, avoids a significant amount of unavoidable adverse impacts to ecological habitats by placing features at or landward of the existing shoreline, designing the project to avoid bayfill to the greatest extent practicable, and integrating NNBFs where feasible. In addition, USACE would further avoid potential construction related effects to the aquatic ecosystem by timing restrictions and construction sequencing, to be further developed in the design phase. The following is a brief assessment of the avoidance and minimization measures by reach.

4.1.1 Reach 1

All measures are considered nonstructural, meaning the measure attempts to reduce the flood risk and the damages associated with flooding rather than focusing on reducing or modifying how the water moves through the area. By design, the nonstructural measures realize impacts at the immediate site of the measure which is often isolated to the structure itself (e.g. floodproofing, building demolition) and do not involve disturbance of ecological habitats. Construction of the concrete curbs around the piers involves minimal construction efforts that would be completed from the pier and would not involve any in-water work which avoids impacts to any aquatic habitats.

Additionally, demolition of two piers would remove approximately 1.0 acres of piles, bayfill, and decking and allow the area to restore to higher quality open water and subtidal habitat.

4.1.2 Reach 2

Reach 2 would involve constructing a seawall landward of the existing seawall and rebuilding approximately 6.3 acres of wharf. The existing wharf would need to be rebuilt to the higher elevation resulting in temporary localized impacts to the aquatic environment during construction. Because of the design, there would be no increase in the footprint of the wharf, all existing wharf material would need to be removed and

replaced with new, more eco-friendly materials, and fewer piles would be necessary per square foot than currently exists.

All NNBFs minimize the long-term adverse impacts of the engineered structure despite some temporary aquatic impacts during construction. By incorporating NNBF into the design, natural processes and materials are used to reduce wave hazards, support nearshore ecology, and provide public water access in lieu of more traditional engineered designs and materials such as concrete, rip rap, or monoculture turf grass, which do not provide any long-term ecological or recreational benefits and are generally less visually desirable. Additionally, implementation of the NNBF avoids conversion of existing habitats into impervious surfaces.

4.1.3 Reach 3

In Reach 3, all measures are constructed landward of the existing shoreline and would not require any in-water work, thus avoiding the need for bay fill and adverse impacts to aquatic habitats. Additionally, all impacts from construction have been avoided on approximately 7,500 linear feet of shoreline because the design was aligned to take advantage of existing high ground to avoid unnecessary construction of additional features. Instead of raising the bridges, deployables are proposed which avoids a significant amount of in-water work and disturbance associated with replacing two bridges.

Approximately 4.5 acres of wharf would need to be rebuilt which would involve some temporary impacts, but overall result in long-term benefits from removal of old construction materials and a reduction in bayfill. The footprint would not be increased and therefore long-term changes from a footprint increase have been avoided. Also, the modified design in this location avoids disruptions and reconfiguration of the light rail system.

4.1.4 Reach 4

Like the other reaches, all measures are constructed landward of the existing shoreline and would not require any in-water work, thus avoiding the need for bayfill and adverse impacts to aquatic habitats. Additionally, all impacts from construction have been avoided on approximately 6,500 linear feet of shoreline because the design was aligned to take advantage of existing high ground to avoid unnecessary construction of additional features. Similar to Reach 3, the impacts of raising of existing bridges would be avoided by relying on deployables for flood defense. Similar to Reach 1, approximately 0.75 acres of building demolition would occur allowing these areas to convert to intertidal or sub-tidal habitat, while an additional 2.0 acres of building demolition would occur and be converted to open space.

4.2 Compensatory Mitigation Measures

There is no anticipated long-term loss of wetlands that would require compensatory mitigation. Approximately 9.0 acres of bayfill will require compensatory mitigation in the form of old and unused pier and piling removal. A conceptual compensatory mitigation

plan was developed (*Appendix K: Mitigation*) and will continue to be updated in the design phase as designs are further refined.

4.3 Findings

Avoidance, minimization, and mitigation measures are conceptual at this stage. Further development would be made during the design phase. USACE has determined that all appropriate and practicable measures would be taken to minimize potential harm to the environment.

5.0 Other Factors in the Public Interest

a) *Fish and Wildlife.* USACE is coordinating with Federal and State agencies and tribes to ensure that direct and indirect loss and damage to fish and wildlife resources attributable to the proposed work would be minimized. USACE would continue to coordinate with Federal and State agencies and tribes during the design phase. Endangered Species Act (ESA) consultation with National Marine Fisheries Service (NMFS) and US Fish and Wildlife Service (USFWS) is expected to be completed by the final IFR/EIS. USACE prepared biological assessments to be submitted to both NMFS and USFWS, initiating formal and informal consultation, respectively. In compliance with Magnuson- Stevens Fishery Conservation and Management Act, effects to essential fish habitat will be consulted on in conjunction with the ESA Section 7 consultation and included in the NMFS consultation.

b) *Water Quality*. USACE would obtain a Water Quality Certification under Section 401 of the CWA during the design phase when more detailed designs are available.

c) *Historic and Cultural Resources*. USACE will consult with representatives of the interested tribes, the State Historic Preservation Office, and other parties on the Recommended Plan. In accordance with 36 CFR 800.14, USACE has prepared a Programmatic Agreement to address the identification and discovery of cultural resources that may occur during the construction and maintenance of proposed or existing facilities. It is anticipated that the Programmatic Agreement would be executed prior to the release of the final IFR/EIS.

d) *Environmental Benefits*. Three of the five measures in Reach 1 would provide long-term ecological benefits. Demolition of two piers would remove approximately 1.0 acre of piles, bayfill, and decking and allow the area to restore to higher quality open water and subtidal habitat. In Reach 2, the overall long-term benefits to the aquatic environment are expected from the net decrease in bay fill and removal of old materials (e.g., creosote piles) that contribute to poor water quality. Any NNBFs would also provide an additional long-term ecological benefit.

e) *Navigation*. No temporary or permanent disruption of navigation traffic is expected from implementation of the Recommended Plan.

Findings. USACE have determined that the Recommended Plan is within the public interest based on review of the public interest factors.

6.0 Conclusions

6.1 Clean Water Act Section 404(B)(1) Evaluation [40 C.F.R. § 230]

Based on the analysis in the SFWCFS IFR/EIS, as well as the following 404(b)(1) Evaluation and General Policies for the Evaluation of the Public Interest, USACE finds that this project complies with the substantive elements of Section 404 of the CWA.

6.1.1 Potential Impacts on Physical and Chemical Characteristics (Subpart C)

1. **Substrate [230.20].** Approximately 9.0 acres of bayfill would cover the substrate at that location resulting in permanent loss. To offset this impact, old and unused pier and piling removal is proposed, as compensatory mitigation. A conceptual compensatory mitigation plan has been developed (*Appendix K: Mitigation*) and will continue to be refined through the design phase as the designs are further refined.
2. **Suspended Particulate/Turbidity [230.21].** Proposed seawall and wharf construction would cause turbidity, resuspended sediments, and could suspend contamination from underlying sediments or result in debris and release of contaminating materials. Replacement of roadways would lead to changes and expansion in stormwater, sewer, and inland drainage systems. Shore-based measures are expected to have less than significant impacts with temporary increases in turbidity and sediment suspension localized to the construction area. Site specific effects regarding suspended particulate and turbidity are not known at this time. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, details will be available to evaluate site-specific effects.
3. **Water [230.22].** Bay fill, construction of bayward sections of the seawall, roadway construction, and wharf replacement are all anticipated to have significant and unavoidable impacts to water quality. Bayfill permanently removes open water, while seawall and wharf construction would cause turbidity, resuspended sediments, and could suspend contamination from underlying sediments or result in debris and release of contaminating materials. Replacement of roadways would lead to changes and expansion in stormwater, sewer, and inland drainage systems. Shore-based measures are expected to have less than significant impacts with temporary increased turbidity and sediment suspension localized to the construction area.
4. **Current Patterns and Water Circulation [230.23].** Temporary impacts to currents may result during construction of shore-based measures located at the MHHW line, such as levees, and some NNBFs such as ecological armoring. Localized, temporary impacts from the in-water measures such as bulkhead walls/seawalls,

wharfs, and bayfill are also anticipated to adversely impact currents due to increased velocities at the toe of the structural measures, which may change wave energy in the bay. Wave energies could increase at the hardened structures which may increase tidal current velocities and lead to temporary indirect impacts from sedimentation or scour. The waterfront is highly urbanized at present; however, some new hardened structures may be introduced to protect against flood risks. Temporary impacts during construction include physical seabed disturbance that increase current velocities such as foundation installation, excavation, and fill activities.

5. Coastal flood risk management measures installed in the bay below the high tide line would likely alter the bay shoreline permanently. Such an alteration could affect the movement of water in the bay due to altered circulation patterns, which could substantially change the bay floor adjacent to the new shoreline as a result of sediment scour. Sediment transport induced by waves and currents interacting with the new structures could alter the hydraulic forces exerted on the bay floor and shoreline, thereby inducing changes in scour and deposition.
6. **Normal Water Fluctuations [230.24].** The Recommended Plan is not expected to affect normal water level fluctuations such as tidal.
7. **Salinity Gradients [230.25].** No impacts to salinity are anticipated during the construction of shore-based measures. Temporary impacts to salinity would be expected during in-water construction measures, which may occur if there is a physical barrier in the water that prevents full tidal exchange (e.g., cofferdam).

6.1.2 Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)

1. **Threatened and Endangered Species [230.30].** ESA consultation with NMFS and USFWS is expected to be completed by the final IFR/EIS. USACE prepared biological assessments to be submitted to both NMFS and USFWS, initiating formal and informal consultation, respectively. In compliance with Magnuson- Stevens Fishery Conservation and Management Act, effects to essential fish habitat will be consulted on in conjunction with the ESA Section 7 consultation and included in the NMFS consultation.
2. **Aquatic Food Web [230.31].** Construction activities that generate turbidity and pile removal may interfere with feeding and respiratory mechanisms of aquatic species. Some sessile invertebrates will suffer mortality from these activities. Most of these species are mobile and are expected to escape the immediate area without significant injury. Potential effects would be reduced and/or avoided through avoidance and minimization measures.
3. **Wildlife [230.32].** Noise and air emissions associated with construction activities may affect wildlife in the project area. The effects of any disturbance would likely cause displacement of wildlife, but injury is possible for aquatic species from bayfill activities. Increases in turbidity associated with in-water work could reduce visibility directly below and for a short distance from disturbance, thereby reducing foraging

success for any animals in the area. Any reduction in food availability would be localized and subside rapidly upon completion of the activity.

6.1.3 Potential Impacts to Special Aquatic Sites [Subpart E]

1. **Sanctuaries and Refuges [230.40].** Not applicable.
2. **Wetlands [230.41].** Effects to wetlands have been determined to be construction-related and temporary. No proposed features of the Recommended Plan would be constructed within the two wetlands in the project footprint.
3. **Mudflats [230.42].** Effects to mudflats, if present, would be construction-related, short-term and indirect. No proposed features of the Recommended Plan are proposed in any mudflats.
4. **Vegetated Willows [230.43].** No vegetated willows such as eelgrass are present in the project area.
5. **Coral Reefs [230.44].** Not applicable.
6. **Riffle and Pool Complexes [230.45].** Not applicable.

6.1.4 Potential Effects on Human Use Characteristics (Subpart F)

1. **Municipal and Private Water Supplies [230.50].** Not applicable.
2. **Recreational and Commercial Fisheries [230.51].** Construction of wharf replacement and seawall would have temporary impacts to fisheries through impacts to fish which would lead to avoidance of the construction area. In-bay fill would permanently remove fish habitat which would likely impact fisheries during construction but is not anticipated to have long-term adverse impacts. Overall, the temporary nature of adverse impacts is expected to be less than significant for fisheries.
3. **Water-Related Recreation [230.52].** The proposed project would not affect water-related recreation in the long-term; however, during the construction period, people recreating at Aquatic Park would experience construction-related noise and air emissions from operation of equipment.
4. **Aesthetics [230.53].** The construction-related activities would have temporary visual and audible impacts to the surrounding viewscape during construction (multi-year). Long-term presence of the elevated structures and new features (naturalized or embankment shorelines and pump stations) would change the viewscape; however, design elements of each feature incorporate the use of materials and architecture that blends with the surrounding landscape and with what was historically present, where appropriate (e.g., historic districts, along the Embarcadero). Some coastal views may be impacted or diminished but would still be available from other vantage points along the waterfront. With the design elements, the impacts are anticipated to be less than significant over the long-term.
5. **Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves [230.54].** The Recommended

Plan is not expected to adversely affect parks, National and Historic Monuments, National Scenic Areas, National Seashores, Wilderness Areas, research sites, or similar preserves, either because none of these sites are in the study area, or the project would result in no or negligible change from the existing condition.

6.1.5 Evaluation and Testing (Subpart G)

1. **General Evaluation of Dredged or Fill Material [230.60].** No specific sediment testing has occurred associated with this project but may be done during the design phase. No contaminated material would be used as fill, nor would it be sidecast after excavation if found to contain contaminants. Sources of fill would be examined to ensure that any material imported to sites to be used as fill is clean material free of contaminants.
2. **Chemical, Biological, and Physical Evaluation and Testing [230.61].** No specific sediment testing has occurred associated with this project but may be done during the design phase.

6.1.6 Action to Minimize Adverse Effects (Subpart H)

1. **Actions Concerning the Location of the Discharge [230.70].** Effects of the discharge would be minimized by implementing BMPs, timing of in-water work, and construction sequencing, as described above in Sections 2.2.6, 2.2.7, and 4.1. Exact information about location of discharge is unknown presently. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, site-specific details will be available.
2. **Actions Concerning the Material to be Discharged [230.71].** Materials to be discharged would be sourced from approved and permitted sources offsite. USACE would evaluate all materials for suitability. Exact information about material to be discharged is presently unknown. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, details will be available.
3. **Actions Controlling the Material after Discharge [230.72].** Implementation of BMPs and construction sequencing, as described above in Sections 2.2.6, 2.2.7, and 4.1 would facilitate controlling material after discharge such as silt fencing. Exact information about how the material will be controlled after discharge is presently unknown. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, these details will be available.
4. **Actions Affecting the Method of Dispersion [230.73].** Implementation of BMPs and construction sequencing, as described above in Sections 2.2.6, 2.2.7, and 4.1 would facilitate method of dispersion in a controlled manner such as silt fencing. Exact information about method of dispersion is presently unknown. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, these details will be available.
5. **Actions Related to Technology [230.74].** Appropriate machinery and methods of transport of material for discharge and placement would be employed. All

machinery would be properly maintained and operated. Exact information about machinery and methods of transport is presently unknown. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, these details will be available.

6. **Actions Affecting Plant and Animal Populations [230.75].** USACE has coordinated with the state and Federal resource agencies to minimize and avoid impacts to the greatest extent possible. Site-specific effects to plant and animal populations are presently unknown. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, these details will be available.
7. **Actions Affecting Human Use [230.76].** During construction, temporary impacts to the human environment would occur from noise, air emissions, and turbidity generating activities. Over the long-term, there are expected to be beneficial effects to the human environment from reduction in coastal flood risk and implementation of NNBFs. Site specific effects to human use are presently unknown. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, these details will be available.
8. **Other Actions [230.77].** Not applicable.

6.1.7 Application By Analogy of the General Policies for the Evaluation of Public Interest [33 C.F.R. § 320.4 For Reference]

1. **Public Interest Review [320.4(a)].** USACE find these actions to be compliant with the 404(b)(1) guidelines and not contrary to the public interest.
2. **Effects on Wetlands [320.4(b)].** Effects to wetlands have been determined to be construction-related and temporary. No proposed features of the Recommended Plan would be constructed within the two wetlands in the project footprint.
3. **Fish and Wildlife [320.4(c)].** USACE is coordinating with Federal and State agencies and tribes to ensure that direct and indirect loss and damage to fish and wildlife resources attributable to the proposed work would be minimized. USACE would continue to coordinate with Federal and State agencies and tribes during the design phase.
4. **Water Quality [320.4(d)].** USACE would obtain a Water Quality Certification under Section 401 of the CWA during the design phase when more detailed designs are available.
5. **Historic, Cultural, Scenic, and Recreational Values [320.4(e)].** USACE will consult with representatives of the interested tribes, the State Historic Preservation Office, and other parties on the Recommended Plan. In accordance with 36 CFR 800.14, USACE has prepared a Programmatic Agreement to address the identification and discovery of cultural resources that may occur during the construction and maintenance of proposed or existing facilities. It is anticipated that the Programmatic Agreement would be executed prior to the release of the final IFR/EIS. No wild and scenic rivers, historic properties, National Landmarks, National Rivers, National Wilderness Areas, National Seashores, National

Recreation Areas, National Lakeshores, National Parks, National Monuments, estuarine and marine sanctuaries would be affected by the Recommended Plan.

6. **Effects on Limits of the Territorial Sea [320.4(f)].** Not applicable.
7. **Consideration of Property Ownership [320.4(g)].** Not applicable.
8. **Activities Affecting Coastal Zones [320.4(h)].** It is anticipated that the Recommended Plan will be consistent with the policies set forth in the San Francisco Bay Conservation and Development Commission's (BCDC) San Francisco Bay Plan, San Francisco Waterfront Special Area Plan, and the San Francisco Bay Seaport Plan. The BCDC has informed the USACE that the project design details are not sufficient to support a formal consistency review and issuance of a determination during feasibility is unattainable. Instead, the BCDC has agreed to provide a letter of concurrence that supports the plan and future coordination efforts in the design phase to attain compliance with the CZMA a greater level of design is available.
9. **Activities in Marine Sanctuaries [320.4(i)].** Not applicable.
10. **Other Federal, State, or Local Requirements [320.4(j)].** USACE has analyzed the Recommended Plan under all applicable Federal, State, and local requirements and documented this compliance in Section 5 of Sub-Appendix D-1 of the SFWCFS IFR/EIS.
11. **Safety of Impoundment Structures [320.4(k)].** Not applicable.
12. **Floodplain Management [320.4(l)].** The Recommended Plan would not alter floodplain areas.
13. **Water Supply and Conservation [320.4(m)].** Not applicable.
14. **Energy Conservation and Development [320.4(n)].** Not applicable.
15. **Navigation [320.4(o)].** Not applicable.
16. **Environmental Benefits [320.4(p)].** Three of the five measures in Reach 1 would provide long-term ecological benefits. Demolition of two piers would remove approximately 1.0 acres of piles, bayfill, and decking and allow the area to restore to higher quality open water and subtidal habitat. In Reach 2, the overall long-term benefits to the aquatic environment are expected from the net decrease in bayfill and removal of old materials (e.g., creosote piles) that contribute to poor water quality. Any NNBFs would also provide additional long-term ecological benefits.
17. **Economics [320.4(q)].** The Federal objective is to contribute to the national economic development. The benefit-cost analysis was completed to measure contributions to the nation in terms of goods and services such as reduce the risk of coastal flooding. The economic analysis is documented in the SFWCFS IFR/EIS.
18. **Mitigation [320.49(r)].** There is no anticipated long-term loss of wetlands that would require compensatory mitigation. Approximately 9.0 acres of bayfill would require compensatory mitigation in the form of old and unused pier and piling removal. A conceptual compensatory mitigation plan was developed (Appendix K of

IFR/EIS) and will continue to be refined through the design phase as the designs are further refined.

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.4.2
WATERBOARD LETTER OF CONFIRMATION

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

San Francisco Bay Regional Water Quality Control Board

October 21, 2025

U.S. Army Corps of Engineers
Tulsa District, ATTN: RPEC-SFWS
2488 E 81st Street, Tulsa, OK 74137
Attn.: Raven Blakeway, Raven.D.Blakeway@usace.army.mil

Subject: San Francisco Bay Regional Water Quality Control Board Acknowledgement of the San Francisco Waterfront Coastal Flood Study

Dear Dr. Blakeway:

The purpose of this communication is to respond to a request by the Tulsa District of the U.S. Army Corps of Engineers (USACE). We have been engaged with USACE staff and management regarding the proposed San Francisco Waterfront Coastal Flood Study (Project), including Regulatory Advisory Workgroup meetings and providing comments on the Draft Integrated Feasibility Report and Environmental Assessment Document.

Due to federal requirements for projects involving in-water work, the USACE is required to submit a request for Water Quality Certification (WQC) pursuant to Section 401 of the federal Clean Water Act for review and acceptance by the Water Board prior to commencing any work. To issue a WQC the Water Board will need to receive a valid request in accordance with 40 CFR § 121 and comply with the California Environmental Quality Act. It is the intent of the Water Board to fully review this Project once a valid request for a WQC that contains sufficient detail of the Project is submitted to the Water Board.

If you have any further questions, please contact Nathaniel Goetz of my staff at (510) 622-2346, or by email at Nathaniel.Goetz@waterboards.ca.gov.

Sincerely,

Eileen M. White

Digitally signed by Eileen M. White
Date: 2025.10.21 13:38:26 -07'00'

Water Boards

Eileen White
Executive Officer

cc (all via email):
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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CA

SUB-APPENDIX D.5 COASTAL ZONE MANAGEMENT ACT COMPLIANCE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CA

ANNEX D.5.1
SAN FRANCISCO BAY PLAN CONSISTENCY DETERMINATION

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Acronyms and Abbreviations

Acronym	Definition
AEP	Annual Exceedance Probability
BCDC	San Francisco Bay Conservation and Development Commission
BMP	Best Management Practice
CARI	California Aquatic Resources Inventory
CDFW	California Department of Fish and Wildlife
CMA	Coastal Zone Management Act
Eco-PCX	Ecosystem Restoration Center of Expertise
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
EWN	Engineering with Nature
EWNG	Engineering with Nature Working Group
FWOP	Future Without Project
HAPC	Habitat of Particular Concern
HEA	Habitat Equivalency Analysis
HTRW	Hazardous, Toxic and Radioactive Waste
IFR-EIS	Integrated Feasibility Report and Environmental Impact Statement
LUST	Leaking Underground Storage Tank
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act

Acronym	Definition
MSFMA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NNBF	Natural and Nature-Based Features
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
PED	Preconstruction Engineering and Design
POSF	Port of San Francisco
RAWG	Resource Agency Working Group
RSLC	Relative Sea Level Change
SAV	Submerged Aquatic Vegetation
SLR	Sea Level Rise
SPCC	Spill Prevention Control and Countermeasure Plan
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

1.0 Introduction

The U.S. Army Corps of Engineers, Tulsa District (USACE) and the Port of San Francisco (non-Federal sponsor) are conducting the San Francisco Waterfront Coastal Flood Study (SFWS) feasibility study to investigate and identify ways to reduce coastal flood risk along 7.5 miles of the San Francisco Waterfront by evaluating alternatives to meet current and future coastal flood risk management (CFRM) needs. This Consistency Determination (CD) describes the activities associated with the Proposed Action and whether they are consistent with the applicable state coastal management program.

The project extends approximately 7.5 miles from Aquatic Park in the northeast to just past Heron's Head Park in the south in San Francisco, CA. The project area is divided into four reaches as shown in Figure 1. These reaches were chosen based on hydrologic separability, identifiable geographic references, specific wave action within each reach, and major differences in physical structure inventory. These reaches also provide a neighborhood-scale approach to communicate risks, impacts, and alternatives. Reach delineations include:

- **Reach 1:** Covers Aquatic Park, Fisherman's Wharf, Pier 31 to Pier 35, and the North Beach neighborhood.
- **Reach 2:** Includes the Northeast Waterfront and Financial District. This area comprises a significant portion of the Embarcadero Historic District and includes popular sites such as the Exploratorium, Embarcadero Promenade, and the San Francisco Ferry Building.
- **Reach 3:** Contains South Beach, Mission Creek, Mission Rock, Mission Bay and Pier 70, and includes the South Beach, SoMa, and Mission Bay neighborhoods. This area is known for the Giants' baseball stadium, Chase Center, and access to Mission Creek and the Bay. It is one of the densest residential areas within the project area.
- **Reach 4:** Encompasses Pier 80, Islais Creek, Cargo Way, Pier 96, and Heron's Head Park. This area is comprised of industrial uses along the waterfront and provides critical industrial, maritime, and commercial Port functions.



Figure 1. San Francisco Waterfront Project Area with Reach Demarcation

2.0 Legal Authority

This CD was prepared in accordance with the Coastal Zone Management Act of 1972, as amended (16 United States Code [U.S.C.] Section 1451), and the implementing regulations entitled Federal Consistency with Approved Coastal Management Programs (15 Code of Federal Regulations [CFR] Part 930). Under these regulations, USACE is responsible for managing its projects within the coastal zone jurisdiction in a manner that is consistent, to the maximum extent practicable, with the coastal zone management programs approved for California by the National Oceanic and Atmospheric Administration (NOAA). The program applicable to USACE projects in the San Francisco Bay is the San Francisco Bay Plan (Bay Plan), which is administered by the San Francisco Bay Conservation and Development Commission (BCDC).

3.0 Federal Determination

USACE has evaluated the Proposed Action and has determined that it is consistent, to the maximum extent practicable, with the Bay Plan policies. A detailed assessment of this project's consistency with those policies is provided in Section 5.0.

4.0 Project Description

The Proposed Action includes a combination of measures including: non-structural methods (i.e., floodproofing, retreat, building demolition); raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. Table 1 provides a summary of the measures proposed within each reach of the Recommended Plan.

Table 1. Measures Within Each Reach of the Recommended Plan

Measure	Reach 1	Reach 2	Reach 3	Reach 4
Floodproofing	•	•	•	
Deployable		•	•	•
Elevate Structures		•	•	•
Relocate Structures				•
Remove Structures				•
Curb Wall	•	•	•	
Elevate Shoreline		•	•	
Seawall		•	•	•
T-wall			•	•
Elevate/Rebuild Wharf		•	•	•
Paved Levee			•	
Planted Levee with EWN Features		•	•	•
Sheet Pile Wall with EWN Features				•
EWN – Marsh/Coarse Beach Restoration			•	•
EWN – Rocky Intertidal Bluff		•		
EWN – Living Seawalls		•	•	•
Bay Fill		•		
Ground Improvements		•	•	•

The project map provides an overview of where proposed features would occur along the San Francisco waterfront, simplified to polygons of the construction footprint (Figure 2). Detailed maps are provided in Section 4.1 that define the measures occurring in each reach, with anticipated construction footprint, and include a description of how measures are assumed to be constructed.

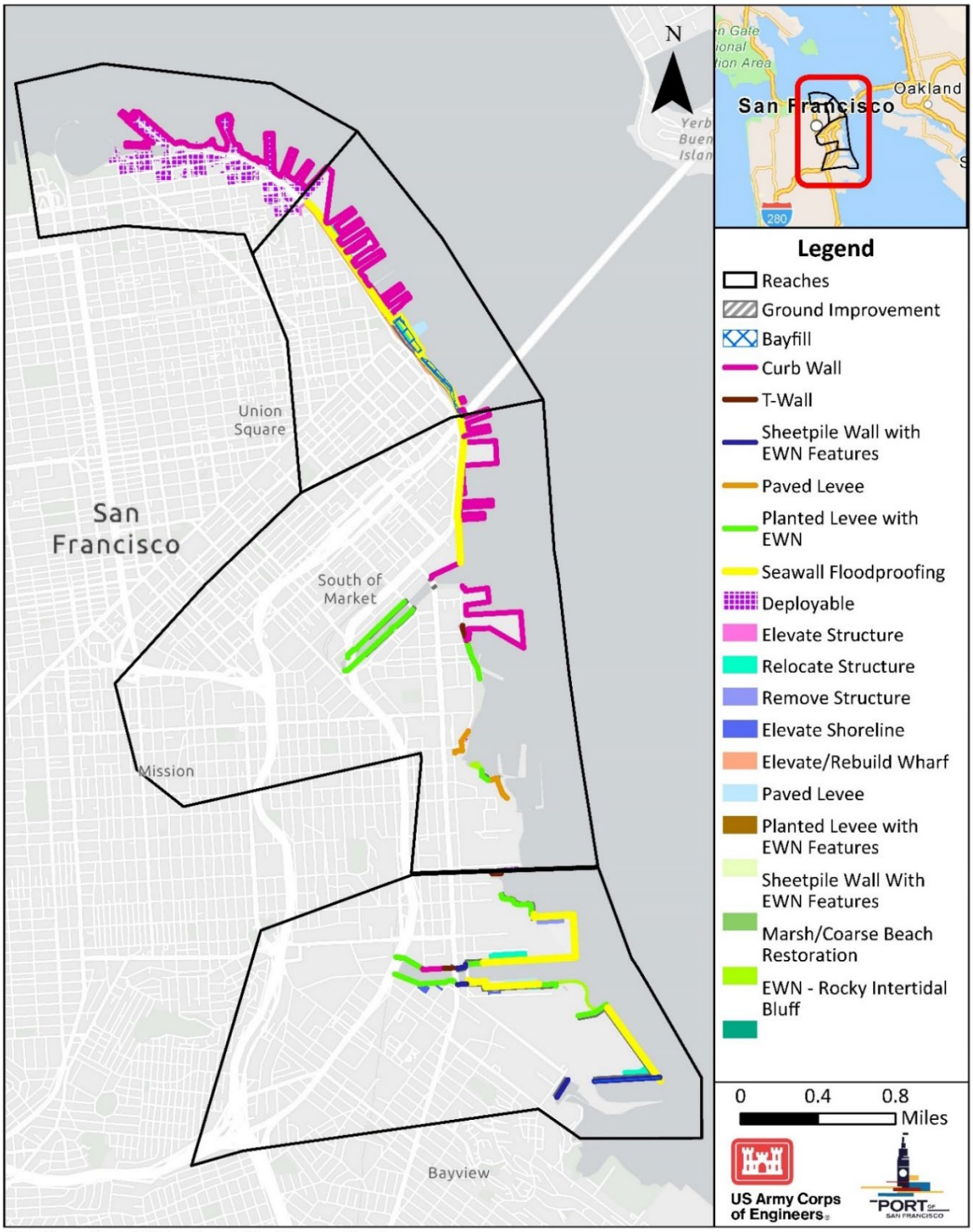


Figure 2. Overview of Footprint for the Proposed Action

A description of the construction activities for the Proposed Action are provided in the following sections. Approximate spatial extent (e.g., linear feet, acres) for the construction footprint are provided in Table 2. A general description of the construction methods and equipment, as well as anticipated duration for construction, is provided below.

Table 2. Recommended Plan Measure Quantities

Measure	Linear Feet (LF)	Square Feet (ft^2)	Acres
Floodproofing	--	2,835,000	65
Deployable	--	50,000	1
Elevate Structures	--	750,000	17
Relocate Structures	--	175,000	4
Remove Structures	--	195,000	4
Curb Wall	51,200	--	--
Elevate Shoreline	11,500	1,030,000	24
Seawall	21,000	--	--
T-wall	1,000	--	--
Elevate/Rebuild Wharf	10,900	660,000	15
Paved Levee	1,800	80,000	2
Planted Levee with EWN Features	11,800	865,000	20
Sheet Pile Wall with EWN Features	2,900	20,000	0
EWN – Marsh/Coarse Beach Restoration	--	225,000	5
EWN – Rocky Intertidal Bluff	--	85,000	2
Living Seawalls	TBD	--	--
Bay Fill	--	395,000	9
Ground Improvements	38,400	--	--

**Note: Linear feet (LF) are rounded to the nearest 100 feet, square feet (ft^2) are rounded to the nearest 5,000 ft^2, and acres are rounded to the nearest whole number. Values denoted as "—" indicate the measurement was not calculated or applicable. TBD = to be determined during preconstruction, engineering and design (PED).*

There are common construction techniques that would be applied across an array of measures, thus, are summarized here to avoid repetitive descriptions:

- **Cast-in-place concrete** is poured into removable forms (or castings) erected on site and cured in the concrete's finished position. Temporary forms or castings would be constructed on site and would be reinforced with steel. Most formwork would be composed of steel, aluminum, and wood. Ready mixed concrete would be delivered via large cement trucks and poured into the castings with a truck chute, bucket, or pump. The concrete is left to cure in the castings before removal. Once cured, casting materials would need to be removed and reused for another measure or hauled off and disposed of.

- **Cofferdams** are an enclosure that allows water to be pumped out to establish a dry working environment. A cofferdam would be constructed from steel sheet piles with interior bracing. Sheet piles would be driven into the sediment in the bay through hydraulic or pneumatic tools, braced internally with waler beams and compression struts to keep the wall from collapsing. Braces would be installed using heavy machinery from work barges in the bay. Inside of the cofferdam would be un-watered and dewatered with a combination of surface pumps/sumps and deep wells as necessary to create a dry and stable work environment. Once construction is completed, the cofferdam would be disassembled and removed. For simplicity, it was assumed cofferdams would be installed across 50 linear ft at a time.

The proposed measures are broken down by individual reach and measure descriptions are provided below in Section 4.1, Project Description.

4.1 Proposed Measures by Reach

4.1.1 Reach 1

Reach 1 focuses on nonstructural measures that move people and assets away from the flood risk. Nonstructural measures reduce consequences of flooding and allow water to disperse naturally rather than constructing traditional structural solutions. In Fisherman's Wharf, the Recommended Plan relies on floodproofing buildings and infrastructure and installing curb walls to floodproof the piers (Figure 3).

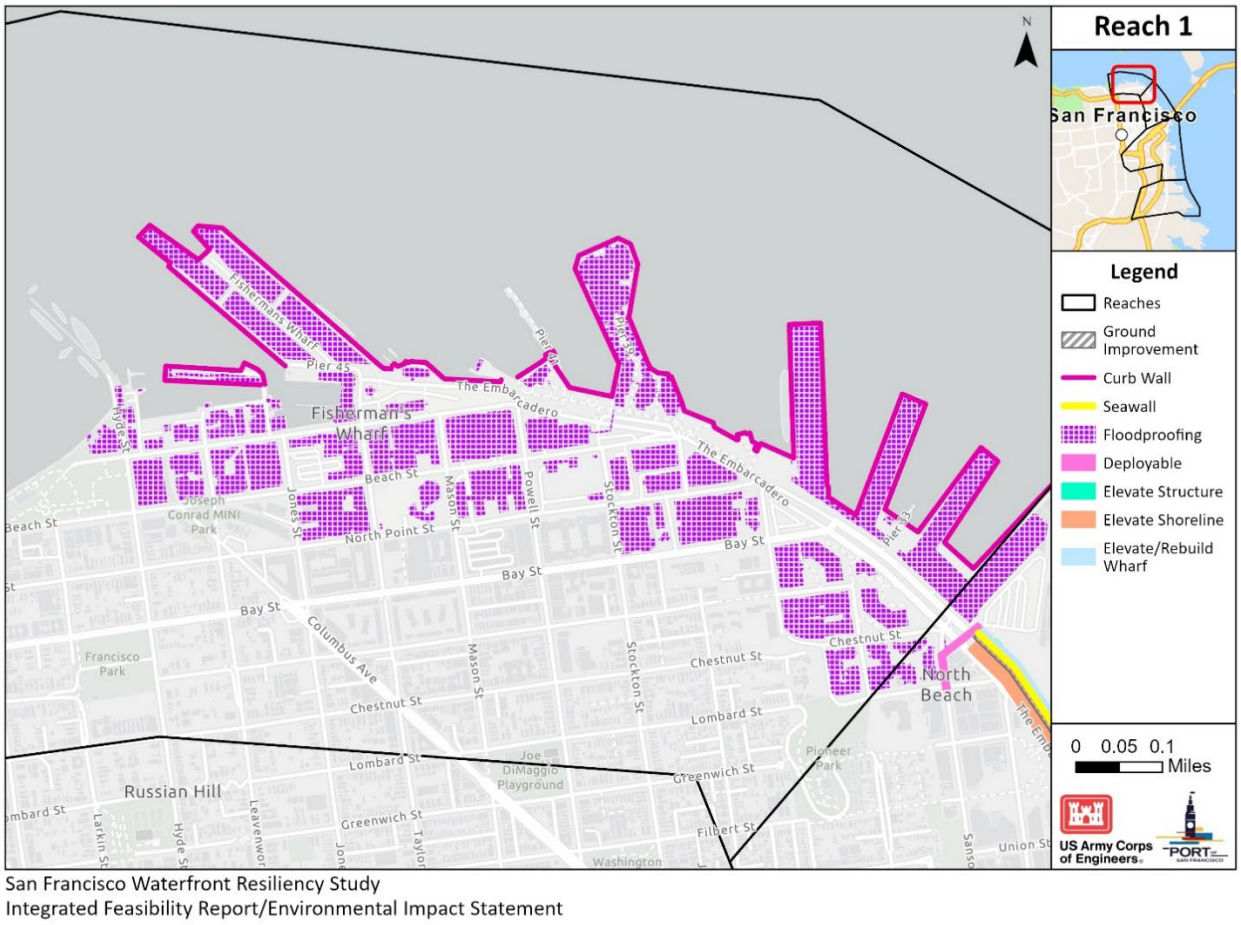


Figure 3. Proposed Action Reach 1

4.1.2 Reach 2

Along the Embarcadero, the Recommended Plan elevates the shoreline in place by raising and reconstructing the bulkhead seawalls and pile-supported wharves north of the Bay Bridge to a finish elevation of 15.5 feet NAVD88, while gradually transitioning down from the new shoreline elevation back to the existing city grade to retain visual and physical access to the waterfront (Figure 4). The plan includes reconstruction of the full Embarcadero roadway right-of-way – surface design of the Embarcadero roadway and promenade would be determined in future project phases. The Ferry Building and bulkhead buildings are raised in place following construction of new pile supported foundations (wharves). Piers are floodproofed with concrete curbs around the perimeter to reduce flood risk. Engineering with Nature (EWN) features have been incorporated into some of the designs to support the long-term resiliency of the structural measures proposed while providing natural features to enhance the aquatic habitats.



Figure 4. Proposed Action Reach 2

4.1.3 Reach 3

In the Mission Creek / Mission Bay geography, the Recommended Plan defends existing city and community assets in place by elevating the creek and Bay shorelines to a finished elevation of 13.5 feet NAVD88 with raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls, natural and nature-based features, and closure structures (Figure 5). The coastal defense would tie into existing and planned high ground at Bayfront, Agua Vista, and Crane Cove Parks, and at the Mission Rock and Pier 70 development areas. The plan also includes partial reconstruction of the Embarcadero roadway south of the Bay Bridge to manage elevation change in this constrained urban area.

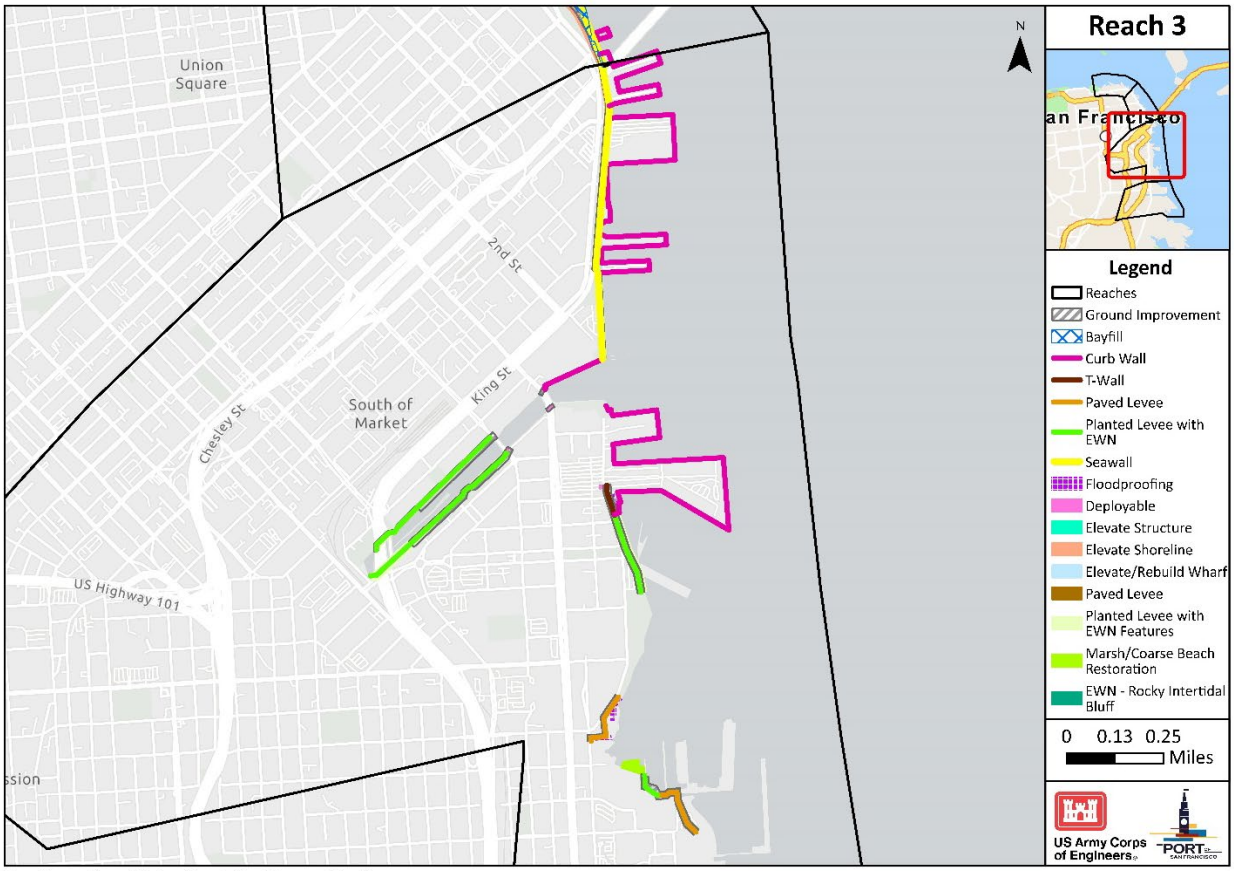


Figure 5. Proposed Action Reach 3

4.1.4 Reach 4

In the Islais Creek / Bayview geography, the Recommended Plan defends the existing shoreline to retain residential and commercial land uses in place, including Port land uses and maritime facilities. The flood defenses consist of raising the shoreline using bulkhead seawalls, levees, natural and nature-based features, floodwalls, closure structures, and tying into existing or planned high ground, near Potrero Power Station and behind the Pier 94 Wetlands (Port backlands). This area of the waterfront contains large parcels independent of the combined sewer system, such that the elevated shoreline would require modification to handle stormwater in a safe and effective manner (Figure 6).

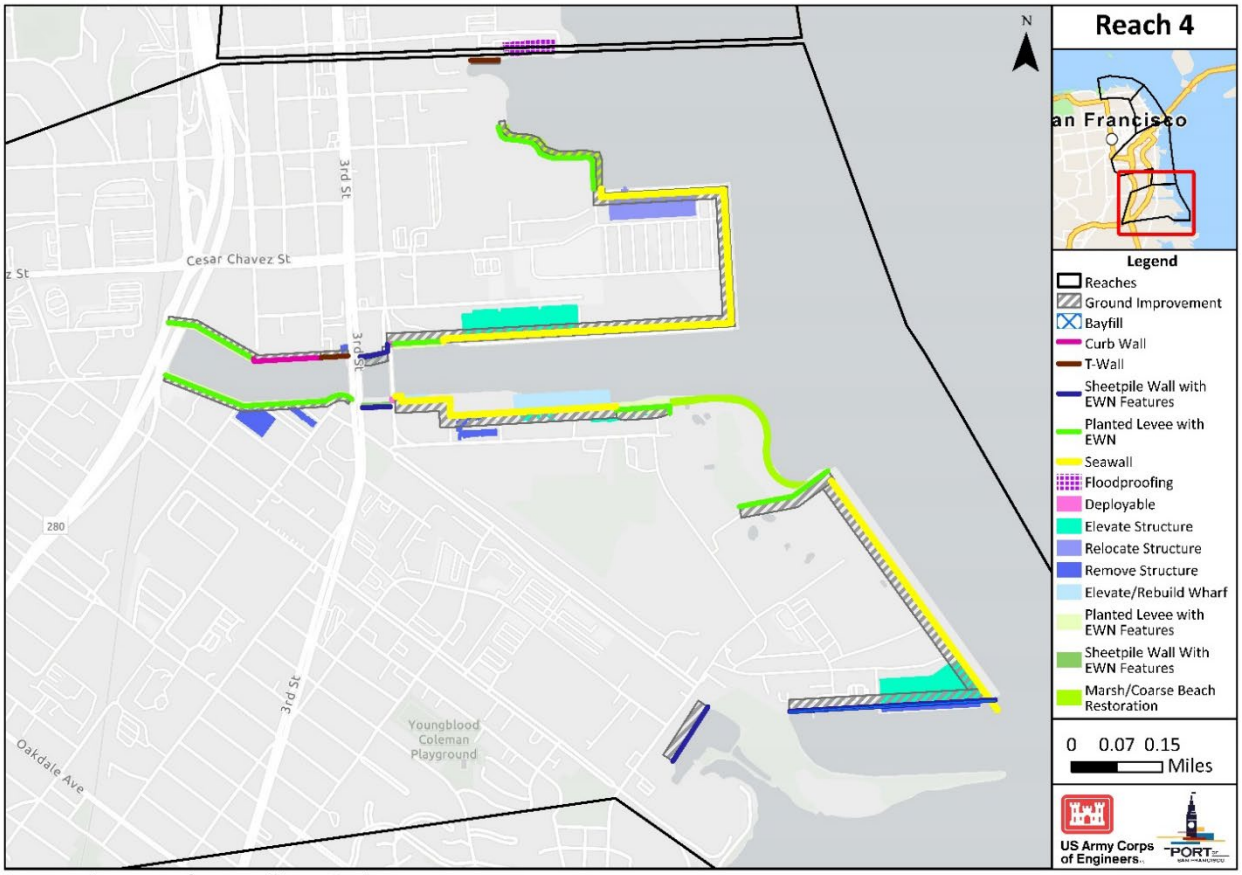


Figure 6. Proposed Action Reach 4

4.2 Measure Descriptions

4.2.1 Floodproofing

There are two types of floodproofing – wet and dry floodproofing. As the name implies, wet floodproofing allows floodwaters to enter the structure, while, in contrast, dry floodproofing prevents the entry of floodwaters. Dry floodproofing is proposed for industrial and commercial properties and critical infrastructures and wet floodproofing is proposed for residential structures.

Wet floodproofing measures involve permanent or temporary measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure. Generally, this includes properly anchoring the structure, using flood resistant materials below the Base Flood Elevation, relocating and/or protecting mechanical and utility equipment, and use of openings or breakaway walls to avoid structural damage due to hydrostatic pressure and to allow flows to enter and exit the structure. Wet floodproofing is practical only for portions of a structure that are not used for living spaces, such as basements, elevated structures, crawlspaces, or attached garages.

Floodproofing activities would be completed in phases based on flooding frequency over a given period. Those with imminent risk would be completed first and properties where the risk rises as sea levels rise would be floodproofed when appropriate. The type of floodproofing would be structure dependent. Each structure would be evaluated independently of the others for what would be the most appropriate and least invasive method of flood protection possible that would still retain the integrity of the structure.

Many of the properties in the project area are considered historic and are eligible or listed on the National Register of Historic Places pursuant to the National Historic Preservation Act. For these historic structures, the National Park Service's "Guidelines on Flood Adaptation" would be used to aid in identification of appropriate measures to increase flood resiliency while meeting the Secretary of the Interior's Standards for Rehabilitation and preserving the property's historic features, spaces, materials, site, and setting.

4.2.2 Deployable

Deployable gates would be used to close the openings at bridges and where additional tie into high ground is needed during high water events, while allowing continued vehicular, pedestrian, and rail access at all other times. A range of potential deployables may be used depending on the location, type of access needed, frequency of use, anticipated flooding conditions, operation and maintenance needs, etc. and may include swing gates, roller gates, flip up barriers, or other removable deployables (Figure 7).

Permanent deployables are constructed to remain on-site and are designed for deployment temporarily during storm events or king tides. Typically, they are constructed of structural steel elements with a steel plate skin and tied into the adjacent flood protection measures (i.e., levee or vertical wall). Swing gates are attached to a reinforced column of a flood wall with hinges on one side, while rolling gates rest and roll on a ground wheel carrier or track along the gate sill.

When closed, compressible seals along the bottom and sides of the gate seal against the wall and sill to resist water infiltration. Depending on the height and width, additional bracing can be placed on the dry side of the gate to help it withstand the pressure of the water. Gates can have the option for a manual cranking system to close depending on size, but many times a motorized opening/closing device is required. Traffic control measures would be added to the bridges to warn of gate deployment when activated.



Swing Gate
Source: courtesy of Flood Control International

Roller Gate
Source: courtesy of Flood Control International

Flip Up Barrier
Source: courtesy of Flood Control International

Figure 7. Example of Permanent Deployable Flood Gates

4.2.3 Elevated Structures

Structure elevation involves raising each structure to a higher elevation to reduce the risk of flooding during high-water events. To do this, the structure is separated from its foundation and temporarily raised in place with hydraulic jacks. The new foundation system, such as fill, columns, posts, piers, or raised foundation walls, would be constructed and then the structure lowered into place on the new foundation system. The goal is to ensure the lowest habitable floor is at or above the base of flood elevation or higher. Selection of proper elevation method depends on flood characteristics such as flood depth or velocity.

4.2.4 Relocate/Remove Structures

Structures may be removed from the existing location to eliminate the potential flood risk or to make room for the proposed flood protection system. This would require heavy machinery such as wrecking balls, excavators, and bulldozers. The building debris would need to be hauled off using large trucks or barges to an appropriate disposal facility. Structures identified for removal would be permanently removed and not rebuilt in place or elsewhere.

Structures identified for relocation would be physically relocated or rebuilt in another location off-site to be determined during the preconstruction, engineering, and design phase (PED). Relocated structures may be transported in whole or disassembled and then reassembled at the new location. For whole structure transport, a temporary steel framework is attached under the structure to support it, then lifted off the foundation using a network of hydraulic jacks placed under the framework and controlled by a unified jacking system. Once the structure is at a sufficient height, hydraulic dollies or a flatbed trailer(s) are placed under the supporting framework. These are used to move the structure to the new location. After the move, the steps are reversed, and the structure is lowered.

In some instances, buildings being relocated would require modifications to allow for moving, and to make structural improvements to meet current building codes and standards once re-established on their new foundation. This is most likely to apply to historic bulkhead and shed building structures that are part of the Embarcadero Historic District.

4.2.5 Curb Wall

A curb wall is a short wall, approximately two feet tall and no more than one-foot wide, made of reinforced concrete that would be connected to existing gray infrastructure (e.g., wharfs, piers, seawalls) to minimize floodwater entry into adjacent structures (Figure 8). The curb wall would be fixed to a concrete deck or capping beam along the perimeter of the main structure. For the feasibility study, the curb wall was assumed to be constructed of either cast-in-place concrete or precast concrete elements which are attached mechanically, both of which would include some type of water stop integrated to ensure an acceptable seal against seepage. During the PED phase, other elements such as glass or clear polymer panel that would provide similar functionality may be considered to minimize visual impacts from the land or Bay.

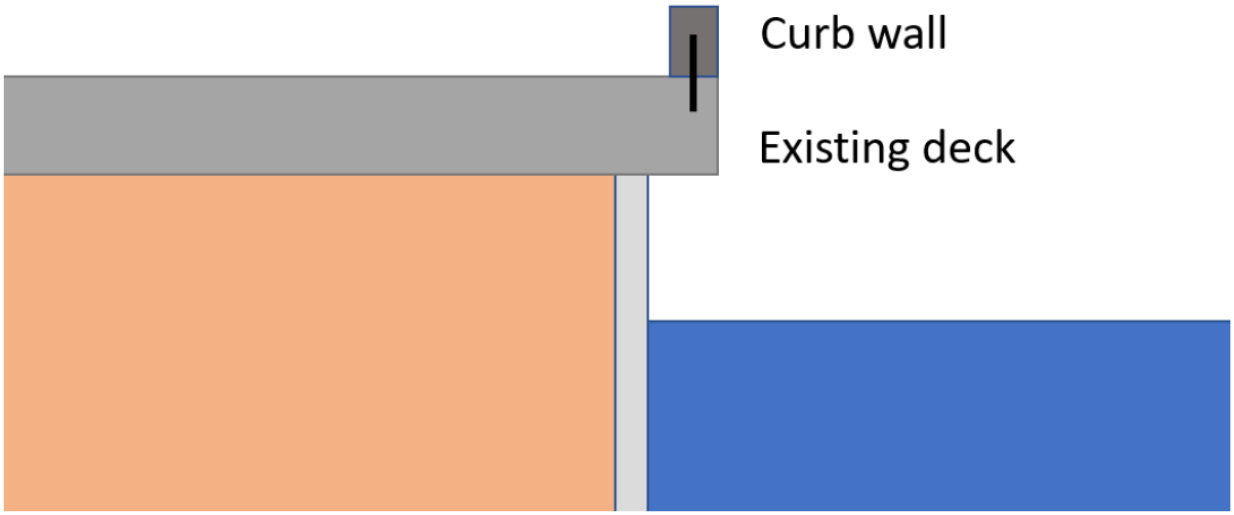


Figure 8. Example Curb Wall

4.2.6 Bulkhead Seawall

A seawall, synonymous with bulkhead wall, is a retaining wall structure that supports earthen fill on one side and protects against erosion caused by a waterbody on the other side. The seawall is the defined line of defense for the protection system. The design height of each seawall is the basis for how high the wharf or shoreline must be raised.

Seawalls are subdivided into two categories, 1) seawalls less than 30ft in vertical height from the seafloor, and 2) seawalls greater than 30ft in vertical height from the seafloor. The two different height groups roughly correspond to the anticipated maritime use along the wall, but also require different means of construction due to their scale and access for construction along the shoreline. Seawalls greater than 30 feet in height generally would require shoreline raises and/or wharf reconstruction and elevation if they are present, while seawalls less than 30 feet in height would typically only need the seawall itself to function as designed and not impede the existing land uses (Figure 9

and Figure 10). Shoreline elevation, wharf elevation, and rebuilding are described in further detail in subsequent sections.

In general, it was assumed that all seawalls are constructed of concrete. The seawall is either constructed of (i) precast concrete piles driven along the wall alignment at close spacing, followed by square piles driven to fit within the interstitial space to fill the voids and create space for a grout pocket, or (ii) forms would be constructed and filled with concrete. Voids would be grouted to create a low permeability wall that would retain soils and resist erosion of the shoreline. The need for additional anchorage or tiebacks at the top of the wall using steel rods or soil anchors may be needed; however, the best technique for installation would be determined during PED.

Construction of the seawall is assumed to be completed from land by using secant pile or diaphragm wall designs. However, if other measures at the location require construction of a cofferdam and dewatering or construction in the “wet”, then the seawall may also employ similar techniques to avoid multiple moves of equipment or additional disruptions.

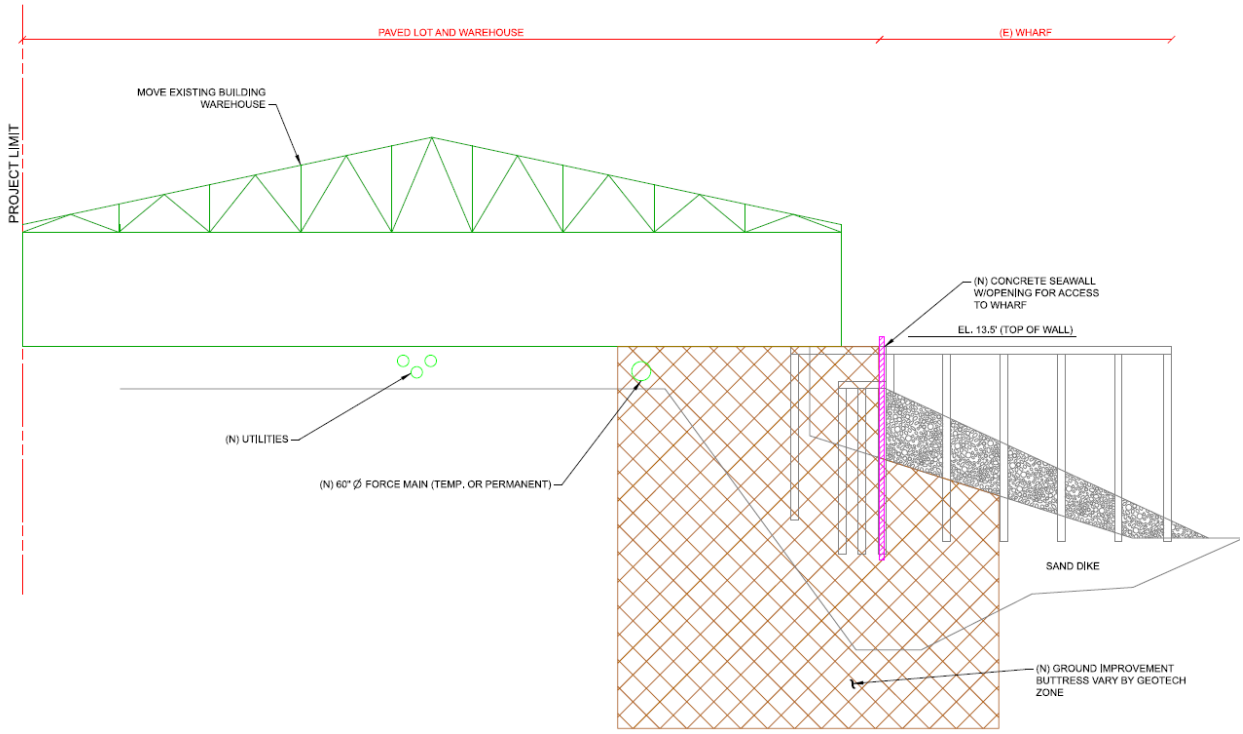


Figure 9. Example Cross-Section of a Seawall <30 Feet Tall Where no Wharf or Shoreline Elevation is Needed (e.g., Pier 80).

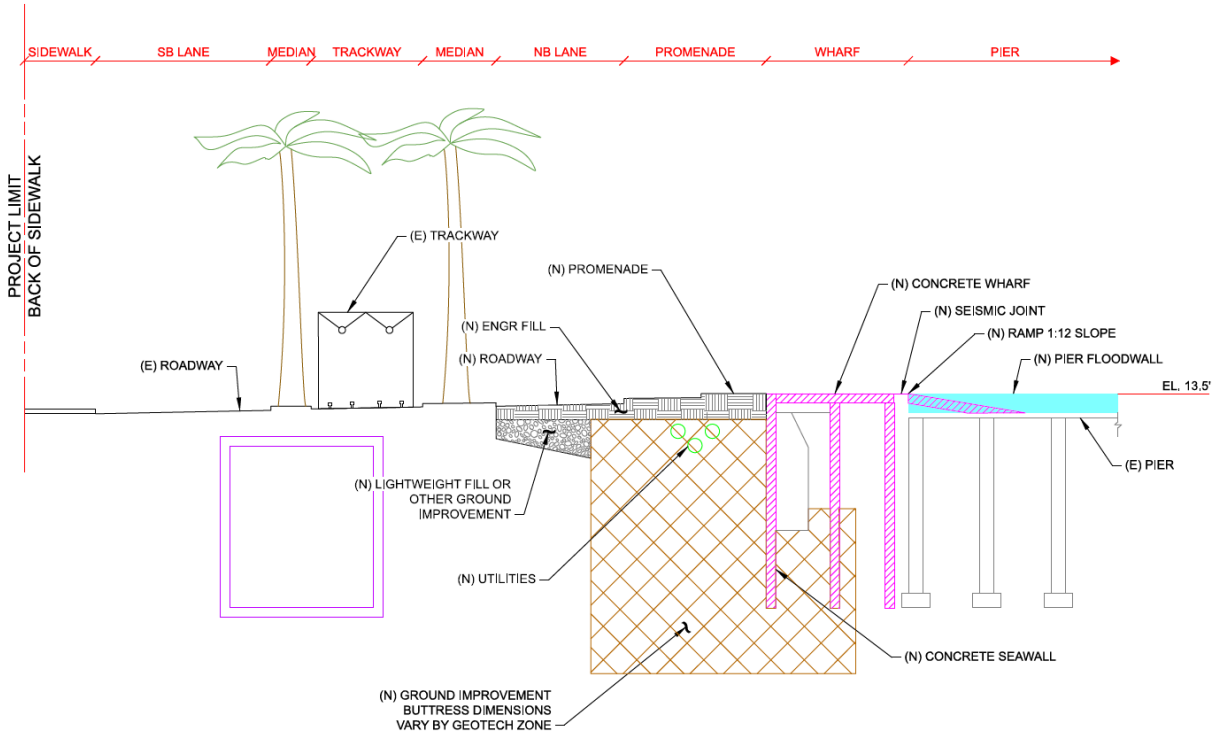


Figure 10. Example Cross-Section of a Seawall >30 feet Tall where Wharf and Shoreline Elevation are Needed (e.g., Pier 28)

4.2.7 Ferry Building Seawall

At the Ferry Building, the complicated foundation condition and confluence of buried infrastructure warrant a bayward line of defense. A new seawall would be constructed to follow the perimeter of the Ferry Building Structure (Figure 11). This would require approximately 4.6 acres of bay fill to back fill voids between the new and existing seawall. Fill materials would be imported material from commercial sources.

To construct the new seawalls, a cofferdam (described in Section 4.0) would be constructed around the work area and the area landward would be dewatered.

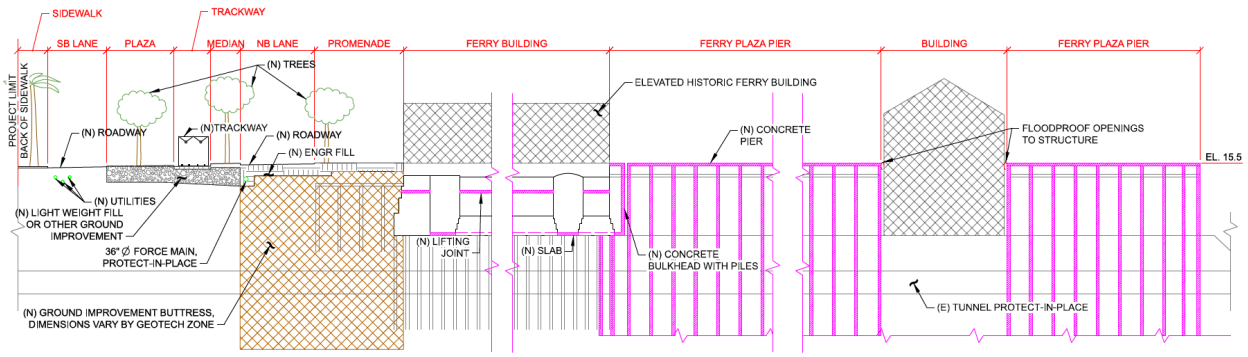


Figure 11. Proposed Cross-Section of the Seawall, Shoreline Elevation, and Wharf Raise at the Ferry Building

4.2.8 Rincon Park Seawall

At Rincon Park, a new seawall needs to be constructed approximately 60 feet into the bay to mitigate disruption to below grade transit infrastructure and the surface transit corridor in this area (Figure 12). The Rincon Park seawall would require approximately 4.0 acres of bay fill to fill the void between the new and existing seawall. Construction at this location would be similar to what is described for the Ferry Building and require cofferdam construction.

Additional EWN features have been added in front of the seawall to provide a natural solution to protecting the new seawall from high tidal energies at this location. The rocky intertidal bluff feature is described further below.

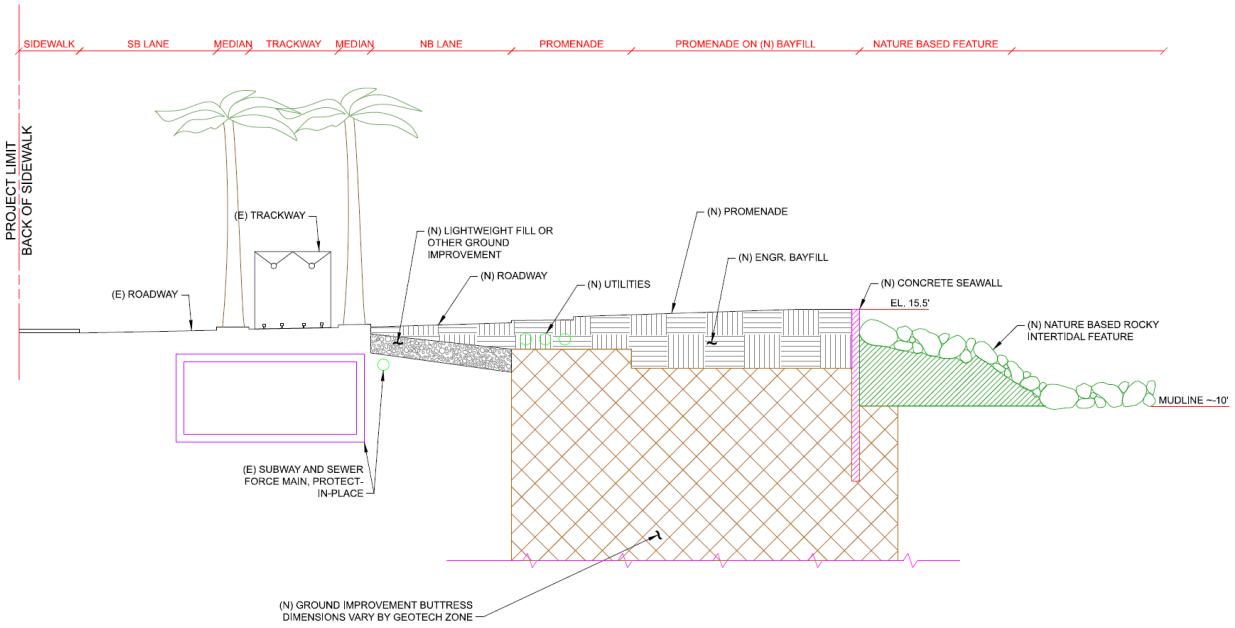


Figure 12. Proposed Cross-Section for the Seawall and Shoreline Elevation at Rincon Park

4.2.9 T-wall

A T-wall has a cross-section of an inverted “T”, and as designed for this project, is configured with a horizontal base (Figure 13) and is also the basis for the line of defense where this measure is employed. In some areas, a new pile-supported T-wall would be constructed landside of the existing or integral to a new seawall. At this design level, the T-walls are assumed to be founded on deep foundations consisting of either steel H-piles or pipe piles which could be driven either vertically or battered depending on the design loads and underground site constraints. A steel sheet pile cutoff, extending 20-30 feet vertically beneath the wall base, would be installed to reduce under seepage and uplift pressures on the structure. The pile foundations are assumed to consist of two rows of piles which are 50 feet in length and placed on 5-foot centers along the wall length. The panel height of each t-wall is dependent upon the existing elevation. The base of each t-wall is constructed wider than typical for the designed panel height to accommodate anticipated adaptability for future height increase. These design estimates would be refined in the PED phase.

After the T-Wall is complete, the area landward of the t-wall would be regraded using imported fill material from commercial sources. After grading, the fill material would be paved to create sidewalks and landscaping added.

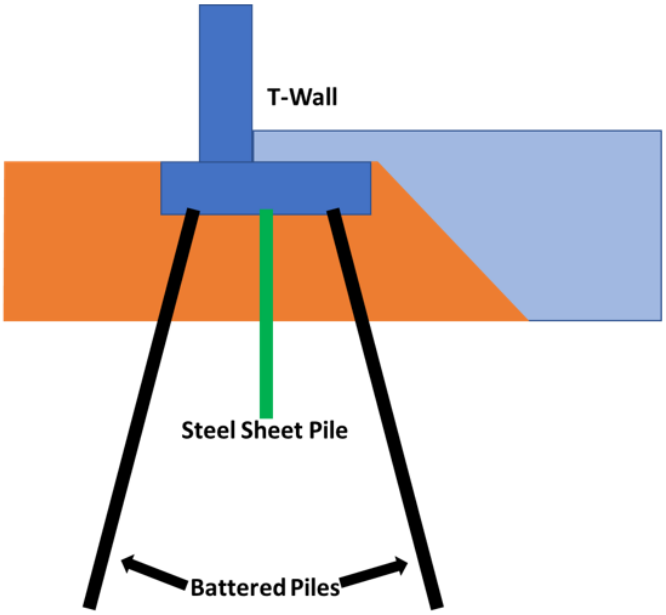


Figure 13. Typical T-Wall Cross-Section

4.2.10 Elevated Shoreline

Where the existing shoreline elevation is lower than the top of design elevation of the new seawall or T-wall, the shoreline may need to be elevated or raised 3.5 to 7.5 feet to defend against 3.5 feet of sea level rise (13.5 or 15.5 feet NAVD88 top design elevation) (Figure 14). To raise the shoreline, the area landward of the seawall would be filled with imported material from commercial sources, compacted down, and regraded over sufficient space to facilitate grade transitions, transit, vehicular and multi-modal access along the urban waterfront edge. Roadway, trackway, and promenade configurations are assumed to be generally the same as existing configuration; however, the exact surface configuration would be determined during PED.

Shoreline elevation would be constructed using standard earth moving equipment such as graders, bulldozers, dump trucks, etc. after all ground improvement measures have been completed. Any utilities that would be affected would also be relocated or modified to function with the new shoreline design.

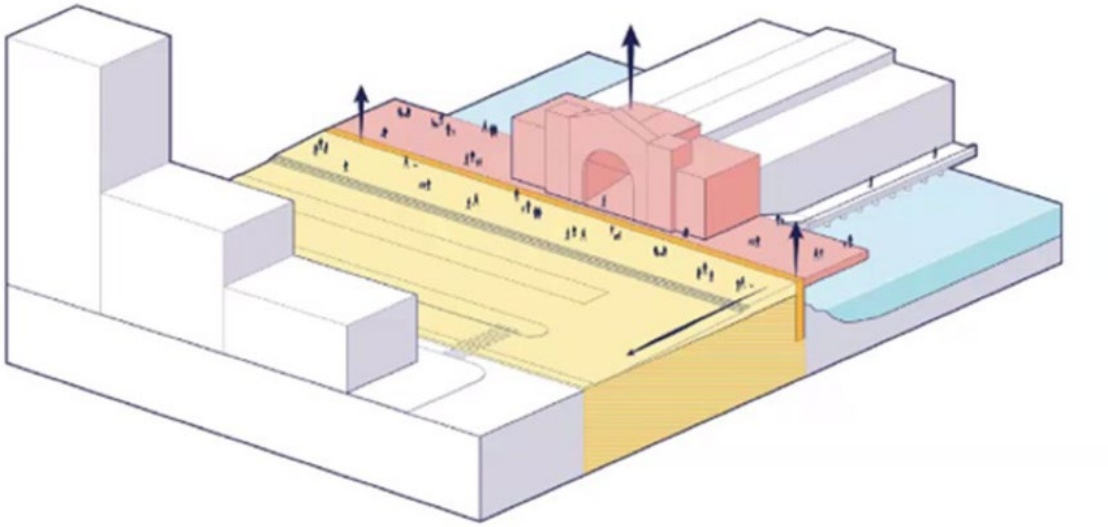


Figure 14. Example of Shoreline Elevation (yellow), Seawall Construction (orange), and Wharf Elevation (red)

4.2.11 Elevate/Rebuild Wharf

In places where the shoreline is being elevated, the existing bulkhead wharf, typically 50 feet wide running parallel to the shoreline, would also be elevated (Figure 15). The bulkhead wharf would be replaced with a new elevated reinforced concrete wharf structure with the top of the deck at specified flood defense design elevation.

To construct the new wharf, the existing wharf would be demolished, material removed, hauled away, and disposed of at an appropriate and approved facility. This would entail pulling out old pilings and existing concrete deck and surfacing (concrete or asphalt). The new wharf would then be constructed in the place of the old wharf. First, the 24-inch octagonal reinforced concrete or steel piles, approximately 100 feet long spaced on a 15-foot by 15-foot grid, would be driven through the rock dike down to competent soils using marine equipment and impact or vibratory pile driving techniques. Then, an approximately 12-inch-thick reinforced concrete deck (flat slab) made of pre-case elements or using cast-in-place construction, extending approximately 50 ft over the bay in all locations, except at the Ferry Plaza, would be constructed on top of the newly placed piles. At the Ferry Plaza, the reconstructed, reinforced concrete deck extends approximately 650’ into the bay to provide emergency egress and vehicular access for the Bay Area Rapid Transit system (Figure 11). During PED the design is likely to be refined (e.g., spacing and thickness may vary depending on load bearing, materials used, increase in height, etc.) and additional features may be incorporated such as glass blocks in the decking to allow for light penetration to the water below.

Reinforced concrete ramps would be constructed to allow pedestrian and vehicular access from the elevated wharf to the finger piers, since the finger piers that stretch out into the bay would remain at the existing elevation, unless otherwise noted.

With the new wharf design, less bay fill from pile material is anticipated when compared to the existing bay fill from existing piles; however, the change cannot be quantified at this time due to uncertainty in the number and size of existing piles at each wharf.

Wharf raising may be constructed in the wet using marine or land-based equipment if the wharf raise is not being completed in conjunction with a measure that would require a temporary cofferdam. If a cofferdam is intended to construct other measures at the location, it is anticipated that the cofferdam would not be breached until after all construction is complete including the wharf elevation and rebuild.

For wharves that supports structures, each would be removed, relocated and/or replaced (see description for relocating/removing structures above). For buildings requiring relocation and replacement back on the wharf, it is assumed that these buildings would be either braced and moved to a temporary location (on land or to floating barge) or carefully dismantled and stored until the new wharf is constructed. Once the new wharf is constructed the structure(s) would be moved back or reassembled.

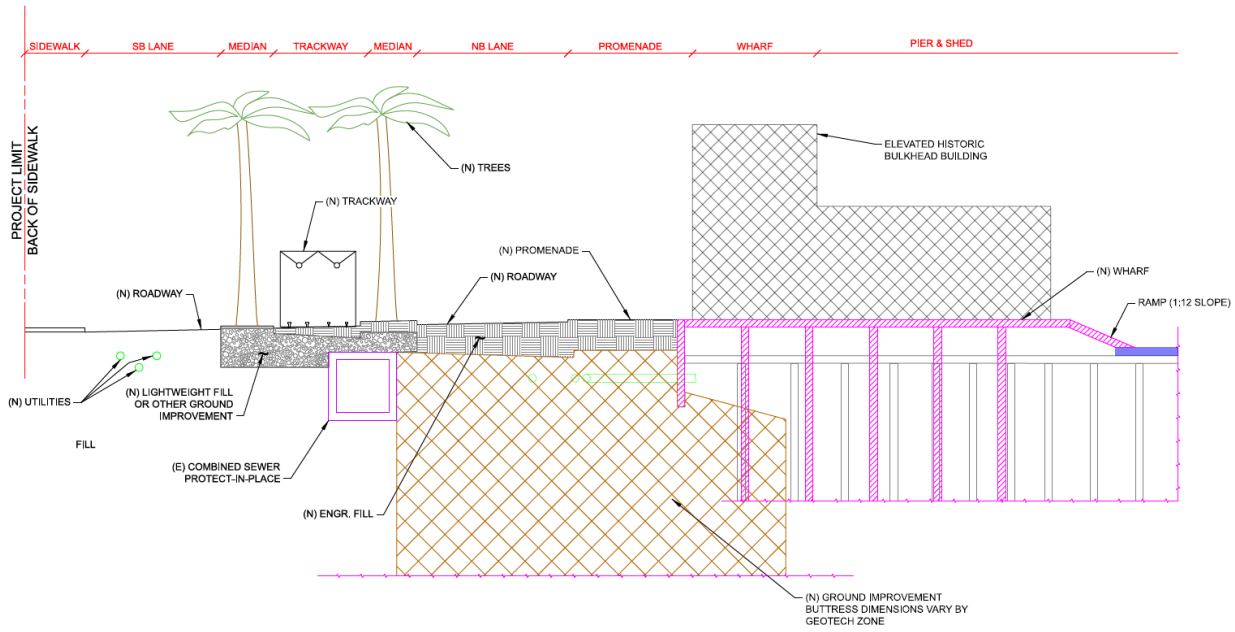


Figure 15. Example Cross-Section with an Elevated Shoreline, Elevated and Rebuilt Wharf, Elevated Structures, and a Ramp Down to the Existing Finger Pier (e.g., Pier 3)

4.2.12 Paved Levee

The levees would be designed as a raised earthen bank with a trapezoidal cross-section with a wider base that slopes up to a narrower crest to fortify against flooding risks (Figure 16). For alternative development, the side slopes were assumed to be no steeper than 3H:1V. It is likely that in locations where vehicle passage is necessary the slopes may range from 5H–10H:1V and on piers the slopes may be 12H:1V to

accommodate Americans with Disabilities Act (ADA) accessibility requirements. The required levee height and width is dependent on local existing elevations and the final flood side design side slope and configuration. The height of the levee could range from one to 10 feet to achieve the target design elevation of 13.5 feet in reach 2 and 3 or 15.5 feet NAVD88 in reach 4. The crest width of the levee may range from 10 to 20 feet. Final levee dimensions would be determined during PED.

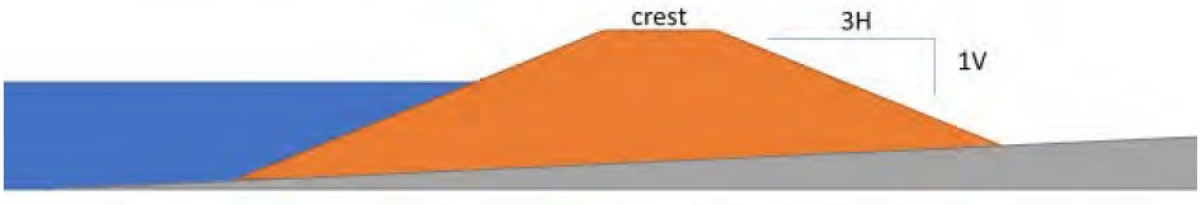


Figure 16. Typical Cross Section of a Levee

To construct the levees, first any existing vegetation, structures, roadways or parking lots along the proposed alignment would be removed and all material disposed of offsite. If utilities are within the alignment, they would need to be relocated prior to construction beginning. The project site would then be prepared for the levee foundation, which may include but is not limited to grading/stripping earthwork, adding or removing subgrade materials, drainage improvements, ground improvements, etc. The levees would be constructed of imported impervious earthen fill material, assumed to be procured from a commercial source near San Francisco and delivered to each site via dump truck. Fill would be placed in layers and compacted to reach the desired strength, width and height. For levees with a crest height ≥ 4 ft, a 20-foot-deep continuous vinyl sheet pile seepage barrier would be installed along the centerline of the structure using a vibratory or impact hammer to prevent undermining of the levee. Once complete, the levee would be dressed in a combination of commercially sourced bedding stones, riprap/armoring stones, concrete, and/or pavement depending on the location of the structure and long-term use (Figure 17). Any existing bike lanes, bay trails, or roadways disrupted by the new structure would be relocated or built into the overall design of the structure (e.g. crest may be converted to a paved bike path or walking trail). Final levee dimensions and site-specific construction requirements would be determined during PED (Figure 18).

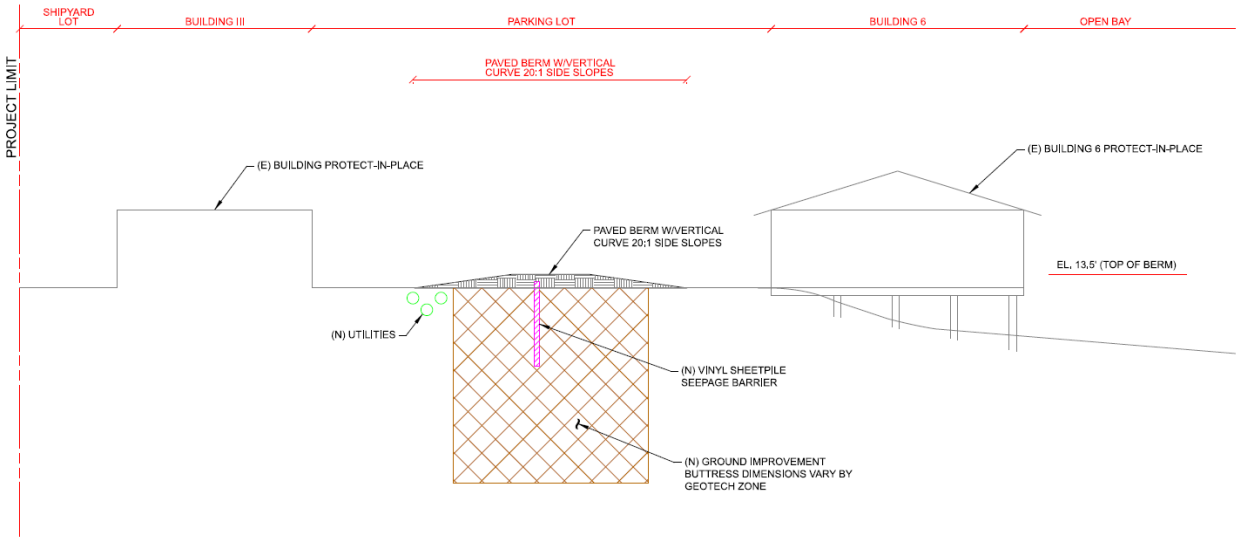


Figure 17. Example Cross-Section of a ≥ 4 ft Levee with a Paved Surface (e.g., Shipyard)

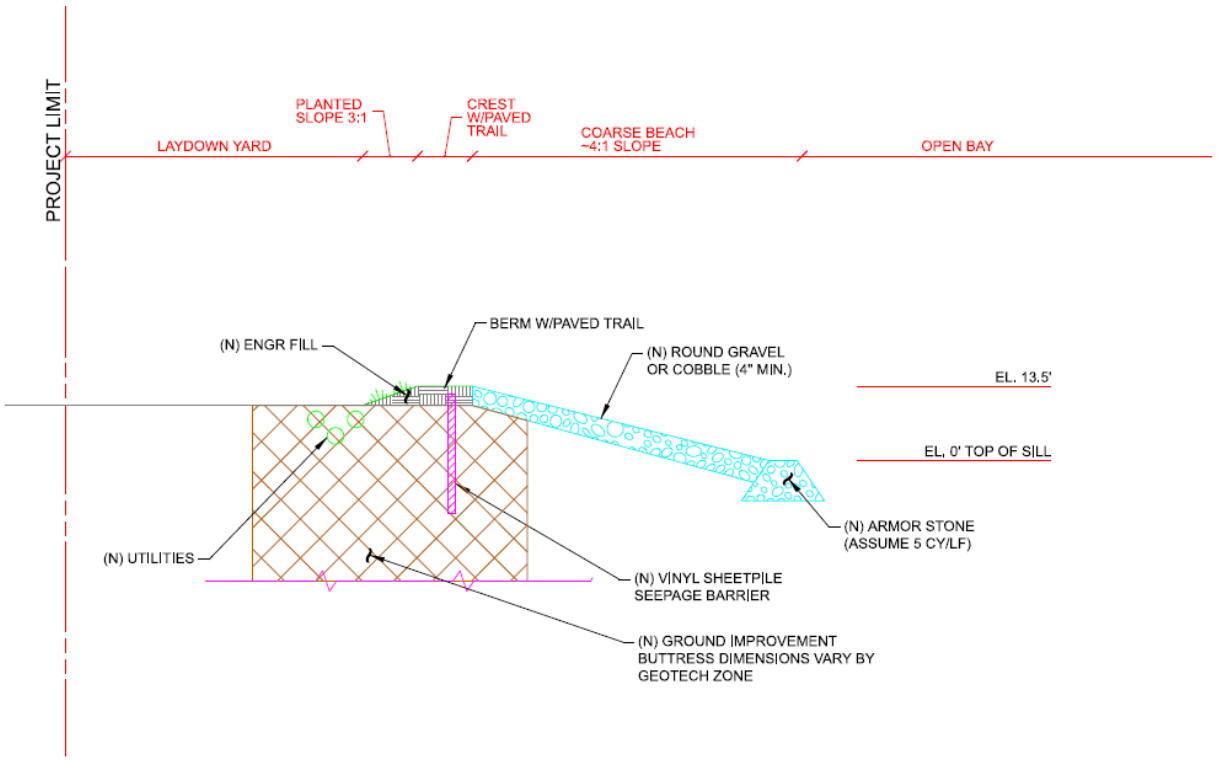


Figure 18. Example Cross-Section of a ≥ 4 ft Levee with a Paved Trail on the Crest and Armoring Stones on the Bayward Slope (e.g., Warm Water Cove)

4.2.13 Planted Levees with EWN Features

The planted levees would be constructed in the same manner as the Paved Levees measure except that the levee surface would be dressed in more native materials and pervious type surfaces and the side slopes may have gentler slopes to incorporate EWN features. This style levee typically connects the levee to terrestrial or aquatic habitat and can provide high quality transition zone habitat when vegetated with native plants. The slopes of these structures would typically vary between 10H:1V in space constrained areas to 30H:1V in isolated areas where real estate is not restrictive.

Each levee would be constructed of the same commercially sourced imported impervious earthen fill material as the paved levee, but the topsoil would need to be specified based on the vegetation type anticipated to cover the slope. The final design of the planted levee and the type of EWN incorporated at each location would be dependent on site-specific conditions including real estate constraints, adjacent habitat types that can be connected, desired species composition and recruitment, and long-term use of the area. Each design would include erosion control and stabilization of slopes using biological, mechanical and ecological concepts while providing floodable area in storms and extreme tides. The additional EWN features may be constructed of many different materials and textures to create a layered approach that can be refined to suit site and design needs. Additionally, each design considered would avoid

introducing material into open water areas to avoid bay fill, while over the long-term would increase available aquatic habitats as RSLC occurs.

For space constrained locations, such as areas along the lower creek banks of Islais and Mission Creeks, creek enhancements such as habitat shelves or terraces, planted edges, live crib walls, and other measures that increase surface complexity could be constructed within the same footprint as the traditional levee proposed (Figure 19).

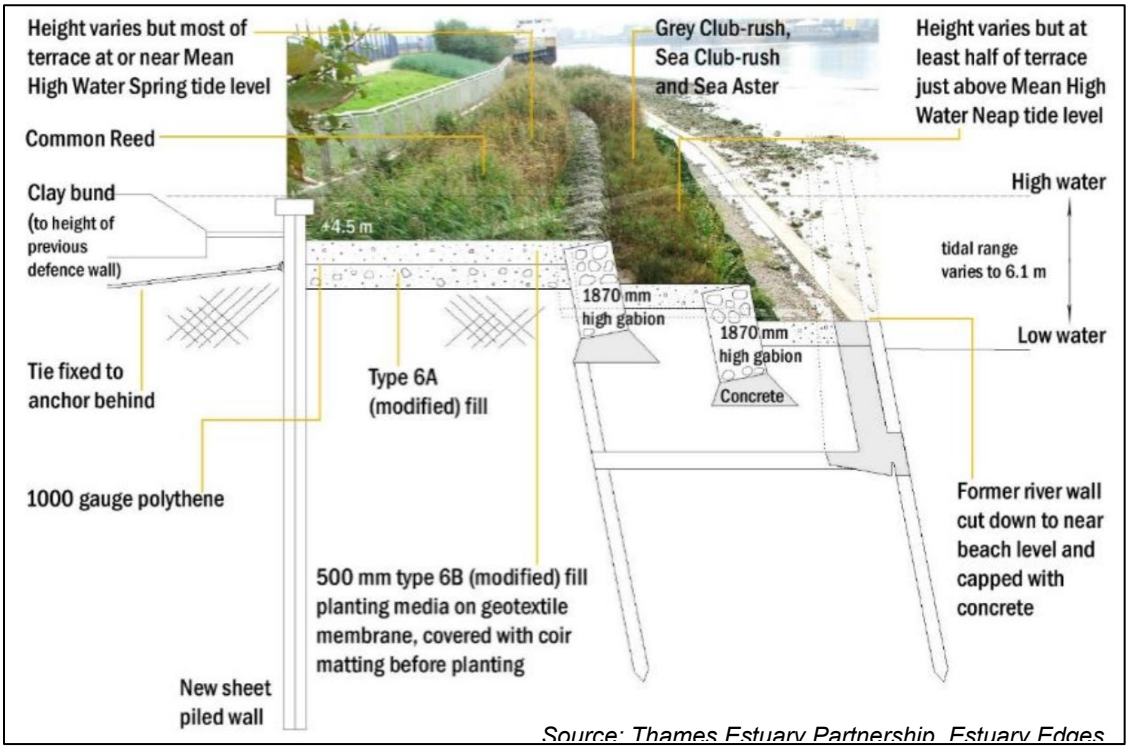


Figure 19. Example Creek Enhancements on the Thames Estuary

Where space is available, a gentle slope may be graded to support multiple transition zones and may feature a levee with side slopes greater than 10H:1V. At the crest, upland habitat would be created and transition to riparian, marsh and/or beach habitat to open water on the bayward side slope (Figure 20 and Figure 21). For levees with a steeper grade slope, vegetated riprap may be incorporated while gentler slopes may rely entirely on native materials.

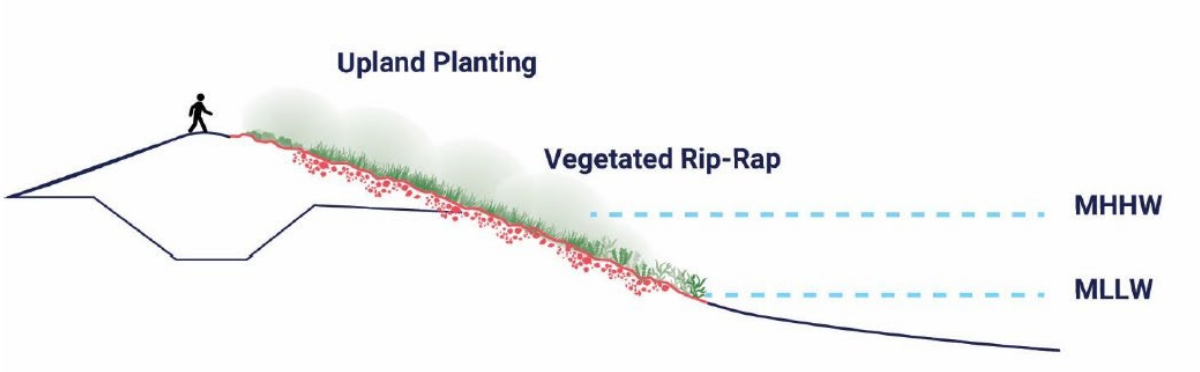


Figure 20. Example Cross-Section of a Planted Levee Where a Moderate Amount of Space is Available (~10H:1V slope)

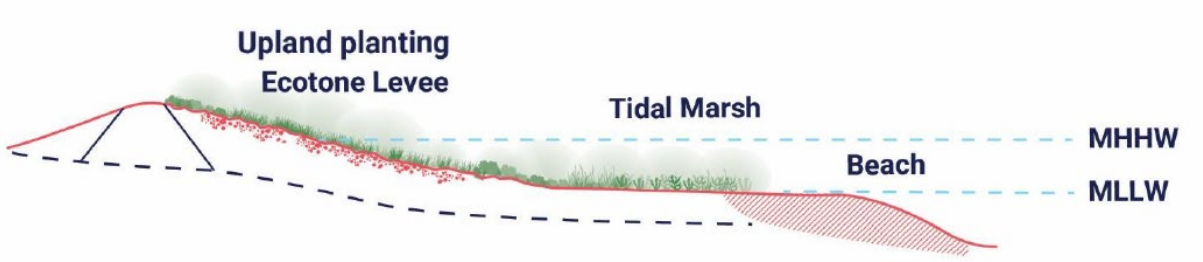


Figure 21. Example Cross-Section of a Planted Levee Where Considerable Space Available (~ 30H:1V slope)

Vegetated riprap, or ecological armoring, is armoring a direct replacement for traditional riprap that aims to replicate the natural processes and functions of rocky, intertidal habitat. Interlocking layered armored protection units or differently shaped riprap, sometimes with integrated tide pools, are designed to mimic natural intertidal conditions and create microhabitats, including vegetation establishment (Figure 22). Units can be stone (riprap), concrete, or other precast materials. In suitable environments, the units may be vegetated by filling in voids with soil and planted with upland, riparian or intertidal species.



Figure 22. Example of Ecologically Engineered Articulated Concrete Block Mattress Used as Ecological Armoring (Source: Courtesy of ECOncrete Tech, Ltd.)

4.2.14 Sheet Pile Wall with EWN Features

At locations identified for Sheet Pile Wall with EWN Features, a standalone sheet pile wall would be constructed as a floodwall, unlike in other measures where a sheet pile wall would be constructed in combination with another feature (e.g., levee or seawall). A sheet pile wall is a construction feature involving driving interlocking sheets of material into the ground to act as a barrier to contain water, for bank stabilization, and to prevent water from overflowing into vulnerable areas. The measure may be constructed using steel and/or cast-in place concrete materials using the same techniques described previously. The sheet pile wall would be constructed using land-based equipment.

As part of this measure, EWN features that would be used in space constrained locations would be incorporated into the overall design to provide additional protection to the floodwall (Figure 23). The EWN features would be constructed as described in the Planted Levees description.

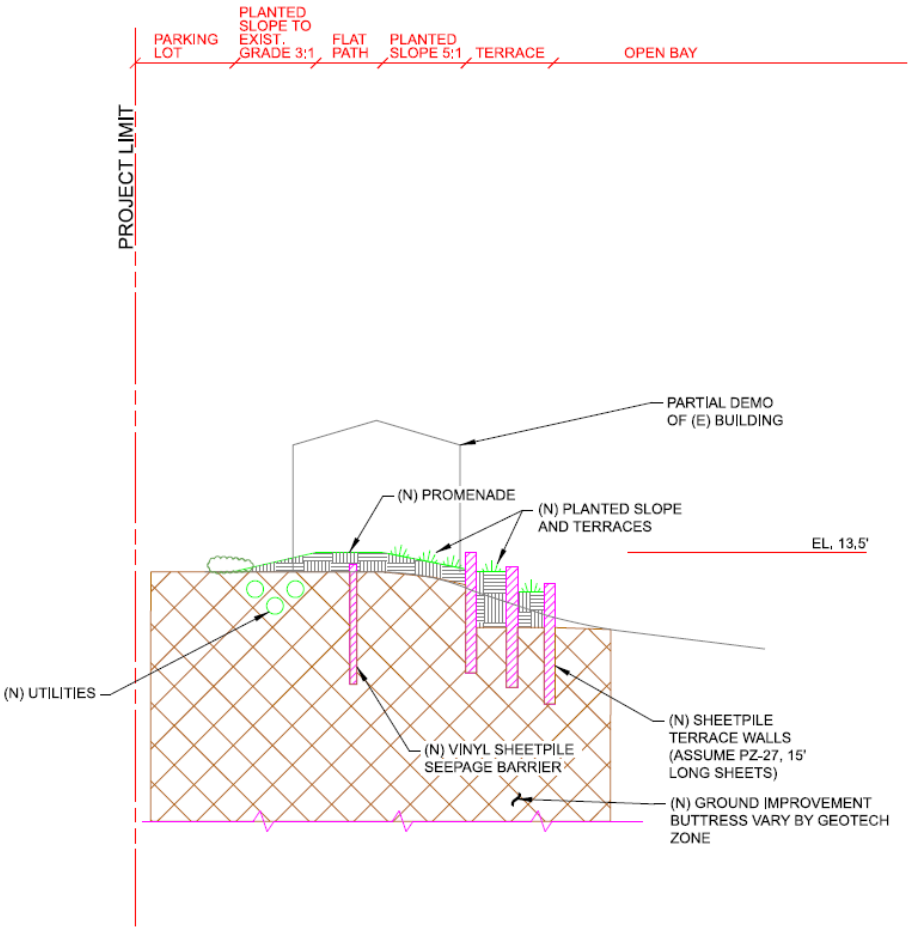


Figure 23. Example Cross-Section Using Sheet Pile Walls and EWN Features (e.g., Mission Creek North)

4.2.15 EWN – Marsh/Coarse Beach Restoration

Marsh and coarse beach restoration involves the restoration of degraded existing coastal wetlands (e.g., salt, brackish, and tidal freshwater marshes), mudflats, and/or coarse beach found in the proposed measure location. To restore the target habitat type at each location, sediment and other natural materials (cobble, gravel, larger rock size) would be introduced to the site to reach a target design elevation that would support the long-term viability of the desired habitat (Figure 24).

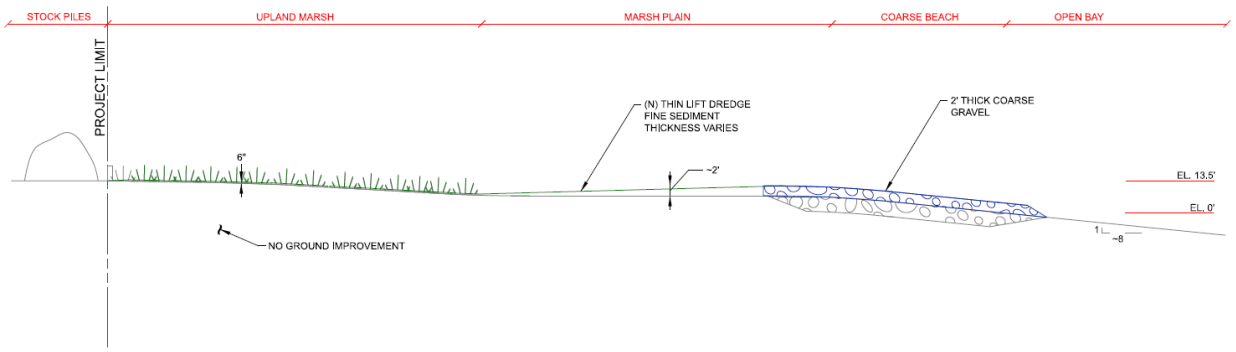


Figure 24. Example Cross-Section of Marsh and Coarse Beach Restoration Proposed at Pier 94 Wetlands

It is assumed material used to augment or nourish the marsh or beach would come from a commercially sourced material or from dredged material removed during normal operations and maintenance cycles (i.e. no new dredging would be pursued to implement this measure). The source of material would be determined during PED, but in any case, material placed at the site must have similar properties to the existing marsh or beach or meet the conditions of the target habitat type, if being created rather than restored.

To construct the marsh or beach, the material would be dumped in place (commercially sourced material) or pumped through a series of pipelines (dredged material) into the site until the surface profile is built up to the target elevations, which would be determined during PED and based on the target species, salinity and flooding regime and site conditions. Heavy machinery would be used to move sediment and facilitate construction which could include bulldozers, front-end loaders, track-hoes, marsh buggy, and backhoes. As necessary, temporary containment dikes would be constructed from in-situ material around the nourished areas to minimize material movement and to delineate work areas. The dikes would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages deemed appropriate for the site.

It is assumed that work would begin in an individual cell and continue until that cell is completed, with attempts made to not place material in more than one cell at a time to minimize the disturbance to existing marsh processes. Figure 25 shows an example of marsh restored at Heron's Head and Figure 26 shows an example of coarse beach restored in San Francisco that both would be suitable reference sites for restoration targets.

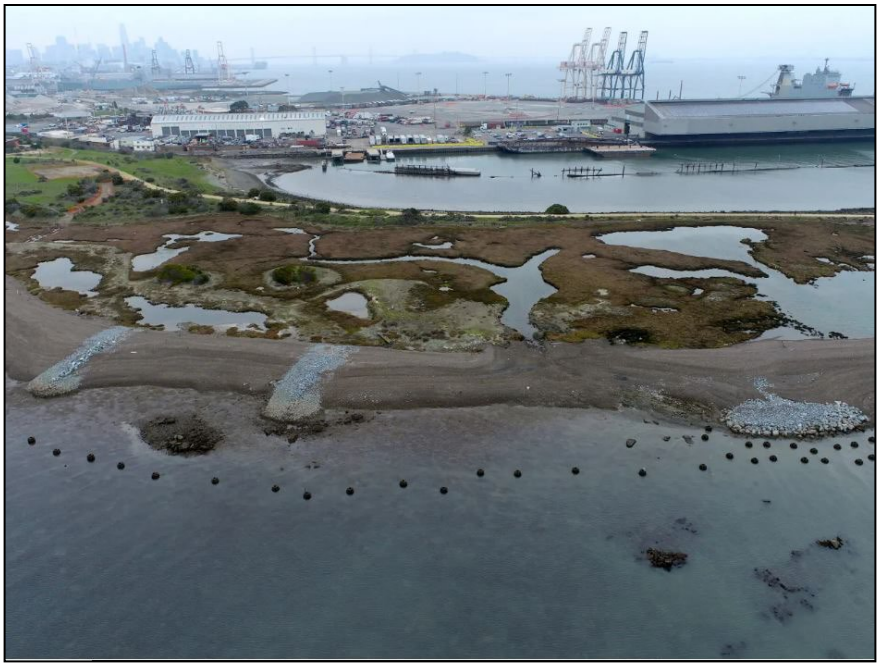


Figure 25. Tidal Marsh at Heron's Head in San Francisco, CA (Source: Port of San Francisco)



Photo Credit: SFEI

Figure 26. Example Coarse Beach Restoration in San Francisco

4.2.16 EWN – Rocky Intertidal Bluffs

Rocky Intertidal Bluffs would only be constructed at Rincon Park just south of the Ferry Building. This particular EWN feature integrates an engineered rocky tidal habitat into the shoreline elevation and bulkhead seawall design as a way to minimize wave runup and promote greater biodiversity along a steep shoreline rather than relying on traditional riprap or other engineered armoring to protect the new bulkhead seawall (Figure 27). Approximately 2.0 acres of new intertidal and subtidal habitat would be constructed bayward of the new seawall.

To construct the rocky intertidal bluff, a foundation of compacted sediment would be placed along the mudline/bay bottom and built up to achieve a target profile that slopes from the new seawall to the mudline. On top of this foundation, a combination of sand, gravel, rock, and/or pre-cast material like ecological armoring of varying sizes would be placed using cranes and heavy machinery to create tidepools and bluff areas to increase surface complexity (grooves, crevices, nooks, etc.). After construction is complete, the cofferdam would be removed, and the area would be subject to inundation. Minor refinements and adjustments to material in the rocky intertidal bluff post-construction, such as moving, replacing or adding more stone or other materials, is anticipated to be needed to meet the design goals.

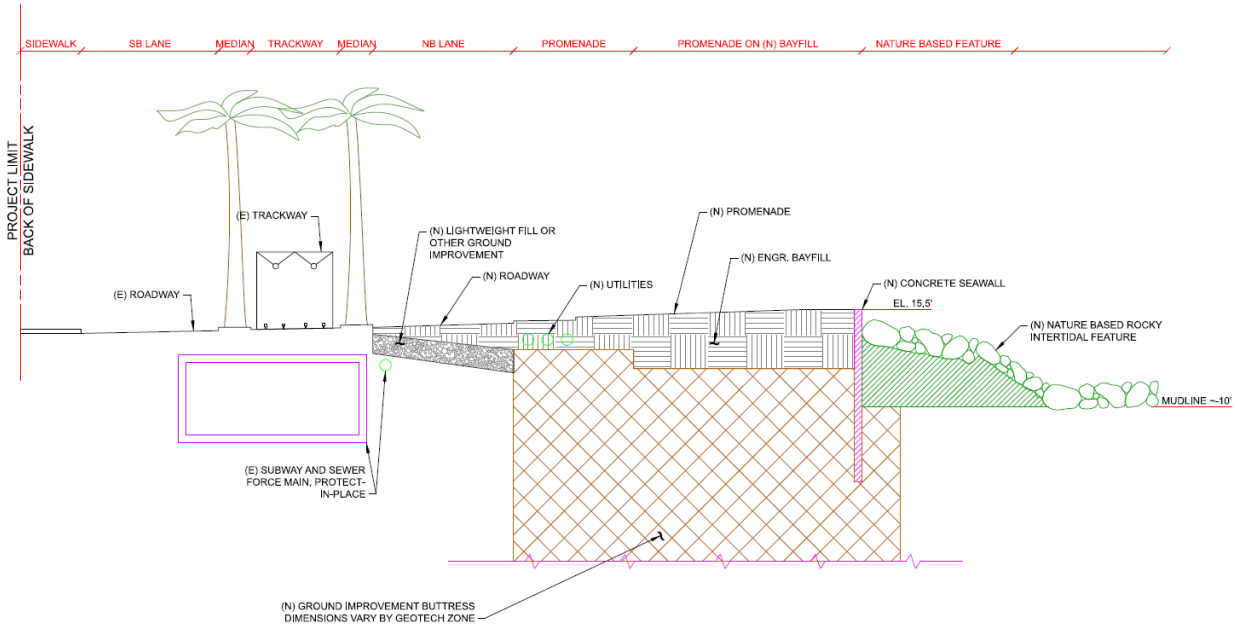


Figure 27. Cross Section of Intertidal Rocky Bluff at Rincon Park

4.2.17 EWN – Living Seawalls

Living seawalls consist of structural elements combined with traditional seawalls that create varied micro-habitat conditions through surface relief and material composition (Figure 28). The introduction of surface complexity (e.g., surface texture, grooves, crevices, and nooks) to traditionally smooth surfaces promote vegetation growth, provides foraging habitat, and creates shelter from predation.

Living seawalls would be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design would incorporate textures to increase surface complexity). These elements would be incorporated as part of the pre-cast or cast-in-place forms used to construct the walls or piles. No additional specialized equipment or methodology is necessary to incorporate this added EWN feature and should not increase the construction duration.

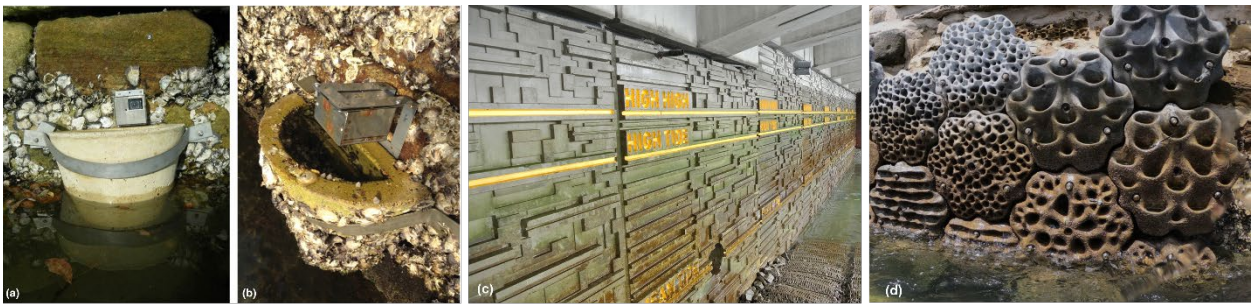


Figure 28. Examples of Living Seawall/Vertical Enhancements that Could Be Installed on Vertical Shorelines

These could consist of pre-cast pots as shown in (a), (b), or (d) and pre-cast panels (c). Source: Morris et al. 2017; Waterfront Seattle; van Remortel 2022.

4.2.18 Ground Improvements

Ground improvements are proposed to be incorporated into several of the structural measures to address both static and seismic loading conditions because of poor soil conditions and the increased weight of the new construction. A deep soil mixed (DSM) stabilization buttress with a 1:1 height to depth ratio (50 feet by 50 feet for Zone 1 and 100 feet by 100 feet for Zone 2) is currently assumed to be sufficient to stabilize the foundation and shoreline soil but would be further refined during PED when site-specific conditions are known. The DSM process forms columns of cemented material in the ground by mechanically mixing the in-situ soil with an introduced binder agent such as cement or lime. The binder can be introduced either by injection of a wet slurry or dry binder systems through the mechanical mixing tool. A grid of individual or overlapping soil mixed columns would make up the buttress.

The installation of DSM columns involves the introduction of a rotating auger into the subsoil which disrupts the existing soil structure and mixes it with the injected binder. Typically, one to six augers are mounted to a drilling rig and each auger consists of a drilling rod and cross bars. The soil mixing process is aided by injecting the cement binder through nozzles located at the end of the drilling rod. The column formation stage starts after reaching the target depth, which is usually divided into several stages where the auger is lifted and lowered to ensure adequate mixing of the soil with the binder and to form a homogeneous column. The width of the column would be determined during PED but could range from 2 to 9 feet wide.

4.3 Avoidance and Minimization Measures

Given the nature of the Proposed Action, USACE would implement various avoidance and minimization measures, as well as construction Best Management Practices (BMPs), as part of the project. The purpose of these measures is to reduce potential adverse environmental effects of the project. A detailed description of these measures is included as Attachment 1 of this CD.

5.0 Consistency with Applicable San Francisco Bay Plan Policies

This section presents analyses of the Proposed Action's consistency with applicable Bay Plan policy topics. The project area does not contain, and the project does not propose and would not result in impacts to, the following Bay Plan topics: areas of shell deposits, dredging, airports, commercial fishing, salt ponds, fills for bay-oriented commercial recreation and bay-oriented public assembly on privately-owned or publicly-owned property, fills for public trust uses on publicly-owned property granted in trust to a public agency by the legislature, and navigational safety and oil spill prevention. Consequently, Bay Plan policies related to those identified topics are not applicable to the project and are not addressed further. As the project progresses and designs are refined, Bay Plan policies will be reviewed for consistency to determine if this evaluation is still applicable.

5.1 Fish, Other Aquatic Organisms, and Wildlife

Three of the Bay Plan's policies related to fish, other aquatic organisms, and wildlife are applicable to the Proposed Action: Policies 1, 2, and 4. The Proposed Action's consistency with these policies is discussed in the following sections.

5.1.1 Policy 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.

The California Aquatic Resources Inventory (CARI) version 2.2 Geographic Information System dataset of aquatic habitats identified beaches, tidal flat and marsh panne, tidal marsh, and subtidal habitat types within the Proposed Action footprint (SFEI 2022). Table 3 identifies the locations of tidal and subtidal habitats within the project area.

Table 3. Tidal and Subtidal Habitats Identified in the Project Area

Habitat or Sub-Habitat Type	Location Found
Subtidal (open water)	All areas bayward of the existing shoreline
Beaches	Aquatic Cove, Crane Cove Park, Heron's Head, India Basin Park
Tidal Flat and Marsh Panne	CARI Mapped: Beneath Ferry Building Wharf (no longer present), Pier 48 and 50, Pier 94, Heron's Head, India Basin Park Not-Mapped: along north and south banks of Islais and Mission creeks
Tidal Marsh	CARI Mapped: Heron's Head, Pier 94, India Basin Park

Habitat or Sub-Habitat Type	Location Found
	Not-Mapped: Islais Creek Park, East of Illinois Bridge on north bank of Islais Creek, on north bank of Islais Creek at Islais Creek Muni Park, Warm Water Cove
Artificial Rocky Intertidal	Throughout the waterfront, along the shorelines of Mission and Islais creeks

Implementation of a majority of the measures under the Proposed Action would not result in any impacts to tidal or subtidal habitats. Construction of the seawall and all seismic ground improvements would be constructed landward of the existing shoreline and would, therefore, have no temporary or permanent impacts on existing habitats. Wharf raising and rebuilding will temporarily impact subtidal habitats but is expected to result in no net change in subtidal habitat. Instead, subtidal habitat may benefit from wharf raising and rebuilding measures as old construction materials, such as creosote, will be removed that may be contributing to poor water quality and result in a reduction of bay fill that would provide more open water. Additionally, new pilings are expected to have a textured surface that would increase surface area for aquatic organisms to attach to.

Permanent adverse impacts to subtidal habitat are expected to occur in Reach 2 as a result of raising the Ferry Building and bulkhead buildings by construction new pile support foundations (wharves). These features are expected to fill in approximately 8.6 acres of subtidal habitat. The area immediately under the Ferry Building would result in a permanent net loss of 4.6 acres. The construction at Rincon Park will have approximately 0.5 acres of bay fill to accommodate some utility and transportation needs; however, an additional 3.5 acres of bay fill is needed to construct the coarse beach (EWN feature) that will be placed over the utility/transportation bay fill and use ecological processes to protect the site rather than using hardened structures such as riprap. Over the long-term, adding a coarse beach would be a net gain in a different habitat type (beach or intertidal habitat) in this reach, benefitting nearshore ecology.

In Reach 3, wharf raising would have temporary adverse impacts on subtidal habitats, but would have a long-term benefit on water quality, hydrology, and aquatic organisms similar to Reach 2. Measures are proposed along Mission Creek where artificial rocky intertidal and tidal flat and marsh panne are found. Each of the measures here would be constructed to have the toe of the planted berm to align with the mean high-water line, thus avoiding any bay fill or long-term permanent impacts to the subtidal, artificial rocky intertidal, and tidal flat and marsh panne habitats. However, during the design phase, site-specific habitat surveys should be completed to confirm that this assumption remains valid. If during those surveys the design is found to disturb or replace any of these habitats, minimization measures should be considered and could include features such as adding ecological armoring instead of rip rap or other toe and slope protection materials, redesigning the planted berm to be an ecotone levee where marsh and other intertidal habitats can be incorporated to protect the toe, or realigning the berm to avoid at a minimum bay fill and tidal pane and marsh habitat.

In Reach 4, Proposed Action measures avoid construction in or near the beach, tidal flat and marsh panne, tidal marsh, eelgrass, and pond habitats. Similar to Reach 2 and 3, wharf raising would have temporary adverse impacts on subtidal habitats, but would have a long-term benefit on water quality, hydrology, and aquatic organisms. There is one measure (EWN ecotone levee) that would be constructed just south of the Pier 94 wetlands. Since this feature is an ecotone levee, over the long-term the constructed feature would be complementary to the existing tidal marsh and tidal flat and marsh panne habitats. While constructing the ecotone levee, BMPs (Attachment 1) would be incorporated to prevent movement of sediment into the existing habitats from the construction site and no surface waters would be diverted from or into those habitats that were not there prior to construction. Additionally, there would be stipulations that no staging areas, access roads, construction footprints would be sited in aquatic habitats. As a result, there would be no direct or indirect loss of the habitats at Pier 94.

Areas of tidal flat and marsh panne habitat and tidal marsh are present along the north bank of Islais Creek where Proposed Action measures are proposed. Similar to Reach 3, as of now the planted levee design that could affect the area of habitat east of Illinois Bridge avoids construction below the mean high-water line. Construction and long-term operation of the structure should avoid any direct or indirect disturbance or loss of these habitats. During the design phase, additional site-specific surveys need to be completed and, if necessary, avoidance or minimization measures incorporated into the final design.

At the Islais Creek Muni Park site, existing habitats would be temporarily filled in or trampled to construct the ecotone levee. These habitats would be replaced as part of the EWN ecotone levee design and the habitat loss would be considered temporary until the restored vegetation reaches maturity and the intertidal habitat becomes fully functioning. The length between loss and restoration is dependent on how long construction takes at the immediate site, type of plants used, and growing conditions, but is anticipated to reach pre-construction conditions or better within one to three growing seasons after a one-year period of construction or two to five years. The purpose of the measure is to support the overall performance of the flood defense feature using natural processes. As a result, these features also provide habitat enhancements that are anticipated to result in a net increase in quantity and quality of intertidal and tidal marsh habitats.

Existing tidal marsh and tidal flat and marsh panne found at Islais Creek Park would be avoided to the greatest extent practicable while constructing the 42.75-acre EWN feature. This measure would remove all existing structures, concrete and pavement from the area and create an open space composed of intertidal habitat at the lower elevations and grading to upland habitat further inland. Over the long-term this will be a significant net increase in tidal marsh and intertidal habitats; however, the exact extent is unknown because site-specific elevation and designs have not been developed to understand the widths of each zone of habitat that would be created after construction is complete. Additionally, as sea levels rise, it is anticipated that each of the aquatic habitats would retreat inland and convert the upland habitats to tidal marsh and additional intertidal habitat would be created, resulting in additional increase in aquatic habitats.

In summary, the Proposed Action will increase bay fill by 9 acres, however 3.5 of those acres of bay fill will be utilized to construct additional beach habitat in Reach 2 and additional bay fill will be removed as part of the project and mitigation plan. Creosote material will be removed and replaced with less toxic bay fill, potentially improving water quality for aquatic organisms. BMPs will be in place to avoid and minimize potential impacts (Attachment 1). While some temporary, localized impacts to aquatic resources are anticipated as a result of the Proposed Action, overall the project is not expected to have any unavoidable adverse impacts and would, over the long-term, increase both quality and quantity of aquatic habitats in the Bay, including tidal marshes, tidal flats, and subtidal habitats, that benefit fish, other aquatic organisms and wildlife for future generations. For these reasons, the Proposed Action is consistent to the maximum extent practicable

5.1.2 Policy 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 U.S. Fish and Wildlife Service have listed under the California or Federal Endangered Species Act; 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.

The majority of the Proposed Action work has been designed for and would be constructed on the landward side of the Bay on previously disturbed impervious surfaces to avoid and minimize adverse impacts to habitats and species. However, some actions do require in-Bay work: wharf raising/rebuilding and four Natural and Nature-Based Features (NNBFs) (ecotone levees, marsh enhancements, coarse beach, and living seawall). A plethora of conservation measures, avoidance and minimization measures, and BMPs will be implemented to minimize adverse effects on special-status species and habitats that occur and/or have the potential to occur in the project area. To ensure that the Proposed Action is conducted in a manner that protects special-status species and their habitats in and around San Francisco Bay, USACE is consulting with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) in accordance with Section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1536[c]), Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFMA) (Public Law 104 297), and Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) (16 U.S.C. 1371(a)(5)), as applicable.

Federal and State Threatened and Endangered Species and Their Critical Habitats

Table 4 identifies federal ESA-listed threatened and endangered species (USFWS 2023c; NMFS 2023) and Table 5 identifies California ESA-listed threatened and

endangered species that are known to occur in or with potential to occur in the project area (CNDDB 2023a; CNDDB 2023b). USACE has reviewed the Proposed Action for its potential effects on federal ESA-listed threatened or endangered species and their designated critical habitats.

Table 4. Federal Threatened, Endangered, or Candidate Species Identified by USFWS and NMFS That May Occur in the Study Area

Common Name ***Scientific Name***	**Federal Status**	**Jurisdiction**	**Potential to occur in the study area**
MAMMALS			
Salt marsh harvest mouse *Reithrodontomys raviventris*	Endangered	USFWS	Minor to moderate – suitable habitat at Heron's Head and Pier 94 wetlands
BIRDS			
California Ridgeway's Rail *Rallus obsoletus obsoletus*	Endangered	USFWS	Moderate – likely to occur in Heron's Head Park; have been previously observed
California least tern *Sterna antillarum browni*	Endangered	USFWS	Moderate – likely to occur, but not likely to be nesting
Marbled murrelet *Brachyrampuhus marmoratus*	Threatened	USFWS	Moderate – may occur feeding
Western snowy plover *Charadrius nivosus nivosus*	Threatened	USFWS	Unlikely; lacks suitable habitat
REPTILES			
Alameda whipsnake *Masticophis lateralis euryxanthus*	Threatened	USFWS	Unlikely; outside known range; no suitable habitat
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	Endangered	USFWS	Unlikely; lacks suitable habitat
Green sea turtle *Chelonia mydas*	Threatened	USFWS	Unlikely; lacks suitable nesting and foraging habitat
Northwestern pond turtle *Actinemys marmorata*	Proposed	USFWS	Unlikely; lacks suitable habitat

Common Name *Scientific Name*	Federal Status	Jurisdiction	Potential to occur in the study area
AMPHIBIANS			
California red-legged frog *Rana draytonii*	Threatened	USFWS	Unlikely; lacks suitable habitat
FISH			
Delta smelt *Hypomesus transpacificus*	Threatened	USFWS	Unlikely; outside of known range
Tidewater goby *Eucyclogobius newberryi*	Endangered	USFWS	Unlikely; outside of known range
Longfin smelt, San Francisco Bay Delta Distinct Population Segment (DPS) *Spirinchus thaleichthys*	Endangered	USFWS	Moderate; suitable habitat exists in the study area. Juveniles or adults could be expected to transition through the bay fall to early winter
Sacremento River Chinook salmon [CH], winter-run Evolutionary Significant Unit (ESU) *Oncorhynchus tshawytscha*	Endangered	NMFS	Likely; migrate through San Francisco Bay from December through July with peak occurrence in March
Central Valley Chinook salmon, spring-run ESU *O. tshawytscha*	Threatened	NMFS	Likely; migrate through San Francisco Bay in summer months before returning to spawn mid-August through early October
Central California Coast Steelhead troutDPS *Oncorhynchus mykiss*	Threatened	NMFS	Likely; temporary as transition through open water adjacent to study area during migration
California Central Valley Steelhead trout DPS *O. mykiss*	Threatened	NMFS	Likely; temporary as transition through open water adjacent to study area during migration
North American Green sturgeon, southern DPS [CH] *Acipenser medirostris*	Threatened	NMFS	Likely; juveniles reside in San Francisco Bay and adults migrate to their spawning grounds through the bay

Common Name *Scientific Name*	Federal Status	Jurisdiction	Potential to occur in the study area
INSECTS			
Monarch butterfly *Danaus plexippus*	Proposed	USFWS	Unlikely; limited suitable habitat
FLOWERING PLANTS			
California seablite *Suaeda californica*	Endangered	USFWS	Likely; suitable habitat at Heron's Head, endemic to California coastal zones
Franciscan manzanita *Arctostaphylos franciscana*	Endangered	USFWS	Unlikely; outside of known range
Marin dwarf-flax *Hesperolinon congestum*	Threatened	USFWS	Unlikely; outside of known range
Marsh sandwort *Arenaria paludicola*	Endangered	USFWS	Unlikely; lacks suitable habitat
Presidio clarkia *Clarkia franciscana*	Endangered	USFWS	Unlikely; outside of known range
Presidio manzanita *Arctostaphylos hookeri var. ravenii*	Endangered	USFWS	Unlikely; outside of known range
Robust spineflower *Chorizanthe robusta var. robusta*	Endangered	USFWS	Moderate – suitable habitat at Heron's Head
San Francisco lessignia *Lessingia germanorum*	Endangered	USFWS	Unlikely; outside of known range
Showy Indian clover *Trifolium amoenum*	Endangered	USFWS	Unlikely; outside of known range
Sonoma sunshine *Blennosperma bakeri*	Endangered	USFWS	Unlikely; outside of known range
White-rayed pentachaeta *Pentachaeta bellidiflora*	Endangered	USFWS	Unlikely; outside of known range and lacks suitable habitat

Sea turtle jurisdiction is shared jointly by USFWS (inland waters and nesting beaches) and NMFS (offshore marine environment). A superscript "CH" indicated critical habitat for the species. Information sourced from USFWS and NMFS species pages and Calflora (www.calflora.org).

Table 5. California State-Listed Threatened and Endangered Species Likely to Occur in the Study Area

Common Name Scientific Name	State Status	Federal Status	Habitat Requirements
BIRDS			
California Ridgeway's rail *Rallus obsoletus obsoletus*	Endangered	Endangered	Resident of San Francisco Bay area; lives in dense vegetation in saltwater marshes, freshwater marshes, and mangrove swamps
Bank swallow *Riparia riparia*	Threatened	None	Breed in open lowland areas near bodies of water; avoid forests, woodlands, or areas that lack appropriate nesting
California black rail *Laterallus jamaicensis coturniculus*	Threatened	None	Lives in tidal and freshwater marshes in California
FISH			
Longfin smelt *Spirinchus thaleichthys*	Threatened	Endangered	Spend early life growing and feeding in freshwater or low saline streams, bays, and estuaries; transition to saline estuaries and bays and open ocean as young adults and adults, then return to freshwater to spawn
Chinook salmon - Central Valley spring-run *Oncorhynchus tshawytscha*	Threatened	Threatened	Spend early life growing and feeding in freshwater streams, estuaries, and wetlands; transition to open ocean and estuaries, then return to freshwater to spawn
PLANTS			
Marsh sandwort *Arenaria paludicola*	Endangered	Endangered	Freshwater-marshes, swamps, and areas that are wet year-round
Marin dwarf flax *Hesperolinon congestum*	Threatened	Threatened	Endemic to San Francisco county; occurs in serpentine soils, in dry native bunch grasses

USACE has determined that the Proposed Action will have ***no effect*** on the following list of federal ESA species:

- **Mammals**: Blue whale, Fin whale, Killer whale, North Pacific right whale, Sei whale, Sperm whale
- **Birds**: Western snowy plover
- **Reptiles**: Alameda whipsnake, San Francisco garter snake, Green sea turtle, Leatherback sea turtle, Loggerhead sea turtle, Olive Ridley sea turtle
- **Amphibians**: California red-legged frog
- **Fish**: Delta smelt, Tidewater goby, White abalone

- **Insects**: Monarch butterfly
- **Flowering plants**: Franciscan manzanita, Marin dwarf-flax, Presidio clarkia, Presidio manzanita, San Francisco lessignia, Showy Indian clover, Sonoma sunshine, and White-rayed pentachaeta

The mammalian species are mostly migratory and only transit to California waters seasonally, though not within the study area. Most of the whale species identified prefer deeper offshore water in the Pacific Ocean or Gulf of California, with only three species (Gray whale, Humpback whale, Killer whale) known to transit in shallower coastal waters periodically. Gray whales can be found in shallow coastal waters in the North Pacific Ocean but are highly unlikely to be encountered in the San Francisco Estuary.

The Proposed Action's in-water project components consist of construction, maintenance, repair, replacement, and debris removal activities along the San Francisco waterfront from Aquatic Park to Heron's Head Park. Project actions could adversely affect green sturgeon, and may affect, but are not likely to adversely affect chinook salmon. These effects would be the result of potential:

- Water quality impairment,
- Underwater noise effects to fish and foraging habitat,
- Shade caused by overwater structures, and
- Fish capture and handling.

Implementation of proposed conservation measures are expected to result in avoidance and minimization of these potential effects as discussed in Attachment 1.

Table 6 presents the effects determinations for ESA species identified as occurring or potentially occurring in the action area and their critical habitat.

Table 6. Effects Determinations for ESA Species Identified as Occurring or Potentially Occurring in the Action Area and Their Critical Habitat

Species	Effect	Take – Death or Injury	Critical Habitat
Green sturgeon [CH] *Acipenser medirostris*	LAA	Potential to occur from pile driving noise and/or during fish capture/handling	Habitat expected to recover within months of construction; very small area compared to habitat available with action area
Steelhead, Central California Coast DPS *Oncorhynchus mykiss*	LAA	None	N/A
Steelhead, California Central Valley *O. mykiss*	LAA	None	N/A
Chinook salmon [CH], Central Valley Sacramento spring-run *O. tshawytscha*	LAA	Negligible to none; Potential to occur from pile driving noise	N/A
Chinook salmon [CH], Sacramento winter-run	LAA	Negligible to none; Potential to occur from	Habitat expected to recover within months of

Species	Effect	Take – Death or Injury	Critical Habitat
O. tshawytscha		pile driving noise	construction; very small area compared to habitat available with action area

A superscript (CH) denotes a species critical habitat in the action area. LAA = likely to adversely affect species and/or critical habitat, as applicable.

Essential Habitat and Special-Status Fish Species

Essential Fish Habitat (EFH) includes "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NMFS 2021; GMFMC & NMFS 2016). Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes). Of the fish species considered by NMFS to potentially occur within the study area, EFH habitat for these species consists of all waters and substrate from mean higher high water (MHHW) to 3,500 water depth, seamounts, and areas designated as Habitats of Particular Concern (HAPC). There are four HAPCs within the study area, including the San Francisco Estuary (estuary HAPC), seagrass, rocky reef, and marine and estuarine SAV HAPC. Estuary HAPCs are defined as "MHHW, or the upriver extent of saltwater intrusion, upstream and landward to where ocean-derived salts measures less than 0.5 ppt during the period of average annual low flow". Seagrasses HAPC include "those waters, substrate, and other biogenic features associated with eelgrass species (*Zostera* spp.), widgeongrass (*Ruppia maritima*), or surfgrass (*Phyllospadix* spp.)." The rocky reef HAPC includes "those waters, substrates, and other biogenic features associated with hard substrate (bedrock, boulders, cobble, gravel, etc.) to MHHW" (NOAA 2022a). Marine and estuarine SAV includes kelps (floating and submerged) and eelgrass (NOAA 2014). The study area includes 0.29 acres of seagrass HAPC, and the entire in-water study area is considered salmon EFH and estuary HAPC. The study area falls within EFH for 20 species of commercially important fish and sharks managed under three Federal fisheries management plans (Table 7).

Table 7. Managed Fish Species in the Study Area Under the MSFMA

FMP	Common name	Scientific name	Life stage	Abundance
Coastal Pelagic	Northern anchovy	*Engraulis mordax*	J, A	A
	Jack mackerel	*Sardinops sagax*	E, L	P
	Pacific sardine	*Trachurus symmetricus*	J, A	P
	English sole	*Parophyrs vetulus*	J, A	A
	Sand sole	*Psettichthys melanostictus*	L, J, A	P
	Curlfin sole	*Pleuronichthys decurrens*	J	R

FMP	Common name	Scientific name	Life stage	Abundance
Pacific Groundfish	Pacific sanddab	*Citharichthys sordidus*	E, L, J, A	P
	Starry flounder	*Platichthys stellatus*	J, A	P
	Lingcod	*Ophiodon elongatus*	J, A	P
	Brown rockfish	*Sebastes auriculatus*	J	P
	Pacific whiting	*Merluccius productus*	E, L	P
	Kelp greenling	*Hexagrammos decagrammus*	J, A	P
	Leopard shark	*Triakis semifasciata*	J, A	P
	Spiny dogfish	*Squalus acanthias*	J, A	P
	Skates	*Raja* spp.	J, A	P
	Soupfin shark	*Galeorhinus galeus*	J, A	R
	Bocaccio	*Sebastes paucispinis*	J	R
	Cabezon	*Scorpaenichthys marmoratus*	J	P
Pacific Coast Salmon	Chinook salmon	*Oncorhynchus tshawytscha*	J, A	Seasonally P
	Coho salmon	*O. kisutch*	J, A	Historically P

Life stage is indicated with A = adult, J = juvenile, L = larvae, and E = egg. Abundance is recorded as A = abundant, P = present, and R = rare.

The Proposed Action would temporarily modify EFH within localized portions of the San Francisco waterfront during construction. Permanent loss of EFH would occur with placement of bay fill; however, this loss would be offset with creation of a NNBF (i.e., rocky intertidal bluff) and removal of piers and pilings, which would improve the quality of EFH in the action area. Short-term displacement of MSFMA-managed species is anticipated during construction. The Recommended Plan may adversely affect EFH through:

- Localized and temporary turbidity impacts caused by the installation and removal of pilings, cofferdams, and over-water structures.
- Disturbance of benthic foraging habitat during the installation and removal of pilings, cofferdams, and over-water structures.

- Potential temporary exclusion from occupied habitat associated with the avoidance of increased noise levels generated during pile driving, cofferdam construction, and in-water vessel operation.

Temporary impacts to EFH would be minor and generally limited to the immediate area of construction. Pile removal would generate a small, localized sediment plume around each removal site that would dissipate quickly, due to typical shoreline hydrodynamics. The installation of piles would temporarily displace some fish during active pile driving; however, the installation of piles may not cause acute barotrauma (i.e., tissue damage) and temporary displacement of fish would be short lived. Likewise, disturbed benthic sediment would quickly be recolonized by benthic invertebrates and should resemble pre-project conditions within 6 months to 1 year following disturbance. The proposed action may adversely affect EFH; however, implementation of the proposed avoidance, minimization, and conservation measures would significantly reduce the relative impact to EFH, and in conjunction with local hydrology, reduce the duration and footprint of disturbance.

Special-Status Bird Species

San Francisco Bay is a migration highway for over 250 species of birds, many of which are small songbirds (e.g., warblers, thrushes, tanagers, sparrows) and some threatened species (GGAS 2023). A variety of birds use this area to forage in the many microclimates while others use the Bay area as a resting stop-over. The San Francisco Bay is the largest estuary on the Pacific Coast, thus, is an ideal refuge for shorebirds, raptors, and songbirds. Some of the prominent species include, but are not limited to (Karlenzig 2013):

- Songbirds: varied thrush (*Ixoreus naevius*), red-winged blackbird (*Agelaius phoeniceus*), golden-crowned sparrow (*Zonotrichia atricapilla*), and black-throated gray warbler (*Setophaga nigrescens*);
- Hawks: ferruginous hawk (*Buteo regalis*), Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*);
- Waterfowl: lesser scaup (*Aythya affinis*), greater scaup (*A. marila*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*);
- Shorebirds: whimbrel (*Numenius phaeopus*), long-billed curlew (*Numenius americanus*), marbled godwit (*Limosa fedoa*), willet (*Tringa semipalmata*), black-bellied plover (*Pluvialis squatarola*), American avocet (*Recurvirostra americana*), and black-necked stilt (*Himantopus mexicanus*).

The Bald and Golden Eagle Protection Act was enacted in 1940 and prohibits the take and/or disturbance of bald or golden eagles without a permit issued by the Secretary of the Interior (16 U.S.C. 668-668d; 50 CFR 22.6). Bald eagles (*Haliaeetus leucocephalus*) are the national symbol that was in danger of extinction throughout most of its range in North America. In 2007, bald eagle populations had recovered to such as state that they were delisted from the ESA (USFWS 2023a). Bald eagles are solely native to North

America and may be found throughout most of California at lakes, reservoirs, rivers, and some rangelands and coastal wetlands. Most breeding occurs in northern California, but scattered nesting also occurs in the central and southern Sierra Nevada mountains and foothills, inland southern California, and Santa Catalina Island (CDFW 2023a).

Golden eagles are global species, with the western U.S. comprising 80% of the species' range in the contiguous U.S. (USFWS 2023b). Most golden eagles in California are resident, though some can be migratory, and inhabit forests, canyons, shrub lands, grasslands, and oak woodlands. Nests are constructed on platforms on steep cliffs or in large trees (CDFW 2023b).

Populations of bald and golden eagles are found in the less urbanized areas of San Francisco Bay and coastal range. While individual eagles may migrate through the area, the project area does not support nesting habitat for eagles as it generally lacks large mature trees. If nesting were to occur, the nest would need to be placed on man-made structures which would present its own set of challenges to survival, although not unheard of in other parts of the county. The chance of this occurring is relatively low since more suitable nesting habitat is available throughout the Bay or in more vegetated areas of the City.

The effect of the Proposed Action on migratory bird species has been assessed. Impacts to migratory birds are expected to be temporary and limited to migratory bird species near the immediate construction area. Minimal nesting trees are present in the project area; however, the trees that are present may be removed during construction and would remove nesting locations over the long-term. Any trees removed would be replaced after construction, however, the planted trees will not be mature enough for several years, thus creating a long-term impact. All tree removal will be completed outside the nesting season where possible and if not a survey of the tree will be completed to ensure no active nests are present before removal. For migratory birds more sensitive to disturbances, in particular those in wetland environments at Heron's Head or Pier 94, construction noise may disrupt their foraging and nesting ability forcing them to avoid the area until construction is complete. For migratory birds used to the noise and disturbance of an urbanized environment, individuals may temporarily avoid the area until they become familiar or used to the disturbance, at which time it is expected they would resume pre-construction behaviors and use of the area.

Over the long-term, new flood defenses should not create impediments to migratory bird movements or result in increases in bird strikes. City-required bird-safe building design standards would be implemented for any required lighting, building modifications, or structure raising measures, as appropriate. Migratory birds would benefit from the NNBF measures by protecting and creating foraging, nesting, and roosting habitat. Improved coastal resiliency is expected to improve bird habitat and increase productivity in the project area. Coordination with USFWS on migratory birds will continue into the design phase for the First Actions to aid in refinement of designs to avoid and minimize the potential for bird-strikes; loss of nesting, roosting, or foraging habitat; or construction

disturbance. Designs may also be refined to protect, restore, or create foraging, nesting, and roosting habitat.

Protected Marine Mammals

There are two pinniped and four species of cetaceans likely to occur in or near the study area, which include harbor seals (*Phoca vitulina richardii*), California sea lion (*Zalophus californianus*), harbor porpoise (*Phocoena phocoena*), common bottlenose dolphin (*Tursiops truncatus*), California gray whale (*Eschrichtius robustus),* and humpback whale (*Megoptera noveangliae*), respectively.

It is expected that construction activities related to pile driving and in water work may result in the incidental take of marine mammals, as defined under the Marine Mammal Protection Act. The anticipated impacts include harassment, serious injury or mortality of marine mammals and would require a Letter of Authorization (LOA) for Incidental Take Authorization to be issued during PED when further design and construction details can be provided. Coordination with NMFS will continue to occur to obtain necessary permits, identify additional impacts and avoidance and minimization measures to build into designs, and better understand potential compensatory mitigation needs.

Summary

In summary, coordination with the appropriate resource agencies has been conducted during the drafting of this study and will continue during the PED and construction phases of the Proposed Action. Impacts of the Proposed Action on native species, including federal and state threatened and endangered species and their designated critical habitats, have been analyzed. Impacts on fish, other aquatic organisms, and wildlife and their habitats have been avoided and minimized in the design of the Proposed Action to the greatest extent practicable. Where adverse impacts are unavoidable, USACE will continue to consult with appropriate resource agencies to acquire any necessary take permits and will implement appropriate mitigation measures. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 2.

5.1.3 Policy 4

The Commission should:

a. *Consult with the California Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, 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*

U.S. Fish and Wildlife Service, National Marine Fisheries Service 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 National Marine Fisheries Service or the U.S. Fish and Wildlife Service in order to avoid possible adverse effects of a proposed project on fish, other aquatic organisms and wildlife habitat.*

Policy 4 is not enforceable with respect to a federal agency. BCDC cannot require a federal agency to enter consultation with another agency. However, please see the response to Policy 2 above regarding consultations undertaken for this action.

5.2 Water Quality

Six of the Bay Plan's water quality policies are applicable to the Proposed Action: Policies 1, 2, 3, 4, 6, and 7. The Proposed Action's consistency with these policies is discussed in the following sections.

5.2.1 Policy 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, when 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.

Only one structural measure (wharf raise/rebuild) and four NNBFs (ecotone levees, marsh enhancements, coarse beach and living seawall) in the Proposed Action include the discharge of dredged or fill material into waters of the U.S. All other measures were designed and would be constructed landward of the existing shoreline to avoid discharge of fill materials and impacts to waters of the U.S.

For the wharf raise/rebuild measures old pier pilings (creosote covered wood or concrete and rebar) and decking (wood, concrete, and rebar) would be removed and replaced with new pilings (concrete) and decking (rebar, concrete, grates, etc.) that would facilitate a higher elevation wharf. There would be no increase in the footprint of the wharf and fewer piles would be necessary per square foot than currently exists resulting in a net decrease in bay fill and overall benefit from removal of old materials (e.g., creosote piles) that contribute to poor water quality and are toxic to marine life. Since the decking footprint would not change, it is anticipated that at a minimum the current light and temperature of the intertidal and subtidal habitat would remain the same. During the design phase, the designs will be refined to incorporate features that allow additional light and air flow, where appropriate, than the current wharf allows, which would also be a long-term benefit to the marine environment.

For the ecotone levees and coarse beach NNBFs, fill materials would primarily involve natural materials free of any contaminants or eco-friendly concrete that supports vegetative growth. Fill material would be placed between the Mean Lower Low Water

(MLLW) and Mean Higher High Water (MHHW) lines to achieve the target elevation that would support the desired community, such as tidal marsh or beach. Any existing fringe wetland or intertidal habitat would be filled with material and then restored. The length between loss and restoration is dependent on how long construction takes at the immediate site, type of plants used, and growing conditions, but is anticipated to reach pre-construction conditions or better within one to three growing seasons after a one-year period of construction (approximately two to five years). At each of these NNBF locations, the purpose of the measure is to support the overall performance of the flood defense feature using natural processes. As a result, these features also provide habitat enhancements that result in a net increase in quantity and quality of intertidal, beach, and marsh habitats and overall benefit to the waters of the U.S. over the life of the project.

For the living seawall NNBF, the fill material (most likely concrete) would be placed directly onto the existing seawall by bolting on, or building into, the design of another feature (e.g., new seawall) to create surface complexity (e.g., surface texture, grooves, crevices, nooks) to replace traditionally smooth surfaces. The living seawall is a relatively flat form of fill that would be placed from the bay bottom elevation to MHHW. This NNBF would increase habitat diversity to the intertidal and sub-tidal environments where only open water currently exists, resulting in an overall net benefit.

One measure (pier demolition) will remove approximately 1.0 acre of fill previously placed in waters of the U.S. including historic piles, bay fill, and pier decking and allow the area to restore to higher quality open water and subtidal habitat.

Bay fill, construction of bayward sections of the seawall, roadway construction, and wharf replacement are all anticipated to have significant and unavoidable impacts to water quality. Bayfill permanently removes open water, while seawall and wharf construction would cause turbidity, resuspended sediments, and could suspend contamination from underlying sediments or result in debris and release of contaminating materials. Replacement of roadways would lead to changes and expansion in stormwater, sewer, and inland drainage systems. Shore-based measures are expected to have less than significant impacts with temporary increased turbidity and sediment suspension localized to the construction area.

Any materials discharged by project actions would be minimized by implementing BMPs, timing of in-water work, and construction sequencing. Materials to be discharged would be sourced from approved and permitted sources offsite. Exact information about material to be discharged and location of discharge is unknown presently. As site-specific designs are developed during the design phase for the implementation of the Recommended Plan, site-specific details will be available.

USACE has completed a Clean Water Act Section 404(b)(1) analysis and would obtain a Water Quality Certification under Section 401 during the design phase when more detailed designs are available. The Proposed Action avoids a significant amount of unavoidable adverse impacts to water resources by placing features at or landward of the existing shoreline, designing the project to avoid bayfill to the greatest extent practicable, removing existing bayfill (e.g., creosote piles) that contribute to poor water

quality, and integrating NNBFs where feasible. In addition, USACE would further avoid potential construction related effects to water quality by timing restrictions and construction sequencing, to be further developed in the design phase. BMPs outlined in Attachment 1 will further avoid and minimize adverse impacts to water quality. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 1.

5.2.2 Policy 2

Water quality in all parts of the Bay should be maintained at a level that will support and promote beneficial uses of the Bay is 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, decision, 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.*

USACE would implement BMPs throughout project construction to protect water quality and prevent the discharge of pollutants to the Bay (Attachment 1). These include implementation of a Stormwater Pollution Prevention Plan. In addition, pursuant to Section 401 of the Clean Water Act (33 U.S.C. Section 1251), USACE is coordinating with the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) and would submit an application for a Section 401 Water Quality Certification for the project ahead of construction to ensure consistency with the SFRWQCB's Water Quality Control Plan for the San Francisco Bay Basin. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 2.

5.2.3 Policy 3

New projects should be sited, designed, constructed and maintained to prevent or, if prevention is infeasible, to minimize the discharge of pollutants into the Bay by: (a) controlling pollutant sources at the project site; (b) using construction materials that contain non-polluting materials; and (c) applying appropriate, accepted and effective best management practices, especially where water dispersion is poor and near shellfish beds and other significant biotic resources.

Project features were designed to the greatest extent practicable to avoid in-water work. Only one structural measure (wharf raise/rebuild) and four NNBFs (ecotone levees, marsh enhancements, coarse beach and living seawall) in the Proposed Action include the discharge of dredged or fill material into waters of the U.S. All other measures were designed and would be constructed and maintained landward of the existing shoreline to avoid discharge of fill materials and impacts to waters of the U.S. As discussed in Water Quality Policy 1 above in Section 5.2.1.

The wharf raise/rebuild measures would entail replacing old pier pilings (creosote covered wood or concrete and rebar) and decking (wood, concrete, and rebar) with new

pilings (concrete) and decking (rebar, concrete, grates, etc.). This would replace existing materials that may adversely contribute to water quality with neutral materials. The living seawall would be constructed of natural materials free of any contaminants or eco-friendly concrete that supports vegetative growth. Any components (e.g., rock pilings, fill material, rock) to be installed as part of the Proposed Action would be constructed with materials that do not contain elevated levels of contaminants. Therefore, the Proposed Action is consistent with Water Quality Policy 3 to the maximum extent practicable.

5.2.4 Policy 4

When approving a project in an area polluted with toxic or hazardous substances, the Commission should coordinate with appropriate local, state and federal agencies to ensure that the project will not cause harm to the public, to Bay resources, or to the beneficial uses of the Bay.

Hazardous, Toxic, and Radioactive Waste (HTRW) conditions as related to the project have been considered under the following regulations: Pollution Prevention Act (42 USC 13101 et seq.), Clean Water Act Section 301, Occupational Safety and Health Act (29 USC 651 et seq./29 CFR Part 1910), Comprehensive Environmental Response, Compensation, and Liability Act 42 USC 9601 et seq./40 CFR Part 300), Resource Conservation and Recovery Act (42 USC 6901 et seq./40 CFR Part 261-265), Toxic Substances Control Act (15 USC 2601 et seq./40 CFR Parts 700-799), Local Bay Protection and Toxic Cleanup Program Legislation of 1989, and USACE HTRW Regulations.

A records search was performed to identify the hazardous sites, toxic waste sites, or radioactive waste sites in the project footprint. The sites identified include locations where releases of hazardous substances or petroleum products have occurred into the soil, groundwater, or surface water. The evaluation included Federal, state, and local databases to identify sites where the presence of hazardous, toxic, or radioactive waste has been previously documented. No environmental sampling of soil or groundwater was performed as part of this evaluation. The results of the records search identified over 157 potential environmental contamination sites within the study area. Of the potential sites identified, approximately 61 are located within the project area with known impacts to the soil or groundwater due to hazardous substances.

For the sites located within the study area, additional information was obtained from the EnviroStor and GeoTracker databases maintained by DTSC and SWRCB respectively for the purpose of determining potential impacts from these sites in relation to potential future construction activities. The potential for these sites to impact the construction activities was determined based on the presence of suspected soil and/or groundwater contamination, mobility within the soil-groundwater-air matrix, and the potential for construction activities to affect the contaminated media. As a result of the screening of the sites, 18 sites were identified within the Project footprint with the potential to impact

the future construction activities. An additional 34 Leaking Underground Storage Tank (LUST) Sites that have received regulatory closure were identified within the project footprint. Although these LUST sites have received regulatory closure, there is potential for waste/contamination to remain in the soil and groundwater that may require special management and disposal related to future construction activities.

Under the No Action Alternative, capped and un-capped HTRW areas would be exposed to flooding and erosion from RSLC, which could result in releasing contaminants that impact water, soil, and sediment quality, as well as human health. The Proposed Action provides an opportunity for the NFS to remediate some of the existing HTRW sites that fall within the project area. USACE has developed strategic flow charts on how to evaluate project sites with known or suspected contamination, including characterization of site conditions through Phase I and Phase II Environmental Site Assessments and risk evaluation to determine whether cleanup, site management, or no further action is warranted. There is also a process for managing soil that is excavated during remedy implementation or construction. This process provides a framework for determining whether the material is regulated or hazardous waste and selecting appropriate disposal methods formed from waste characterization testing results or the appropriate reuse pathway based on total analysis and comparison to residential and commercial/industrial screening criteria.

In summary, additional investigation and testing for HTRW will be required prior to construction. The existence of any HTRW will be identified in a future Phase 2 Environmental Site Assessment that will be conducted in subsequent phases of this project and appropriately addressed. However, USACE will ensure that any portions of the project located in or near HTRW sites would not cause harm to the public, to Bay resources, or to the beneficial uses of the Bay by following established processes and adhering to the aforementioned applicable laws, regulations, and policies, that govern HTRW. Therefore, the project is consistent with Policy 4 to the maximum extent practicable.

5.2.5 Policy 6

To protect the Bay and its tributaries from the water quality impacts of nonpoint source pollution, new development should be sited and designed consistent with standards in municipal stormwater permits and state and regional stormwater management guidelines, where applicable, and with the protection of Bay resources. To offset impacts from increased impervious areas and land disturbances, vegetated swales, permeable pavement materials, preservation of existing trees and vegetation, planting native vegetation and other appropriate measures should be evaluated and implemented where appropriate.

Climate change, including more frequent and intense storms and flooding events, can increase stormwater runoff. An increase in stormwater runoff can exacerbate existing, or introduce new, contaminants into water sources and soils. Increased precipitation

could overwhelm the study area's municipal stormwater management system, which can lead to backups that cause localized flooding or greater runoff of contaminants (e.g., trash, nutrients, bacteria) in waterways and soils (EPA 2023).

Most areas proposed for measures under the Proposed Action are currently developed and largely covered by impervious surfaces. The proposed action includes modifying existing stormwater conveyance and discharge infrastructure required as a result of new roadway and seawall construction.

To obtain a State Section 401 Water Quality Certification, USACE must conduct an impervious surface analysis, which has not yet been conducted due to a lack of project specifications that are due to be determined in PED. Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control erosion, storm water runoff, sedimentation, and other construction-related pollutants during all phases of construction, until the construction is complete and all disturbed areas are permanently stabilized throughout the project area.

During construction, stormwater runoff and associated discharges have the potential to exceed water quality criteria or waste discharge requirements, including National Pollutant Discharge Elimination System (NPDES) permit effluent limitations. An NPDES permit would be required because more than one acre of surface disturbance would occur. Any discharges of shallow groundwater produced during excavation dewatering could also exceed these criteria. Stormwater runoff from disturbed soils associated with construction activities is a common source of pollutant to receiving waters. Earthwork can render soils and sediments more susceptible to erosion from stormwater runoff, causing it to migrate to storm drains and downgradient water bodies such as the bay. It is likely project construction would involve using materials such as paint, solvents, oil and grease, petroleum products, concrete, and corrosion resistance coating, which if not handled properly, could be mobilized, and transported offsite by stormwater runoff thereby degrading water quality of receiving bay waters. Any such impacts would be minimized and controlled by using BMPs, as well as a site-specific SWPPP. Following shore-based construction, degraded water quality conditions would be expected to return to baseline conditions.

EWN solutions will also be implemented under the proposed action to reduce the use of impervious surfaces such as riprap and concrete and, in turn, increase pervious surface area and the presence of vegetation. Constructing planted levees is anticipated to have low impacts but also converts impervious surface to a NNBF with long-term beneficial impacts. These levees would be planted with native vegetation and can absorb runoff. Additionally, the construction of marsh and coarse beach restoration will create a permeable surface that can absorb stormwater runoff.

In summary, the Proposed Action was designed to minimize the creation of new impervious surfaces and maximize EWN to promote pervious surfaces and native vegetation. Preparation and implementation of a SWPPP, NPDES permit effluent limitations, and other water quality BMPs will be implemented to avoid and minimize

impacts of nonpoint source pollution on the Bay. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 6.

5.2.6 Policy 7

Whenever practicable, native vegetation buffer areas should be provided as part of a project to control pollutants from entering the Bay, and vegetation should be substituted for rock riprap, concrete, or other hard surface shoreline and bank erosion control methods where appropriate and practicable.

Under the Proposed Action, the introduction of hard surface shoreline and bank erosion control methods is in many cases not appropriate or practicable. Through a robust planning process, those hard features proposed for construction were identified as the minimum required to achieve the flood and RSLC resiliency objective of the project. However, as mentioned above Water Quality Policies 1, 2, and 6, multiple EWN solutions will be implemented under the Proposed Action to the greatest extent possible to achieve the desired flood and RSLC resiliency objectives. See Section 4.2 Measure Descriptions for a more detailed explanation of what each EWN feature entails.

Constructing planted levees converts impervious surface to a NNBF with long-term beneficial impacts. These levees would be planted with native vegetation and can absorb runoff and filter pollutants ahead of water entering the Bay. Additionally, the construction of marsh and coarse beach restoration will create a permeable surface that supports vegetation and can absorb and filter stormwater runoff. These features not only avoid the introduction of new hard surface shoreline but provide habitat enhancements that result in a net increase in quantity and quality of intertidal, beach, and marsh habitats and overall native vegetation buffer areas to aid in the control of pollutants from entering the Bay. Therefore, the Proposed Action is consistent with Policy 7 to the maximum extent practicable.

5.3 Water Surface Area and Volume

Two of the Bay Plan's water surface and volume policies are applicable to the Proposed Action: Policies 1 and 2. The Proposed Action's consistency with these policies is discussed in the following sections.

5.3.1 Policy 1

The surface area of the Bay and the total volume of water should be kept as large as possible in order to maximize active oxygen interchange, vigorous circulation, and effective tidal action. Filling and diking that reduce surface area and water volume providing substantial public benefits and only if there is no reasonable alternative.

Project features were designed to the greatest extent practicable to avoid adversely impacting the Bay's total volume and surface area. Only one structural measure (wharf raise/rebuild) and four NNBFs (ecotone levees, marsh enhancements, coarse beach

and living seawall) in the Proposed Action include the discharge of dredged or fill material into waters of the U.S. All other measures were designed and would be constructed and maintained landward of the existing shoreline to avoid discharge of fill materials and impacts to waters of the U.S. As discussed in Water Quality Policy 1 above in Section 5.2.1.

Approximately 9 acres of bay fill are anticipated under the proposed project. During project design, the introduction of new fill was minimized to the greatest extent practicable while still achieving project goals and objectives. The Ferry Building and bulkhead buildings would be raised in place following construction of new pile supported foundations (wharves), resulting in 4.6 acres of bay fill. The Ferry Building is designated a San Francisco landmark and is protected under the National Register of Historic Places. It provides substantial public benefits, including cultural and historical importance, recreation and social opportunities, commercial business, and transportation. Existing fill, including creosote, will be removed and replace with the new fill, thus resulting in a net decrease in bay fill beneath the Ferry Building and bulkhead buildings.

Construction at Rincon Park would have approximately 0.5 acres of bay fill to accommodate some necessary utility and transportation needs; however, an additional 3.5 acres of bay fill is needed to construct the coarse beach (EWN feature) that will be placed over the utility/transportation bay fill and use ecological processes to protect the site rather than using hardened structures such as rip rap. Over the long-term, adding a coarse beach would be a net gain in a different habitat type (beach or intertidal habitat) in this reach, benefitting nearshore ecology and having a plethora of benefits to the public.

Structures may be removed from the existing location to eliminate the potential flood risk or to make room for the proposed flood protection system. Structures identified for relocation would be physically relocated or rebuilt in another location off-site to be determined during PED. Depending on the locations of buildings removed or relocated and where buildings are relocated to, this may result in a decrease an increase in Bay surface area.

The pier demolition measure will remove approximately 1.0 acre of fill previously placed in waters of the U.S. including historic piles, bay fill, and pier decking and allow the area to restore to higher quality open water and subtidal habitat.

Despite a net decrease in bay fill, introduced bay fill will require compensatory mitigation in the form of old and unused pier and piling removal. A compensatory mitigation plan was developed and will continue to be refined through the design phase. In summary, the Proposed Action introduces bay fill (which will be mitigated), removes bay fill, and removes/relocates structures on the Bay, potentially increasing Bay volume and surface area. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 1.

5.3.2 Policy 2

Water circulation in the Bay should be maintained, and improved as much as possible. Any proposed fills, dikes, or piers should be thoroughly evaluated to determine their effects upon water circulation and then modified as necessary to improve circulation or at least to minimize any harmful effects.

Temporary impacts to currents may result during construction of shore-based measures as this is located at the MHHW line, such as levees, and some NNBFs such as marshes and ecological armoring. Localized, temporary impacts from the in-water measures such as bulkhead walls/seawalls, wharfs, and bay fill are also anticipated to adversely impact currents due to increased velocities at the toe of the structural measures, which may change wave energy in the bay. Wave energies could increase at the hardened structures which may increase tidal current velocities and lead to temporary indirect impacts from sedimentation or scour. The waterfront is highly urbanized at present; however, some new hardened structures may be introduced to protect against flood risks. Temporary impacts during construction include physical seabed disturbance that increase current velocities such as foundation installation, excavation, and fill activities.

Measures installed in the Bay below the high tide line would likely alter the bay shoreline permanently. Such an alteration could affect the movement of water in the bay due to altered circulation patterns, which could substantially change the bay floor adjacent to the new shoreline as a result of sediment scour. Sediment transport induced by waves and currents interacting with the new structures could alter the hydraulic forces exerted on the bay floor and shoreline, thereby inducing changes in scour and deposition.

Standard engineering hydrodynamic and wave modelling of tidal currents and wind waves would need to be conducted to analyze the proposed projects impacts associated with altered coastal hydraulics, which could occur from the proposed features. This type of model analysis could evaluate whether the project would include changes to currents and waves that could change the bay's bed elevations, and if so, the amount of change in depth and extent that it could be expected.

Operational impacts involve long-term effects related to the proposed features, including NNBFS measures, to maintain the adequacy of performance against RSLC. Operations and maintenance activities could include inspections, repairs, and fill activities. Hardened structures would require regular inspection for natural wear and/or damage following coastal and combined flooding or seismic events. NNBFs such as marshes, coarse beaches, and ecological armoring would require supplementation as sea levels rise over time. In the long-term this would offer benefits to coastal hydrology by dissipating wave energy, but would result in temporary, localized impacts to currents and hydrology during O&M activities. Maintenance for wharves would have temporary impacts to coastal hydrology through use of in-water construction equipment, similar to that described in construction impacts. However, these are expected to be far less impactful than those from construction because of the shorter duration.

Bay fill and seawall construction would have moderate to high impacts during construction, as well as likely permanent changes to bay hydrology, as described

previously. Both measures are expected to have significant and unavoidable impacts to bay hydrology. Construction of the coarse beach would require some in-water work activities, including work barges to stage equipment or transport material for placement, as well as heavy equipment that would be needed to move and grade material. These impacts are expected to be localized and temporary but would alter coastal hydrology in the construction area. Construction impacts are expected to be significant and unavoidable. Upon construction completion, coarse beaches are anticipated to have beneficial impacts on coastal hydrology by attenuating wave energies during tidal exchange and coastal surge. The coarse beach would require augmentation to be adapted to RSLC, which would use similar techniques as those during construction, but would likely take less time. Maintenance activities are anticipated to have low impacts and be less than significant.

Adverse to impacts on water circulation due to in-water construction actions would be temporary and localized in nature. Bay fill and seawall construction would likely have permanent effects to bay hydrology. Additional modeling is required to assess impacts and long-term changes as a result of the Proposed Action, and these analysis are expected to be performed during PED when more project detail is determined. To reduce impacts of in-water construction activities, BMPs described in Attachment 1 would be implemented. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 2.

5.4 Tidal Marshes and Tidal Flats

Four of the Bay Plan's tidal marsh and tidal flats policies are applicable to the Proposed Action: Policies 1, 2, 3, and 11. The Proposed Action's consistency with these policies is discussed in the following sections.

5.4.1 Policy 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.

The California Aquatic Resources Inventory (CARI) version 2.2 Geographic Information System dataset of aquatic habitats identified tidal flat and marsh panne as well as tidal marsh habitat within the Proposed Action footprint (SFEI 2022). CARI describes tidal flat and marsh panne habitat as: "non-vegetated areas that satisfy the hydrology and substrate criteria." Tidal marsh is described as "Emergent vegetation consists of erect rooted herbaceous hydrophytes (excluding mosses and lichens) and is usually dominated by perennial plants. Dominated by salt-tolerant species of emergent vascular vegetation, such as cordgrass (*Spartina spp*.), pickleweed (*Salicornia spp*.), and salt grass (*Distichlis spp*.) along the foreshore of the wetland and along the immediate banks of the larger tidal channels that tend to dewater at low tide."

Tidal flat and marsh panne habitat was mapped on the CARI database beneath the Ferry Building Wharf (though habitat here is no longer present after surveys), Pier 48 and 50, Pier 94, Heron's Head, and India Basin Park. USACE also identified this habitat type along the north and south banks of Islais and Mission creeks. Tidal marsh habitat was mapped on the CARI database at Heron's Head, Pier 94, and India Basin Park. USACE also identified this habitat type at Islais Creek Park, East of Illinois Bridge on north bank of Islais Creek, on north bank of Islais Creek at Islais Creek Muni Park, and Warm Water Cove.

No tidal marsh or tidal flat and marsh panne habitat is located within Reach 1. In Reach 2, a 0.25-acre area of tidal flat and marsh panne is mapped beneath the Ferry Building. This site is no longer tidal flat and has converted to subtidal habitat (i.e. the area is permanently submerged now).

Tidal flat and marsh panne habitats are also found in Reach 3. Most of the Proposed Action measures avoid its occurrence with the exception of actions along Mission Creek. Each of the measures here would be constructed to have the toe of the planted berm to align with the mean high-water line, thus avoiding any bay fill or long-term permanent impacts to the tidal flat and marsh panne habitat. However, during the design phase, site-specific habitat surveys should be completed to confirm that this assumption remains valid. If during those surveys the design is found to disturb this habitat, minimization measures should be considered and could include features such as adding ecological armoring instead of rip rap or other toe and slope protection materials, redesigning the planted berm to be an ecotone levee where marsh and other intertidal habitats can be incorporated to protect the toe, or realigning the berm to avoid at a minimum bay fill and tidal pane and marsh habitat.

Both tidal marsh and tidal flat and marsh panne habitat can be found in the Reach 4 project area, although the Proposed Action measures largely avoid construction in or near these habitats. There is one measure (EWN ecotone levee) that would be constructed just south of the Pier 94 wetlands. Since this feature is an ecotone levee, over the long-term the constructed feature would be complementary to the existing tidal marsh and tidal flat and marsh panne habitats. While constructing the ecotone levee, BMPs would be incorporated to prevent movement of sediment into the existing habitats from the construction site and no surface waters would be diverted from or into those habitats that were not there prior to construction. Additionally, there would be stipulations that no staging areas, access roads, construction footprints would be sited in aquatic habitats. As a result, there would be no direct or indirect loss of the habitats at Pier 94.

Areas of tidal flat and marsh panne habitat and tidal marsh are present along the north bank of Islais Creek in Reach 4 where project measures are proposed. Similar to Reach 3, as of now the planted levee design that could affect the area of habitat east of Illinois Bridge avoids construction below the mean high-water line. Construction and long-term operation of the structure should avoid any direct or indirect disturbance or loss of these habitats. During the design phase, additional site-specific surveys need to be completed and, if necessary, avoidance or minimization measures incorporated into the final design. At the Islais Creek Muni Park site, existing habitats would be temporarily filled in

or trampled to construct the ecotone levee. These habitats would be replaced as part of the EWN ecotone levee design and the habitat loss would be considered temporary until the restored vegetation reaches maturity and the intertidal habitat becomes fully functioning. The length between loss and restoration is dependent on how long construction takes at the immediate site, type of plants used, and growing conditions, but is anticipated to reach pre-construction conditions or better within one to three growing seasons after a one-year period of construction or two to five years. The purpose of the measure is to support the overall performance of the flood defense feature using natural processes. As a result, these features also provide habitat enhancements that are anticipated to result in a net increase in quantity and quality of intertidal and tidal marsh habitats.

Existing tidal marsh and tidal flat and marsh panne found at Islais Creek Park in Reach 4 would be avoided to the greatest extent practicable while constructing the 42.75-acre EWN feature. This measure would remove all existing structures, concrete and pavement from the area and create an open space composed of intertidal habitat at the lower elevations and grading to upland habitat further inland. Over the long-term this will be a significant net increase in tidal marsh and intertidal habitats; however, the exact extent is unknown because site-specific elevation and designs have not been developed to understand the widths of each zone of habitat that would be created after construction is complete. Additionally, as sea levels rise, it is anticipated that each of the aquatic habitats would retreat inland and convert the upland habitats to tidal marsh and additional intertidal habitat would be created, resulting in additional increase in aquatic habitats.

In summary, no unavoidable adverse impacts to tidal marsh or tidal flat and marsh panne habitat are expected as a result of the Proposed Action. Some features may abut existing habitat and are not expected to result in any impacts, but site-specific habitat surveys should be completed during PED to confirm that this assumption remains valid. The integration of new EWN features may provide habitat enhancements and result in a net increase in the quality and quantity of tidal marsh habitats. Therefore, the Proposed Action is consistent to the greatest extent practicable with Policy 1.

5.4.2 Policy 2

Any proposed filling, 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.

As discussed in the Policy 1 analysis above in Section 5.4.1, tidal marshes and tidal flats in the area have been identified. Proposed Action features have been designed to avoid and minimize harmful effects on tidal habitat. Bay fill components would not affect dial marsh or tidal flat habitat. Ecotone levee construction in Reaches 3 and 4 has the potential to adversely affect tidal marshes and flats during its construction, but has been designed ultimately complement existing tidal marsh and tidal flat and marsh panne habitats. While constructing the ecotone levee, BMPs would be incorporated to prevent movement of sediment into the existing habitats from the construction site and no surface waters would be diverted from or into those habitats that were not there prior to

construction. Additionally, there would be stipulations that no staging areas, access roads, construction footprints would be sited in aquatic habitats.

No adverse effects to or net losses of tidal flat or tidal marsh habitats are expected; however, site-specific habitat surveys are needed ahead of construction to confirm. If during those surveys the design is found to disturb this habitat, minimization measures should be considered and could include features such as adding ecological armoring instead of rip rap or other toe and slope protection materials, redesigning the planted berm to be an ecotone levee where marsh and other intertidal habitats can be incorporated to protect the toe, or realigning the berm to avoid at a minimum bay fill and tidal pane and marsh habitat. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 2.

5.4.3 Policy 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.

Both upland and tidal habitats are very limited in the study area as the San Francisco Bay area is largely composed of developed urban land that includes buildings, paved streets, sidewalks, parking lots, docks, and piers. These areas provide limited habitat opportunities for wildlife and do not include natural vegetation communities. Upland habitats in the study area include California annual grassland, coastal scrub, and coastal saltmarsh.

The California annual grassland community, also known as non-native grassland, is typically composed of a dense cover of introduced annual grasses and ruderal (woody) forbs (broad-leaved plants) adapted to colonizing and persisting in disturbed upland habitats. California annual grassland is present at Heron's Head Park and Pier 94 where it is interspersed with scattered shrubs such as coyote brush (*Baccharis pilularis*). Coastal scrub is present only at the easternmost portion of the study area, within India Basin Open Space. Coastal saltmarsh is a wetland type flood and drained by saltwater between high and low tides and is composed of a variety of terrestrial and aquatic species (NOAA 2022b). Coastal saltmarshes can be fully tidal, or brackish if they occur near the mouth of a freshwater source. Coastal saltmarsh is present in the Southern Waterfront subarea, including at the Pier 94 Wetlands and Heron's Head Park. The saltmarsh at Heron's Head is interspersed with areas of unvegetated salt panne (water retaining depressions). Coastal saltmarshes in the Central and South Bay are remnants of their former extent. Where salt marshes are still present, they support high densities and high diversity of wildlife.

Because of how highly urbanized the study area is, transitional zones are extremely limited and wildlife corridors between two core habitat areas do not exist. Where limited transition zones do exist (Heron's Head and Pier 94), the Proposed Action has been

sited and designed to avoid and minimize adverse impacts to tidal-upland transition zones.

NNBFs that would be constructed landward of the tidal zone would create new transition zone habitat from terrestrial to aquatic ecosystems. Planted levee design specifications would be dependent on site-specific conditions including real estate constraints, adjacent habitat types that can be connected, desired species composition and recruitment, and long-term use of the area. Each design would include erosion control and stabilization of slopes using biological, mechanical and ecological concepts while providing floodable area in storms and extreme tides. Specifically, the ecotone levee planned near Heron's Head Park would offer a transitional zone from salt marsh to upland habitat. This transition zone could provide suitable areas for special status species such as the California seablite and salt marsh harvest mouse that may be present. For space constrained locations, such as areas along the lower creek banks of Islais and Mission Creeks, creek enhancements such as habitat shelves or terraces, planted edges, live crib walls, and other measures that increase surface complexity could be constructed within the same footprint as the traditional levee proposed.

These NNBF features have been incorporated and designed to increase transition zones between aquatic and terrestrial habitat sites within the project area. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 3.

5.4.4 Policy 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.

The San Francisco Waterfront Flood Study is an innovative, first-of-its-kind plan to defend the city and waterfront against sea level rise, stormwater flooding, and earthquakes. The Proposed Action is structured in terms of first actions (completed over the next several decades) and subsequent actions (future adaptations, with their scale and timing dependent on the rate of sea level rise and other factors). It includes a Monitoring and Adaptation Plan to track evidence of sea level rise and global climate change to understand when future adaptation plan actions will be required.

The use of NNBFs and EWN features as a means to combat current and future flood risks to the Bay area, and the long-term Monitoring and Adaption Plan to implement additional measures to combat RSLC in the future, is the first of its kind in USACE's portfolio and may serve as a pilot/demonstration project for future projects with the objective of combatting risks from sea level rise.

The IFR/EIS recommends a higher level plan including features, locations, and methods to combat the aforementioned goals; however, greater detailed design and

monitoring/adaptive management are necessary and will be developed during PED. In general, these specifications still needed include detailed designs for flood defenses, timing and sequencing of construction, and funding plans. Before any construction or implementation of the Proposed Action, these more detailed analyses and designs will be developed to ensure the size, design, and management of the project would minimize the project's potential to negatively impact Bay habitats and species. This includes but is not limited to site-specific habitat analyses for tidal and subtidal habitat; hydrologic modeling of the impacts of bay fill; additional coordination with resource agencies on special status species and their habitats; and refinement of the current compensatory mitigation plan. For these reasons, the Proposed Action is consistent to the greatest extent practicable with Policy 11.

5.5 Smog and Weather

The Bay Plan's smog and weather Policy 1 is applicable to the Proposed Action. The Proposed Action's consistency with this policy is discussed in the following section.

5.5.1 Policy 1

To the greatest extent feasible, the remaining water volume and surface area of the Bay should be maintained.

As described in Section 5.3, the Proposed Action was designed to avoid adversely impacting the Bay's total volume and surface area to the greatest extent practicable. Only one structural measure (wharf raise/rebuild) and four NNBFs (ecotone levees, marsh enhancements, coarse beach and living seawall) in the Proposed Action include the discharge of dredged or fill material into waters of the U.S. All other measures were designed and would be constructed and maintained landward of the existing shoreline to avoid discharge of fill materials and impacts to waters of the U.S. Some existing structures (piers and piles) will be removed under the Proposed Action as part of the compensatory mitigation plan to offset bay fill during construction, to result in no net loss of Bay habitat. The project is not expected to affect the Bay's function as an environmental regulator for particulate and smog in the atmosphere for the Bay Area. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 1.

5.6 Fresh Water Inflow

The Bay Plan's freshwater inflow Policy 1 is applicable to the Proposed Action. The Proposed Action's consistency with this policy is discussed in the following section.

5.6.1 Policy 1

Diversions of fresh water should not reduce the inflow into the Bay to the point of damaging the oxygen content of the Bay, the flushing of the Bay, or the ability of the Bay to support existing wildlife.

Fresh water diversions to enable the evacuation of flood waters from behind coastal protected was handled with either gravity flow structures, water management structures, or pumps. Measures included in the Proposed Action First Action include new box and circular culverts of various sizes with backflow prevention throughout Reaches 2-4; four new pumps (two in Reach 3, 2 in Reach 4) of varying cfs for a total pump flow of 1500 cfs; and deployable flood gates in Reaches 2-4.

Pumps and culverts with backflow prevention would be placed in locations of natural low elevation where ponding occurs to maximize relief in areas prone to flooding. They would be integrated with existing infrastructure when the wharf is elevated and rebuilt.

Deployable gates would be used to close the openings at bridges and where additional tie into high ground is needed during high water events, while allowing continued vehicular, pedestrian, and rail access at all other times. A range of potential deployables may be used depending on the location, type of access needed, frequency of use, anticipated flooding conditions, operation and maintenance needs, etc. and may include swing gates, roller gates, flip up barriers, or other removable deployables. Permanent deployables are constructed to remain on-site and are designed for deployment temporarily during storm events or king tides. Typically, they are constructed of structural steel elements with a steel plate skin and tied into the adjacent flood protection measures (i.e., levee or vertical wall). Swing gates are attached to a reinforced column of a flood wall with hinges on one side, while rolling gates rest and roll on a ground wheel carrier or track along the gate sill. When closed, compressible seals along the bottom and sides of the gate seal against the wall and sill to resist water infiltration. Depending on the height and width, additional bracing can be placed on the dry side of the gate to help it withstand the pressure of the water. Gates can have the option for a manual cranking system to close depending on size, but many times a motorized opening/closing device is required. Traffic control measures would be added to the bridges to warn of gate deployment when activated.

Detailed modeling was conducting to inform the specifications and locations of freshwater diversion features included in alternatives considered and ultimately the Proposed Action. However, deployable, pump, and culvert locations and types estimated in the feasibility study would be reevaluated in PED when more detailed design and modeling will be conducted. These features would divert water to prevent flood risk, but surface waters would ultimately discharge into the Bay. Diversions of fresh water would not reduce inflow into the Bay to the point of damaging the oxygen content of the Bay, the flushing of the Bay, or the ability of the Bay to support existing wildlife. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 1.

5.7 Subtidal Areas

Four of the Bay Plan's subtidal policies are applicable to the Proposed Action: Policies 1, 2, 3, and 9. The Proposed Action's consistency with these policies is discussed in the following sections

5.7.1 Policy 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.

Impacts to subtidal areas resulting from the Proposed Action have been avoided and minimized to the greatest extent practicable. Project features were sited on the landward side of the Bay on previously disturbed, impervious surfaces as much as possible to avoid impacts to Bay waters. See Attachment 1 for more details on avoidance and minimization measures. Despite these efforts, 9.0 acres of bay fill were deemed required to fulfill study objectives. Under the Proposed Action, this acreage will be converted from subtidal habitat to bay fill.

Invasive species

BMPs would be employed during construction activities to prevent the spread and introduction of invasive and non-native species in accordance with EO 13112. NNBF features of the Proposed Action would help offset some habitat loss as a result of invasive species by restoring native habitats. Fill as well as construction equipment used for in-water construction would be inspected and approved by USACE prior to introduction into the Bay to ensure invasive species are not introduced.

Tidal hydrology and sediment movement

Localized, temporary impacts from the in-water measures such as bulkhead walls/seawalls, wharfs, and bay fill are also anticipated to adversely impact currents due to increased velocities at the toe of the structural measures, which may change wave energy in the bay. The waterfront is highly urbanized at present; however, some new hardened structures may be introduced to protect against flood risks. Wave energies could increase at the hardened structures which may increase tidal current velocities and lead to temporary indirect impacts from sedimentation or scour. Temporary impacts during construction include physical seabed disturbance that increase current velocities such as foundation installation, excavation, and fill activities.

Measures installed in the Bay below the high tide line would likely alter the bay shoreline permanently. Such an alteration could affect the movement of water in the bay due to altered circulation patterns, which could substantially change the bay floor adjacent to the new shoreline as a result of sediment scour. Sediment transport induced by waves and currents interacting with the new structures could alter the hydraulic

forces exerted on the bay floor and shoreline, thereby inducing changes in scour and deposition.

Standard engineering hydrodynamic and wave modelling of tidal currents and wind waves would need to be conducted to analyze the proposed projects impacts associated with altered coastal hydraulics, which could occur from the proposed features. This type of model analysis could evaluate whether the project would include changes to currents and waves that could change the bay's bed elevations, and if so, the amount of change in depth and extent that it could be expected.

Bay fill and seawall construction would have moderate to high impacts during construction, as well as likely permanent changes to bay hydrology, as described previously. Both measures are expected to have significant and unavoidable impacts to bay hydrology. Construction of the coarse beach would require some in-water work activities, including work barges to stage equipment or transport material for placement, as well as heavy equipment that would be needed to move and grade material. These impacts are expected to be localized and temporary but would alter coastal hydrology in the construction area. Construction impacts are expected to be significant and unavoidable. Upon construction completion, coarse beaches are anticipated to have beneficial impacts on coastal hydrology by attenuating wave energies during tidal exchange and coastal surge. The coarse beach would require augmentation to be adapted to RSLC, which would use similar techniques as those during construction, but would likely take less time.

To reduce impacts of temporary in-water construction activities to tidal hydrology and sediment movement, BMPs described in Attachment 1 would be implemented. Further modeling of the permanent effects of bay fill are needed and will be completed during PED so that detailed design plans avoid and minimize adverse effects to the greatest extent possible.

Fish, other aquatic organisms, and wildlife

Short-term direct impacts from construction-related activities are anticipated to adversely affect aquatic habitat and wildlife, whether they occur as a resident, migrant, or incidental, within or near the project area. Temporary in-water impacts include increased turbidity during construction activities and resuspension of sediments into the water column during pile driving, placement of concrete blocks, dewatering, and excavation and fill activities. Temporary and localized impacts to aquatic habitats from vessel anchoring and dewatering activities may occur but are expected to return to pre-existing conditions following active construction. Additionally, sheetpiles would be treated with corrosion-resistant coating prior to installation, which may require application by hand as necessary to touch-up areas potentially damaged during the installation process. These activities could pose a temporary risk of exposing resident aquatic organisms to toxic contaminants and non-edible forage. A site-specific spill prevention control and countermeasure plan (SPCC) would be developed and implemented to prevent spills and minimize the potential impacts for any inadvertent spills. With implementation of the SPCC and BMPs, impacts from spills or leaks are anticipated to be minor. Water quality is anticipated to return to baseline conditions after construction activities are completed.

For fish, turbid water concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). High total suspended solids (TSS) levels can cause a reduction in dissolved oxygen levels, which may result in protected fish becoming stressed. For example, young sturgeons have experienced high levels of mortality at low dissolved oxygen levels while older sturgeon tolerated reduced levels for short durations. However, tolerances may decline if chronic exposure to low dissolved oxygen occurs (Jenkins et al. 1993). Behavioral and physiological effects could occur if sturgeon are exposed to TSS levels of 1,000 mg/L above ambient for greater than 14 days at a time (Johnson 2018). While increases in suspended sediments may cause fish to alter their normal movements, these movements are expected to be minor and temporary. Other suitable habitat would be available in adjacent areas to the construction zone. TSS is not likely to exceed 1,000 mg/L above normal during construction for an extended duration (e.g., 2 weeks) as the turbidity causing activity would not be fully continuous for the duration of construction. For example, pile driving for wharf replacement would occur during daylight hours and cease at night, affording suspended sediments and turbidity time to settle before the next workday. TSS is most likely to affect fish if a plume causes a barrier to normal behaviors; however, the aquatic protected species are mobile and are anticipated to move from the areas of in-water construction to more suitable habitat during those activities. Additionally, BMPs such as seasonal restrictions and protected species observers would be used to mitigate and minimize impacts to ESA and protected species during operations. Details can be found in the Mitigation section.

Sessile and some benthic invertebrates would be lost during removal and replacement of pilings for wharf replacement actions. This would temporarily disrupt prey availability in localized areas for marine protected fish and birds. Other areas would be available for consumption and foraging within and adjacent to the study area, so it is assumed mobile fish and birds would shift elsewhere. Because of the temporary duration of work and that it would be conducted in distinct sections, impacts to protected species forage ability is expected to be less than significant.

Construction of in-water features such as foundations, piles, and walls (e.g., seawall, sheetpile wall) could cause changes to community composition and attraction of structure-oriented invertebrates. The new foundations and structure installations can produce the artificial “reef effect”, attracting species of algae, fish, shellfish, and other invertebrates to the hardened structures (Langhamer 2012). The loss of benthic habitat, in some instances, is expected to be offset by the introduction of new hard-bottoms substrate that would support benthic communities. This may attract prey species important in supporting protect marine mammals, birds, and fish. However, biofouling or colonization by invasive species could also occur, causing a long-term permanent impact.

Construction of in-water structures may indirectly affect pelagic birds that use the San Francisco Estuary for foraging by disturbing benthic habitat, invertebrates, and potentially the fish on which they feed. The area of impact would be relatively small at any given time as the measures would be constructed in sections so that birds could forage in other areas that are not being affected.

Permanent adverse impacts include habitat loss through measures such as bulkhead wall construction and wharf extensions. However, this bay fill will require the removal/replacement of existing creosote, which in turn will improve water quality and positively effect aquatic organisms. The mitigation plan will also result in a net gain for subtidal habitat for use by aquatic species.

Aquatic plants

No impacts to special status plants are anticipated from in-water construction activities. Submerged Aquatic Vegetation (SAV) refers to all underwater flowering plants. In San Francisco Bay SAV includes sago pondweed (*Stuckenia pectinata*), eelgrass (*Zostera marina*), surfgrasses (*Phyllospadix torreyi* and *P. scouleri*), and widgeongrass (*Ruppia maritima*). Eelgrass is the most extensive SAV in San Francisco Bay (Cosentino-Manning et al. 2010), albeit very few beds are documented or known to occur within the study area (Merkel and Associates 2014). Small, isolate beds are known to occur along the southern extent of the study area, such as Heron's Head Park. All SAV in the Central Bay basin is considered critical essential fish habitat (EFH) for spawning Pacific herring, which attach their egg masses to eelgrass, seaweed, and hard substrates.

No impacts to eelgrass beds are anticipated in work areas that are located within the action area as no in-water construction would occur near known eelgrass beds (Merkel 2010). It is possible, that sparse undiscovered stands of eelgrass may be present between Mission Creek and Heron's Hear Park in waters shallower than 7 ft and could be impacted by activities. However, review of the Merkel (2010) survey, bathymetry profiles suggest that eelgrass is in fact absent from these areas. Based on the above, potential impacts to eelgrass are expected to be negligible to none.

Furthermore, the implementation of NNBFs, specifically sheetpile walls with EWN features, planted levees, and living seawalls (described above in Sections 4.2.14, 4.2.16, and 4.2.17, respectively) would introduce new surfaces to be planted with or available for colonization by native aquatic species.

Bay bathymetry

Bay fill would have temporary, localized, but substantial impacts to hydrology during its construction, as well as likely permanent changes to bay hydrology. Such an alteration could affect the movement of water in the bay due to altered circulation patterns, which could substantially change the bay floor adjacent to the new shoreline as a result of sediment scour. Sediment transport induced by waves and currents interacting with the new structures could alter the hydraulic forces exerted on the bay floor and shoreline, thereby inducing changes in scour and deposition.

Standard engineering hydrodynamic and wave modelling of tidal currents and wind waves would need to be conducted to analyze the proposed projects impacts associated with altered coastal hydraulics, which could occur from the proposed features. This type of model analysis could evaluate whether the project would include changes to currents and waves that could change the bay's bed elevations, and if so, the amount of change in depth and extent that it could be expected. During PED, this

modeling will be completed, and detailed specifications for bay fill features will be designed accordingly.

Summary

The Proposed Action has been evaluated, and will be more thoroughly evaluated during PED, to evaluate the local and Bay-wide effects of the proposed bay fill. This includes evaluation of impacts to invasive species; aquatic species and wildlife; aquatic plants; tidal hydrology, sediment movement, and bathymetry. The Proposed Action has been designed to minimize and avoid harmful effects to Bay resources. As more detailed models are run and design is further refined in PED, additional ways to avoid and minimize impacts will be further implement when possible. For these reasons, the Proposed Action is consistent to the greatest extent practicable with Policy 1.

5.7.2 Policy 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.

Subtidal habitats are submerged areas beneath the San Francisco Bay water surface and include mud, shell, sand, rocks, artificial structures, shellfish beds, eelgrass beds, macroalgal beds, and the water column above the bay bottom (Cosentino-Manning et al. 2010). Soft substrate comprises the majority of the bay's bottom (approximately 90%) and ranges between soft mud with high silt and clay content and areas of coarser sand. Eelgrass beds are considered to be the only rare or unique subtidal habitat in or near the study area.

Eelgrass is a native marine plant found globally within soft-bottom bays and estuaries. It is typically found in healthy, shallow bays and estuaries where the depth of occurrence is a function of light penetration. In deeper water, light penetration is reduced below a level in which photosynthesis is able to meet the metabolic demands of the plant to sustain net growth. Eelgrass beds are dynamic, expanding and contracting seasonally and annually dependent on habitat quality. Importantly, eelgrass is considered an indicator community for the health of an estuary. It enhances water quality through sediment trapping and habitat stabilization, transforms nutrients, oxygenizes water, and serves as a primary producer, nursery habitat, and forage area for commercially and recreationally important fish, as well as migratory birds.

Eelgrass is sensitive to changes in water quality and turbidity and disturbances from shipping and boating that can disrupt seagrass beds directly through destruction of plants by propellers, anchors and anchor chains, dredging, and construction of facilities. Indirect impacts can occur through turbidity from dredging and boat wakes or shading from structures such as docks. Hardening of the shoreline can reflect waves that may increase wave action or limit or destroy eelgrass beds. Most of these threats are localized and have a limited spatial and temporal effect. However, eelgrass beds may

be impacted by climate change through RSLC but may respond by establishing closer to the present-day shoreline and dying out at greater depths.

In San Francisco Bay eelgrass is afforded special management considerations by the California Department of Fish and Wildlife (CDFW), USFWS, NMFS, Environmental Protection Agency (EPA), and BCDC. In the bay, eelgrass beds occur on soft bottom substrate in shallow areas and are most likely limited to the southern waterfront near Heron's Head.

No eelgrass impacts are anticipated in work areas that are located within the action area as no in-water construction would occur near known eelgrass beds (Merkel 2010). It is possible, that sparse undiscovered stands of eelgrass may be present between Mission Creek and Heron's Hear Park in waters shallower than 7-foot and could be impacted by activities. However, review of the Merkel (2010) survey, bathymetry profiles suggest that eelgrass is in fact absent from these areas. Based on the above, potential impacts to eelgrass are expected to be negligible to none. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 2.

5.7.3 Policy 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.

While the San Francisco Waterfront Flood Study is not specifically a subtidal habitat project, subtidal habitat mitigation is anticipated as a result of adverse impacts from bay fill. The proposed mitigation plan includes all stipulations required by Policy 3, as detailed in response to Mitigation policies discussed in Section 5.21. Therefore, the Proposed Action is consistent to the greatest extent practicable with Policy 3.

5.7.4 Policy 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.

The San Francisco Waterfront Flood Study is an innovative, first-of-its-kind plan to defend the city and waterfront against sea level rise, stormwater flooding, and earthquakes. The Proposed Action is structured in terms of first actions (completed over the next several decades) and subsequent actions (future adaptations, with their scale and timing dependent on the rate of sea level rise and other factors). It includes a Monitoring and Adaptation Plan to track evidence of sea level rise and global climate change to understand when future adaptation plan actions will be required.

The use of NNBFs and EWN features as a means to combat current and future flood risks to the Bay area, and the long-term Monitoring and Adaption Plan to implement additional measures to combat RSLC in the future, is the first of its kind in USACE's portfolio and may serve as a pilot/demonstration project for future projects with the objective of combatting risks from sea level rise.

The IFR/EIS recommends a higher level plan including features, locations, and methods to combat the aforementioned goals; however, greater detailed design and monitoring/adaptive management are necessary and will be developed during PED. In general, these specifications still needed include detailed designs for flood defenses, timing and sequencing of construction, and funding plans. Before any construction or implementation of the Proposed Action, these more detailed analyses and designs will be developed to ensure the size, design, and management of the project would minimize the project's potential to negatively impact Bay habitats and species. This includes but is not limited to site-specific habitat analyses for tidal and subtidal habitat; hydrologic modeling of the impacts of bay fill; additional coordination with resource agencies on special status species and their habitats; and refinement of the current compensatory mitigation plan. For these reasons, the Proposed Action is consistent to the greatest extent practicable with Policy 9.

5.8 Environmental Justice and Social Equity

Two of the Bay Plan's environmental justice and social equity policies are applicable to the Proposed Action: Policies 3 and 4. The Proposed Action's consistency with these policies is discussed in the following sections.

5.8.1 Policy 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 occur, further outreach and engagement should be conducted prior to Commission action.

There has been extensive outreach to the local community related to the alternatives. Since 2017, the Port, through the Waterfront Resilience Program, has engaged with tens of thousands of people, including engaging community members at local events and Port-hosted meetings and walking tours, businesses and merchants, advisory committees, non-profit groups, youth, and others.

Engagement has focused on sharing information about the multi-hazard earthquake and flood risks facing San Francisco's waterfront and gaining feedback about community priorities and concerns. It also has reflected and reported back to the public how their input has shaped the resilience work led by the Port, including affirming the Waterfront Resilience Program's focus on life safety and emergency response. The Port has conducted outreach and engagement to communities within the project area starting in 2017. Some of the outreach conducted was intercept, where people were stopped on the street and asked questions relevant to the Program at the time. Some outreach was done via community events, where the Port had a table and engaged people via activities at the table. In 2018, we conducted tenant outreach to connect with workers along the waterfront. At all outreach opportunities, we ask people to sign up for the WRP newsletter and stay connected with our work (Port of San Francisco, 2023a). Regular updates and notifications about upcoming outreach events are shared via a subscription list of over 4,500 recipients and the sfport.com/wrp website, which averages more than 1,200 views a month. The community engagement and outreach strategies are intended to respond to the needs and priorities of San Francisco's waterfront communities and targeted community groups, including youth, seniors, and communities historically excluded from planning processes.

Engagement strategies are inclusive, culturally nuanced, and available in multiple languages, allowing communities, especially those who do not or have never participated in the public process, to participate and provide their input. Therefore, the Proposed Action is consistent with Policy 3 to the maximum extent practicable.

5.8.2 Policy 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 reference community for the Proposed Action is the area that represents the general population that could be affected adversely or beneficially by the alternatives. For this study, the reference community is the City and County of San Francisco (City).

The study area for direct and indirect effects for socioeconomics and for minority populations and low-income populations encompasses the census blocks within the maximum project alternative area footprint plus a 200-foot buffer, and that would experience flooding under the 2090-sea-level rise plus 100-year storm event. The most recent and comprehensive U.S. Census Bureau data were considered for socioeconomic analyses performed. This data, the 2017–2021 American Community Survey data are used to describe existing (2020) population, housing, employment, and income in the reference community and study area.

To evaluate potential community impacts within the study area, a demographic profile of the relevant census blocks was developed to identify the low-income and minority populations. For the purposes of this analysis, a census block included a population to be evaluated for community issues if:

- The total minority population of the census block was more than 50% of the total population or substantially higher (i.e., more than 15%) than that of the city or county (reference area) where it is located, or
- The proportion of the census block population that was below the poverty level was substantially higher (i.e., more than 15% greater) than the proportion of the City/county of San Francisco (reference area) population below the poverty level.

Because the city has a minority population that totals more than 50%, at 61%, the “substantially higher” criterion (i.e., more than 15%) was used in this analysis (i.e., more than 61% + 15% = 76%).

Minorities represent approximately 61% of the total population of the City and approximately 61% of that of the study area. the 2017–2021 American Community Survey 5-year estimates indicate that the proportion of the population within the study area composed of minority populations ranges from 23% (census track block 0126.02/1) to 98% (census tract block 0231.03/1). Using the “substantially higher” criterion, census tract, 0231.03/1, 231.03/02, and 0612.00/1 in the Bayview Neighborhood, and 0611.01/2 in the Financial District each meet the minority criteria, because the percentage of minority populations is more than 15% greater than the proportion of minority populations in the City (61%), that is, more than 76% meeting the minority criteria. Of these minority-population-identified census blocks, only blocks, 0231.03/2, and 0612.00/1 are located within the footprints of the Proposed Action.

The study area has a median household income of $157,093, which is higher than the median household income in the City, $126,187. In contrast, the total percentage of individuals living below the poverty threshold is higher in the study area (11.2%) compared to the City as a whole (9.8%). However, using the “substantially higher than the city” criterion for population below the poverty level (9.8% + 15% = 24.8%), only the following census blocks meet the low-income criteria (again at or above 24.8%): census tract blocks 0105.00/1 in the Northern Waterfront, 0611.01/2, 0117.00/2, and 0615.01/1 in the Financial District, and 0231.03/2 in the Bayview Neighborhood. Of these low-

income-population-identified census blocks, only blocks 0105.00/1 and 0231.03/2 are located within the maximum construction footprints of the Proposed Action.

Because the Recommended Plan supports the preservation of existing structures and infrastructure relative to FWOP conditions, and long term supports a more aggressive timeline for sea-level-rise defense, the Recommended Plan would preserve substantially more features and values of the existing community relative to the FWOP. While the Recommended Plan includes alterations to the existing community to support some managed retreat inland along the southern waterfront, the new LOD would not generate construction effects that would divide the community and these features would ensure that future flood events do not physically divide the waterfront neighborhoods.

Long term, these protection measures would avoid the worse effects of the FWOP on communities and neighborhoods, displacements, and economics. Additionally, implementation of project construction- and displacement-related measures under AMM-CIA-1, AMM CIA-3 through AMM-CIA-9 and AMM-TR-1 through AMM TR-5 would be required for all future construction activity under the Recommended Plan for both the first and Subsequent Actions to reduce socioeconomic effects.

Overall, the Recommended Plan would generate an adverse effect on communities resulting from flooding- and displacement-related effects as well as construction-related effects; however, the distribution of these effects (displacement, flooding, and construction) would be dispersed throughout the study area for both the first and subsequent actions.

The following avoidance, minimization, and mitigation measures would be required for all alternatives:

AMM-CIA-1: EIS Outreach and Communication

Outreach and communication of impacts throughout the design and construction phases during the following stages: (1) Consideration of adverse effects and potential project design modifications; (2) Identification of substantial effects, and; (3) Development of mitigation. The Port and/or USACE will also conduct additional outreach and communication to unhoused persons during the design and construction phases. An outreach plan for unhoused persons will be developed, in coordination with local agencies and non-profit organizations that work with underserved communities and those experiencing homelessness.

AMM-CIA-2: *Note: Redundant with AMM TR-1, TR-2, TR-3, and TR-4 (see Annex D.1.4, Transportation). Reference kept to maintain numbering, but text deleted.*

AMM-CIA-3: Construction Loading Zones

Loading areas within active construction zones will be relocated as close to the construction zone as practical. Temporary loading zones may be possible under some circumstances.

AMM-CIA-4: Access Change Notices and Coordination

Advanced notice and coordination with emergency service providers and school officials will minimize potential temporary impacts from access changes, routing and scheduling. USACE and the City will coordinate with service providers as design and phasing is further developed.

AMM-CIA-5: Utility Relocation and Notification

Utility lines will be relocated by the utility companies, in coordination with the City. Potentially affected utility customers will be notified of potential service disruptions before relocation.

AMM-CIA-6: Targeted Outreach

Targeted outreach to businesses in the project area will take place to accommodate the loading/unloading needs of each business.

AMM-CIA-7: Homeless Outreach

The City will conduct targeted outreach to homeless persons within the construction area to notify them at least three days in advance of construction activities.

AMM-CIA-8: Property Acquisition

Where project construction requires displacement, the City will ensure fair and equitable treatment of affected persons related to relocation assistance and real property acquisition per the Uniform Relocation Assistance and Real Property Acquisition Policies Act.

AMM-CIA-9: Relocation Implementation Plan

If required, a relocation implementation plan will be prepared to support affected property owners in the event of real property acquisition (could apply to utilities).

With the above considerations made and mitigation measures in place, the Proposed Action is consistent to the greatest extent practicable with Policy 4.

5.9 Climate Change

Six of the Bay Plan's climate change policies are applicable to the Proposed Action: Policies 1, 2, 3, 4, 5, and 7. The Proposed Action's consistency with these policies is discussed in the following sections.

5.9.1 Policy 1

The Commission intends that the Bay Plan Climate Change findings and policies will be used as follows for the purposes of reviewing projects and activities by the Commission's Regulatory Program:

a. *The findings and policies apply only to projects and activities located within the following areas: San Francisco Bay, the 100-foot shoreline band, salt ponds, managed wetlands, and certain waterways, as these areas are described in*

Government Code section 66610, and the Suisun Marsh, as this area is described in Public Resources Code section 29101;

b. *For projects or activities that are located partly within the areas described in subparagraph a and partly outside such area, the findings and policies apply only to those activities or that portion of the project within the areas described in subparagraph a;*
c. *For the purposes of implementing the federal Coastal Zone Management Act, the findings and policies do not apply to projects and activities located outside the areas described in subparagraph a, even if those projects or activities may otherwise be subject to consistency review pursuant to the federal Coastal Zone Management Act; and*
d. *For purposes of implementing the California Environmental Quality Act, the findings and policies are not applicable portions of the Bay Plan for purposes of CEQA Guideline 15125(d) for projects and activities outside the areas described in subparagraph a and, therefore, a discussion of whether such proposed projects or activities are consistent with the policies is not required in environmental documents.*

The Proposed Action will take place in the San Francisco Bay area. Accordingly, applicable policies of the Bay Plan have been addressed in this document. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 1.

5.9.2 Policy 2

When planning shoreline areas or designing larger shoreline projects, a risk assessment should be prepared by a qualified engineer and should be based on the estimated 100-year flood elevation that takes into account the best estimates of future sea level rise and current flood protection and planned flood protection that will be funded and constructed when needed to provide protection for the proposed project or shoreline area. A range of sea level rise projections for mid-century and end of century based on the best scientific data available should be used in the risk assessment. Inundation maps used for the risk assessment should be prepared under the direction of a qualified engineer. The risk assessment should identify all types of potential flooding, degrees of uncertainty, consequences of defense failure, and risks to existing habitat from proposed flood protection devices.

Low-lying assets and economic activity along the San Francisco Waterfront are at risk of flooding from coastal storms and extreme high tides, and from the potential failure of the century-old San Francisco seawall, which could result from structural deterioration or earthquake induced shoreline instability. A 100-year period of analysis was used in this study. NOAA's San Francisco Presidio tide gauge was selected to formulate the RSLC strategy based on its proximity to the study area. The PDT formulated alternatives considering five RSLC curves to address USACE requirements, as well as the requirements of the State of California and CCSF. Risks of a 100-year flood event, or 1% annual exceedance probability (AEP) event, were assessed under each RLSC

curve condition. The study identified all types of potential flooding, degrees of uncertainty and further information needs to be evaluated during PED, consequences of defense failure, and risks to existing habitat. These modeled scenarios were utilized to develop various alternatives and ultimately recommend the Proposed Action as the most appropriate approach to address risks from flooding along San Francisco Bay. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 2.

5.9.3 Policy 3

To protect public safety and ecosystem services, within areas that a risk assessment determines are vulnerable to future shoreline flooding that threatens public safety, all projects—other than repairs of existing facilities, small projects that do not increase risks to public safety, interim projects and infill projects within existing urbanized areas––should be designed to be resilient to a mid-century sea level rise projection. If it is likely the project will remain in place longer than mid-century, an adaptive management plan should be developed to address the long-term impacts that will arise based on a risk assessment using the best available science-based projection for sea level rise at the end of the century.

The purpose of the San Francisco Waterfront Coastal Flood Study is to investigate the feasibility of managing tidal and fluvial flooding and sea level rise along 7.5 miles of the San Francisco Bay shoreline. The project area is at risk of flooding from bay water during coastal storms, extreme tides, and future sea level rise, with the potential for extensive damage to public infrastructure and private property and associated impacts to the San Francisco waterfront. The risk is expected to increase over time as sea levels rise in the bay. The Study recommends a comprehensive plan with long-term adaptive management measures to protect public safety and ecosystem services risks that may result from RSLC at the mid- and end of century time period. Thus, the Proposed Action is consistent to the maximum extent practicable with Policy 3.

5.9.4 Policy 4

To address the regional adverse impacts of climate change, undeveloped areas that are both vulnerable to future flooding and currently sustain significant habitats or species, or possess conditions that make the areas especially suitable for ecosystem enhancement, should be given special consideration for preservation and habitat enhancement and should be encouraged to be used for those purposes.

Coastal saltmarsh is present in the Southern Waterfront subarea, including Pier 94 Wetlands and Heron's Head Park. They are considered significant in the study area, particularly Heron's Head, due to the rare nature in the otherwise urban environment. Where salt marshes are still present, they support high densities and high diversity of wildlife. Additionally, they provide habitat for the Ridgway's rail (*Rallus obsoletus*) and salt marsh harvest mouse (*Reithrodontomys raviventris*), both of which are federally and

state-endangered and state fully protected species. Avoidance and minimization measures will be implemented to ensure these habitats' preservation and longevity.

The implementation of NNBFs and EWN creates conditions suitable for ecosystem enhancement, creating tidal-upland transition zone habitat, increasing native vegetation, and/or creating new coarse beach habitat, among other ecosystem benefits, instead of using unnatural hard surfaces such as rip rap to realize the same flood risk reduction benefits. Because it preserves existing significant habitat and creates new habitat for ecosystem enhancement, the Proposed Action is consistent to the maximum extent practicable with Policy 4.

5.9.5 Policy 5

Wherever feasible and appropriate, effective, innovative sea level rise adaptation approaches should be encouraged.

As discussed above in Sections 5.4.4 and 5.7.4, the San Francisco Waterfront Flood Study is an innovative, first-of-its-kind plan to defend the city and waterfront against sea level rise, stormwater flooding, and earthquakes. The Proposed Action is structured in terms of first actions (completed over the next several decades) and subsequent actions (future adaptations, with their scale and timing dependent on the rate of sea level rise and other factors). It includes a Monitoring and Adaptation Plan to track evidence of sea level rise and global climate change to understand when future adaptation plan actions will be required.

The use of NNBFs and EWN features as a means to combat current and future flood risks to the Bay area, and the long-term Monitoring and Adaption Plan to implement additional measures to combat RSLC in the future, is the first of its kind at this scale in USACE's portfolio and may serve as a pilot/demonstration project for future projects with the objective of combatting risks from sea level rise. For these reasons, the Proposed Action is consistent to the greatest extent practicable with Policy 5.

5.9.6 Policy 7

The Commission should evaluate each project proposed in vulnerable areas on a case-by-case basis to determine the project's public benefits, resilience to flooding, and capacity to adapt to climate change impacts. The Commission may consult the Regional Shoreline Adaptation Plan and consider any approved Subregional Shoreline Adaptation Plan as advisory in its review of projects and activities associated with those plans by the Commission's Regulatory Program. The following specific types of projects have regional benefits, advance regional goals, and should be encouraged, if their regional benefits and their advancement of regional goals outweigh the risk from flooding:

a. *remediation of existing environmental degradation or contamination, particularly on a closed military base;*

b. a transportation facility, public utility or other critical infrastructure that is necessary for existing development or to serve planned development;
c. a project that will concentrate employment or housing near existing or committed transit service (whether by public or private funds or as part of a project), particularly within those Priority Development Areas that are established by the Association of Bay Area Governments and endorsed by the Commission, and that includes a financial strategy for flood protection that will minimize the burdens on the public and a sea level rise adaptation strategy that will adequately provide for the resilience and sustainability of the project over its designed lifespan; and
d. a natural resource restoration or environmental enhancement project.

The following specific types of projects should be encouraged if they do not negatively impact the Bay and do not increase risks to public safety:

e. repairs of an existing facility;
f. a small project;
g. a use that is interim in nature and either can be easily removed or relocated to higher ground or can be amortized within a period before removal or relocation of the proposed use would be necessary; and
h. a public park.

The purpose of the San Francisco Waterfront Flood Study is to investigate and identify ways to reduce coastal flood risk along 7.5 miles of the San Francisco Waterfront by evaluating alternatives to meet current and future coastal flood risk management, taking into account relative sea level change, to protect life and property. Therefore, it is inherently consistent with this Policy.

The methods proposed to achieve the project's objective include modifying existing transportation, utility, and other public critical infrastructure; NNBFs and EWN solutions that would result in environmental enhancement, and compensatory mitigation for adverse impacts to subtidal habitat. A majority of the work is planned on the landward side of the bay on previously disturbed, impervious surfaces to make existing infrastructure more resilient to flooding, RSLC, and seismic activity. These types of projects have regional benefits and advance regional goals while reducing flood risk and risks to public safety. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 7.

5.10 Safety of Fills

Two of the Bay Plan's safety of fills policies are applicable to the Proposed Action: Policies 1 and 4. The Proposed Action's consistency with these policies is discussed in the following sections.

5.10.1 Policy 1

The Commission has appointed the Engineering Criteria Review Board consisting of geologists, civil engineers specializing in geotechnical and coastal engineering, structural engineers, and architects competent to and adequately empowered to: (a) establish and revise safety criteria for Bay fills and structures thereon; (b) review all except minor projects for the adequacy of their specific safety provisions, and make recommendations concerning these provisions; (c) prescribe an inspection system to assure placement and maintenance of fill according to approved designs; (d) with regard to inspections of marine petroleum terminals, make recommendations to the California State Lands Commission and the U.S. Coast Guard, which are responsible for regulating and inspecting these facilities; (e) coordinate with the California State Lands Commission on projects relating to marine petroleum terminal fills and structures to ensure compliance with other Bay Plan policies and the California State Lands Commission's rules, regulations, guidelines and policies; and (f) gather, and make available performance data developed from specific projects. These activities would complement the functions of local building departments and local planning departments, none of which are presently staffed to provide soils inspections.

The Proposed Action would involve only the minimum fill necessary to ensure the future structural integrity of the wharf, utility/transportation infrastructure, and EWN features where existing fill is being replaced or new fill is being introduced against flood and RSLC risks. All other measures were designed and would be constructed landward of the existing shoreline to avoid discharge of fill materials and impacts to waters of the U.S. The project would be designed in accordance with USACE design specifications. Moreover, all plans and specifications for the project would be subject to review by the Commission's Engineering Criteria Review Board to ensure adequacy with adopted safety provisions related to Bay fills. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 1.

5.10.2 Policy 4

Adequate measures should be provided to prevent damage from sea level rise and storm activity that may occur on fill or near the shoreline over the expected life of a project. The Commission may approve fill that is needed to provide flood protection for existing projects and uses. New projects on fill or near the shoreline should either be set back from the edge of the shore so that the project will not be subject to dynamic wave energy, be built so the bottom floor level of structures will be above a 100-year flood elevation that takes future sea level rise into account for the expected life of the project, be specifically designed to tolerate periodic flooding, or employ other effective means of addressing the impacts of future sea level rise and storm activity. Rights-of-way for levees or other structures protecting inland areas from tidal flooding should be sufficiently wide on the upland side to allow for future levee widening to support additional levee height so that no fill for levee widening is placed in the Bay.

The purpose of the fill recommended under the Proposed Action is to provide flood protection for existing projects and uses. Existing fill will be removed and replaced under the Ferry Building and bulkhead buildings to increase their resilience against flood events and RSLC. Construction at Rincon Park would require bay fill to accommodate some necessary utility and transportation needs, and additional bay fill will be utilized to construct a coarse beach (EWN feature) over the utility/transportation bay fill and use ecological processes to protect the site from dynamic wave energy rather than using hardened structures such as rip rap. The Ferry Building, bulkhead buildings, and Rincon Park features are being raised to withstand 100-year flood events and storm activity, taking into account future sea level rise over a 100-year period of analysis during modeling. No fill for levee widening is being placed in the Bay. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 4.

5.11 Shoreline Protection

Eight of the Bay Plan's environmental justice and social equity policies are applicable to the Proposed Action: Policies 1, 2, 3, 4, 5, 6, 7, and 8. The Proposed Action's consistency with these policies is discussed in the following sections.

5.11.1 Policy 1

New shoreline protection projects and the maintenance or reconstruction of existing projects and uses should be authorized if: (a) the project is necessary to provide flood or erosion protection for (i) existing development, use or infrastructure, or (ii) proposed development, use or infrastructure that is consistent with other Bay Plan policies; (b) the type of the protective structure is appropriate for the project site, the uses to be protected, and the causes and conditions of erosion and flooding at the site; (c) the project is properly engineered to provide erosion control and flood protection for the expected life of the project based on a 100-year flood event that takes future sea level rise into account; (d) the project is properly designed and constructed to prevent significant impediments to physical and visual public access; (e) the protection is integrated with current or planned adjacent shoreline protection measures; and (f) adverse impacts to adjacent or nearby areas, such as increased flooding or accelerated erosion, are avoided or minimized. If such impacts cannot be avoided or minimized, measures to compensate should be required. Professionals knowledgeable of the Commission's concerns, such as civil engineers experienced in coastal processes, should participate in the design.

The San Francisco Waterfront Flood Study investigates the feasibility of providing protection against tidal and fluvial flooding and measures to adapt to rising sea levels along 7.5 miles of the San Francisco Bay shoreline. The Proposed Action serves to provide necessary flood and erosion protections for existing development, use, and infrastructure. The types of measures proposed under the project have followed

USACE's plan formulation process to develop an array of seven action alternatives, which were then further evaluated and refined to identified the Recommended Plan, or Proposed Action. The Proposed Action entails the most appropriate type of protective measures for the project site, its uses, and the causes and conditions of erosion and flooding at the site.

The project has undergone higher level engineering design and modeling to be able to select the Proposed Action from the slew of action alternatives formed. Additional modeling and more detailed engineering plans will be developed during the PED project phase to ensure erosion control and flood protection measures are effective for the duration of the 100-year period of analysis for a 100-year flood event, all the while taken into account RSLC.

Effects of the Proposed Action on environmental resources including upland and aquatic resources, special status species, recreation, transportation, public access, and aesthetics have been evaluated. The project was sited so as to avoid and minimize impacts to these resources to the greatest extent practicable during construction as well as operations and maintenance, and BMPs will be in place to further minimize potential adverse effects during construction and operations (see Attachment 1, Avoidance and Minimization Measures). Where adverse impacts to subtidal habitat from bay fill were unavoidable, a compensatory mitigation plan was developed to offset negative effects.

The project was developed in unison with the Port of San Francisco (POSF) – the project's Non-Federal Sponsor – as well as numerous other federal, state, and local entities to ensure consideration was given to all applicable land and water resource plans applicable to the San Francisco Bay area. The study identified actions that the City and County of San Francisco, as well as individual public and private property and asset owners, would take to address sea level rise and coastal flood hazards in the area if this project did not occur. Additionally, many development projects are underway along the waterfront on POSF-owned land. The POSF has identified 23 Embarcadero Early Projects to reduce earthquake and flood risk related to seismic risk in response to a 2018 proposition passed by voters. USACE is working with the POSF, City and County of San Francisco, and other Bay stakeholders to ensure Proposed Action measures are integrated with current and anticipated shoreline protection projects.

The effects of the Proposed Action on adjacent or nearby areas has been considered to ensure flooding and/or erosion are not exacerbated by actions in the project area. Siting and hydrologic and hydraulic modeling will be further evaluated during PED to ensure the desired effects of features can be realized without unwanted ancillary effects. Adverse effects to adjacent and nearby areas will be avoided and minimized. Multiple engineers with a diverse, comprehensive background in hydraulic and hydrologic engineering are participating in the project design. For these reasons, the Proposed Action is consistent with Policy 1.

5.11.2 Policy 2

Equitable and culturally-relevant community outreach and engagement should be conducted to meaningfully involve nearby communities for all shoreline protection project planning and design processes – other than maintenance and in-kind repairs to existing protection structures or small shoreline protection projects – in order to supplement technical analysis with local expertise and traditional knowledge and reduce unintended consequences. In particular, vulnerable, disadvantaged, and/or underrepresented communities should be involved. If such previous outreach and engagement did not occur, further outreach and engagement should be conducted prior to Commission action.

As discussed under Environmental Justice and Social Equity Policy 3 (Section 5.8.1), there has been extensive outreach to the local community related to the alternatives. Since 2017, the Port, through the Waterfront Resilience Program, has engaged with tens of thousands of people, including engaging community members at local events and Port-hosted meetings and walking tours, businesses and merchants, advisory committees, non-profit groups, youth, and others.

Comments were solicited during the Draft Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS) scoping period and 60-day draft public comment period. Comments received were thoroughly evaluated and addressed in the IFR/EIS as appropriate.

Engagement strategies are inclusive, culturally nuanced, and available in multiple languages, allowing communities, especially those who do not or have never participated in the public process, to participate and provide their input. Therefore, the Proposed Action is consistent with Policy 2 to the maximum extent practicable.

5.11.3 Policy 3

Riprap revetments, the most common shoreline protective structure, should be constructed of properly sized and placed material that meet sound engineering criteria for durability, density, and porosity. Armor materials used in the revetment should be placed according to accepted engineering practice, and be free of extraneous material, such as debris and reinforcing steel. Generally, only engineered quarrystone or concrete pieces that have either been specially cast, are free of extraneous materials from demolition debris, and are carefully selected for size, density, and durability will meet these requirements. Riprap revetments constructed out of other debris materials should not be authorized.

Project features such as levees that would utilize riprap would be constructed of properly sized and placed material that meets sound engineering criteria for durability, density, and porosity. No demolition debris or any other types of debris would be utilized as riprap material. Commercial rip rap or more ecologically friendly substitutes such as eco riprap may be considered for use, and specific materials would be determined

during PED. It was assumed that riprap will be acquired from a commercial quarry. USACE guidance criteria and testing requirements for riprap are rigorous and tend to lead to a much higher quality than commercial or private applications would utilized. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 3.

5.11.4 Policy 4

Authorized protective projects should be regularly maintained according to a long-term maintenance program to assure that the shoreline will be protected from tidal erosion and flooding and that the effects of the shoreline protection project on natural resources during the life of the project will be the minimum necessary.

Operation, maintenance, repair replacement, and rehabilitation (OMRR&R) includes actions to sustain the constructed project and to maintain the stated level of benefits at the completion of construction and into the future. The Port of San Francisco, the project's Non-Federal Sponsor, would be responsible for OMRR&R costs and actions. Generally, the NFS is required to repair, rehabilitate, or provide replacement of components to maintain the original project benefits. A detailed OMRR&R manual will be developed during the PED phase to outline the expected OMRR&R requirements for each project component. OMRR&R requirements would also include but are not limited to, annual exercising of gates and closure structures, grass mowing of levee and floodwall right of way, painting of metal surfaces, pump station operations and maintenance, and general maintenance of drainage structures. Because OMRR&R execution is required as part of the project, the Proposed Action is consistent to the maximum extent practicable with Policy 4.

5.11.5 Policy 5

All shoreline protection projects should evaluate the use of natural and nature-based features such as marsh vegetation, levees with transitional ecotone habitat, mudflats, beaches, and oyster reefs, and should incorporate these features to the greatest extent practicable. Ecosystem benefits, including habitat and water quality improvement, should be considered in determining the amount of fill necessary for the project purpose. Suitability and sustainability of proposed shoreline protection and restoration strategies at the project site should be determined using the best available science on shoreline adaptation and restoration. Airports may be exempt from incorporating natural and nature-based features that could endanger public safety by attracting potentially hazardous wildlife.

Although opportunities for expansive NNBFs are limited, the Port and USACE collaborated with local, regional, and national experts to develop a range of feasible solutions appropriate for San Francisco's shoreline. The Port also initiated a living seawall pilot study to test different seawall surface textures and concrete mixes that would allow the Port to identify that most likely approaches for creating habitat for native

biota along otherwise barren seawalls. NNBFs under the Proposed Action include paved levees with EWN features, sheetpile walls with EWN features, marsh/coarse beach restoration, rocky intertidal bluffs, and living seawalls as described in Section 4.2 Measure Descriptions.

NNBFs were utilized where feasible and effective, however 9.0 acres of bay fill was deemed necessary to meet project objectives. Ecosystem impacts and benefits, including habitat and water quality improvement, were evaluated when assessing impacts of fill. The removal of creosote piles to replace with new fill, and fill removal as a measure and through compensatory mitigation may improve water quality in the long term. Mitigation will be implemented for loss of subtidal habitat from fill conversion. Temporary impacts to habitats and water quality will be avoided and minimized to the greatest extent practicable.

Suitability and sustainability of proposed shoreline protection strategies were thoroughly analyzed using the best available science on shoreline adaptation and restoration through the USACE planning process. The Proposed Action measures represent the best available solution to the flood risk problems at hand working within planning, engineering, funding, and other restraints governing the project. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 5.

5.11.6 Policy 6

Adverse impacts to natural resources and public access from new shoreline protection should be avoided. When feasible, shoreline protection projects should include components to retain safe and convenient water access, for activities such as fishing, swimming, and boating, especially in communities lacking such access. Where significant impacts cannot be avoided, mitigation or alternative public access should be provided. Shoreline protection projects that include natural and nature-based features may be self-mitigating or require less mitigation than projects that do not include any natural or nature-based features.

The Proposed Action includes avoidance and minimization measures to mitigation adverse impacts to natural resources and public access. Project siting, specific measures, and BMPs are in place to mitigate impacts to the physical environment, including aquatic and terrestrial resources, special status species and their habitats (as discussed in previous sections), as well as the built environment, including public access and recreation infrastructure. Public access to the waterfront will be disrupted primarily during construction activities; however, public access to the shoreline, including recreation opportunities, would be maintained during construction with temporary access routes. Detours around construction areas would be included where appropriate. Recreation would resume in a manner like the existing condition after construction is complete. During O&M activities, access should not be readily, but it is likely that detours may be set where appropriate or restricted access during activities may be instilled for public safety. Once maintenance is complete, recreational activities

would resume normally. Construction Transportation Management Plans will be prepare to mitigate impacts during construction, including to public access infrastructure such as pedestrian trails. The bay fill components would require compensatory mitigation; however, these impacts are not expected to directly impact public access or recreation opportunities. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 6.

5.11.7 Policy 7

The Commission should encourage pilot and demonstration projects to research and demonstrate the benefits of incorporating natural and nature-based techniques in San Francisco Bay.

As discussed above in Sections 5.4.4, 5.7.4, and 5.9.5, the San Francisco Waterfront Flood Study is an innovative, first-of-its-kind plan to defend the city and waterfront against sea level rise, stormwater flooding, and earthquakes. The Proposed Action is structured in terms of first actions (completed over the next several decades) and subsequent actions (future adaptations, with their scale and timing dependent on the rate of sea level rise and other factors). It includes a Monitoring and Adaptation Plan to track evidence of sea level rise and global climate change to understand when future adaptation plan actions will be required.

NNBFs under the Proposed Action include paved levees with EWN features, sheetpile walls with EWN features, marsh/coarse beach restoration, rocky intertidal bluffs, and living seawalls as described in Section 4.2 Measure Descriptions. The use of NNBFs and EWN features as a means to combat current and future flood risks to the Bay area, and the long-term Monitoring and Adaption Plan to implement additional measures to combat RSLC in the future, is the first of its kind at this scale in USACE's portfolio and may serve as a pilot/demonstration project for future projects with the objective of combatting risks from sea level rise. The Port also initiated a living seawall pilot study to test different seawall surface textures and concrete mixes that would allow the Port to identify that most likely approaches for creating habitat for native biota along otherwise barren seawalls. For these reasons, the Proposed Action is consistent to the greatest extent practicable with Policy 7.

5.11.8 Policy 8

All contamination remediation projects in the Bay or along the Bay shoreline should integrate the best available science on sea level rise, storm surge, and associated groundwater level changes into the project design in order to protect human and ecological health by preventing the mobilization of contaminants into the environment and preventing harm to the surrounding communities.

Although this study is not specifically a contamination remediation project, HTRW sites in the project area may require remediation before Proposed Action elements may be

constructed. HTRW considerations are described in Water Quality Policy 4 in Section 5.2.4.

Under the No Action Alternative, capped and un-capped HTRW areas would be exposed to flooding and erosion from RSLC, which could result in releasing contaminants that impact water, soil, and sediment quality, as well as human health. The Proposed Action provides an opportunity for the NFS to remediate some of the existing HTRW sites that fall within the project area. USACE has developed strategic flow charts on how to evaluate project sites with known or suspected contamination, including characterization of site conditions through Phase I and Phase II Environmental Site Assessments and risk evaluation to determine whether cleanup, site management, or no further action is warranted. There is also a process for managing soil that is excavated during remedy implementation or construction. This process provides a framework for determining whether the material is regulated or hazardous waste and selecting appropriate disposal methods formed from waste characterization testing results or the appropriate reuse pathway based on total analysis and comparison to residential and commercial/industrial screening criteria.

In summary, additional investigation and testing for HTRW will be required prior to construction. The existence of any HTRW will be identified in a future Phase 2 Environmental Site Assessment that will be conducted in subsequent phases of this project and appropriately addressed. At this time, consideration will be given to affected HTRW sites with regards to mobilization of contaminants. USACE will ensure that any portions of the project located in or near HTRW sites would not cause harm to the public, to Bay resources, or to the beneficial uses of the Bay by following established processes and adhering to the aforementioned applicable laws, regulations, and policies, that govern HTRW. Therefore, the project is consistent with Policy 8 to the maximum extent practicable.

5.12 Water-Related Industry and Ports

The Bay Plan's water-related industry and ports Policy 1 is applicable to the Proposed Action. The Proposed Action's consistency with this policy is discussed in the following section.

5.12.1 Policy 1

Sites designated for both water-related industry and port uses in the Bay Plan should be reserved for those industries and port uses that require navigable, deep water for receiving materials or shipping products by water in order to gain a significant transportation cost advantage.

The Proposed Action does not propose changes to the uses or designations of sites reserved for water-related industry or Port uses. Accordingly, the Proposed Action is consistent to the maximum extent practicable with Policy 1.

5.13 Transportation

Two of the Bay Plan's policies related to transportation are applicable to the Proposed Action: Policies 1 and 4. The Proposed Action's consistency with these policies is discussed in the following sections.

5.13.1 Policy 1

Because of the continuing vulnerability of the Bay to filling for transportation projects, the Commission should continue to take an active role in Bay Area regional transportation and related land use planning affecting the Bay, particularly to encourage alternative methods of transportation and land use planning efforts that support transit and that do not require fill. The Metropolitan Transportation Commission, the California Department of Transportation, the California Transportation Commission, the Federal Highway Administration, county congestion management agencies and other public and private transportation authorities should avoid planning or funding roads that would require fill in the Bay and certain waterways.

Although this project is not considered a transportation project in the context of the Bay Plan policies, components of the Proposed Action impact Bay area transportation corridors. Permanent impacts would result from transportation system redesign around new levees, walls, some areas of raised elevations, and retreat areas. Certain measures would have permanent impacts on existing transportation facilities and roadways such as narrowing of roadways to accommodate raising roads and buildings, and transportation system changes such as removing bridges, installing tide gates, and creation of levees that would permanently block access to some areas. Transit and transportation re-routing around retreat areas and constructed facilities would be required in some cases.

Construction of levees and raising building and wharf elevations can not only affect access during construction but new elevations and slopes may change slopes within intersections and roadway approaches, change driveway and trail slopes and accessibility. Rail lines and light rail tracks are particularly susceptible to changes in elevation and slopes and may not be able to cross these new elevated areas and levees.

The design of levees and slopes in relation to roadways, bikeways, transit routes, and sidewalks can create barriers and impede movement due to the slopes and geometrics of the measures. Roadway intersections such as along the Embarcadero or near the I-280 on- and off-ramps near Islais Creek would need to accommodate raised elevations or be redesigned and raised as needed to incorporate the new geometry. Pedestrian, bicycle, and ADA compliant access along some areas of the waterfront would require well-planned ramps to allow continued access.

Residual flooding would impact existing transportation services by flooding transportation infrastructure causing these transportation modes to be either

permanently or intermittently unusable. Transit services especially light rail, subway, and the electric trolley network would require advanced work to relocate the associated infrastructure and modify transit routes not protected by the given alternatives.

Permanent transportation impacts would cause major disruptions in transportation circulation from changes in elevation and inundation in retreat areas. With implementation of mitigation measures (discussed below in Policy 4, Section 5.13.2), these impacts would be coordinated and planned for re-design to maintain adequate circulation near the San Francisco Waterfront. In general, permanent transportation impacts would range from minimal to substantial depending on the importance of the transportation corridor. However, no new or additional transportation corridors would be created under the Proposed Action, therefore it is consistent to the greatest extent practicable with Policy 1.

5.13.2 Policy 4

Transportation projects on the Bay shoreline and bridges over the Bay or certain waterways should include pedestrian and bicycle paths that will either be a part of the Bay Trail or connect the Bay Trail with other regional and community trails. Transportation projects should be designed to maintain and enhance visual and physical access to the Bay and along the Bay shoreline.

The proposed project does not include creating new any new pedestrian or bicycle paths. During project construction, San Francisco waterfront transportation corridors will be impacted by efforts such as raising the elevation of the Emabarcadero. The recommended plan would introduce substantial temporary, and in some cases long-term (one year or more in duration), detours for all reaches and across different modes of transportation, including pedestrian and bicycle paths.

The project would affect major roadways; rail vehicle traffic that utilizes the Embarcadero in Reaches 1, 2 and 3; the bridges for Third Street and Fourth Street over Mission Creek in Reach 3; and the Illinois Street over Islais Creek in Reach 4. The bridges would implement closure structures during the First Action at the Embarcadero near Pier 27, Terry Francois Boulevard near Pier 50, Third Street, Fourth Street, and Illinois Street bridges. Also, the reduction in space for the Embarcadero could also lead to the potential minimization or removal of the Bay Trail, roadway, and rail tracks in Reaches 2 and 3 during the First Action, and Reaches 1 and 3 during the Second Action.

Additionally, the proposed action would introduce closure structures to protect bridges and two roadways at their current elevation. The use of closure structures at several locations along the waterfront would disrupt traffic and expose roadway and bridges to prolonged flooding. When closure structures are in place, seawater, freshwater, or brackish water would flood the existing infrastructure on the bay-side or creek-side of these structures. Bridges and portions of roadways would be submerged for hours up to possibly days until the high-water event has concluded. While permanent relocation of

these transportation corridors for vehicle traffic, transit, or bicycle and pedestrian traffic has not been identified as part of the Recommended Plan, alternative corridors would be identified part of the implementation plan. The corridors on the water-side of the closure structures would be exposed to water that could more rapidly degrade roadways, cement, railroad tracks and supporting transportation components that would shorten the lifespan of these facilities.

The following avoidance, minimization, and mitigation measures will be in place to curtail adverse impacts to pedestrian and bicycle paths, including but not limited to the following:

AMM-TR-1: Prepare Construction Transportation Management Plans (CTMP) for construction of the Project.

A series of CTMPs would be prepared as the actions are planned, in consultation with appropriate agencies (City of San Francisco, SFMTA, WETA, Caltrans, BART, SamTrans, Golden Gate Transit, Muni, Caltrain and HSR) to determine safe access to and movement through the Project area during construction for all transportation uses. Mitigation for traffic and transit disruption will be developed under coordination with the impacted agencies. As the project is further refined and advanced, implementation and responsible agencies would be identified. These plans will be prepared based on the specific location, duration, and work space needed for a given project activity. Plans will include a communication plan for agencies and public. The communication plan would include details for notifying persons adjacent to construction activities, construction duration, mitigations implemented, persons to call for questions or complaints, and should be multilingual.

The CTMP would include project-specific information on expected hours of construction, duration of construction at a given location, and will include measures such as:

- compliance with SFMTA blue book for Regulations for Working in San Francisco Streets
- identification of road and/or lane, bike path, sidewalk closures; bus and transit route or stop modification, if any; bus bridges if needed for rail transit; and identification of any detour routes or temporary infrastructure for different travel modes
- emergency services alternative routes for essential services
- delivery vehicle access to local businesses
- coordination with San Francisco Unified School District and other local schools to ensure safe access to school for students, faculty, and the public
- identify construction truck haul routes for transport of construct materials, waste disposal for heavy construction vehicles
- identify off-street parking for construction related vehicles

- coordination with SFMTA and other City agencies on the development of a robust public outreach plan
- when detours for transit, other vehicles, and/or pedestrians and bicyclists are implemented, require that police officers or parking control officers monitor critical locations along the detour to promote unobstructed travel by vehicular traffic, transit, and people walking and bicycling as needed
- require contractors to provide carpool, bicycle, walk and transit access for construction workers that meets Americans with Disabilities Act (ADA) requirements; and
- the construction contractor(s) shall submit a project corridor segment-specific emergency access response plan as part of compliance with bid specifications. This plan shall include fire department and emergency service access to construction areas and maintain access for emergency services such as fire hydrants.

AMM-TR-2: Include Pedestrian Access in CTMP

- Maintain access on existing sidewalks and trails in the waterfront area. Provide suitable detour routes if construction will obstruct pedestrian routes. Any pedestrian detours would need to comply with Americans with Disabilities Act (ADA). Coordinate with SFMTA on pedestrian access and potential obstructions to pedestrian movement. Coordinate with MTC on Bay Trail access and potential detours. A performance standard would be developed with SFMTA to evaluate whether adequate pedestrian access is provided during construction.

AMM-TR- 3: Include Bicycle Access in CTMP

- Maintain access on existing bike lanes and pathways through the Project area during construction or provide a satisfactory detour for bicycles. Coordinate with SFMTA on bicycling routing and any potential detours. Coordinate with MTC on Bay Trail access and potential detours. A performance standard would be developed with SFMTA to evaluate whether adequate bicycle access provides is provided during construction.

AMM-TR-8: Coordinate with the City of San Francisco and Transit Agencies for roadway access

- This measure could include coordination on elements that increase redundancy in the transportation network, such as expanding transit, bike and pedestrian infrastructure.
- For Alternatives where transit and roadway access has changed substantially, the USACE and the Port will coordinate closely with the City and transit agencies on the need for modifications to the City’s transportation system in response to areas that might otherwise be isolated by construction of the measures. During the PED phase, design engineers will coordinate with transportation agencies

and where minor changes can be made to minimize impacts, these will be incorporated into the design. This could include, for instance, minor modifications to alignment of levees to one side of an existing road so as not to affect traffic once constructed. Prior to implementation of any measures that cause permanent changes or lengthy construction disruptions to the roadway system, coordination will occur to identify modifications to the transit and roadway system and incorporate planning for these measures into the future City and Caltrans transportation network. Examples of areas to be evaluated would include areas such as reconfiguration of the I-280 on/off ramps at Cesar Chavez Street, or to the approaches to the Bay Bridge, as well as changes to circulation patterns with narrowing of the Embarcadero or incorporation of changes to Terry Francois Blvd, or the bridges over Mission and Islais Creeks.

With these considerations and mitigation measures in place, the Proposed Action is consistent to the greatest extent practicable with Policy 4.

5.14 Recreation

Four of the Bay Plan's policies related to recreation are applicable to the Proposed Action: Policies 1, 3, 6 and 7. The Proposed Action's consistency with these policies is discussed in the following sections.

5.14.1 Policy 1

Diverse and accessible water-oriented recreational facilities, such as marinas, launch ramps, beaches, and fishing piers, should be provided to meet the needs of a growing and diversifying population, and should be well distributed around the Bay and improved to accommodate a broad range of water-oriented recreational activities for people of all races, cultures, ages and income levels. Periodic assessments of water-oriented recreational needs that forecast demand into the future and reflect changing recreational preferences should be made to ensure that sufficient, appropriate water-oriented recreational facilities are provided around the Bay. Because there is no practical estimate of the acreage needed on the shoreline of the Bay, waterfront parks should be provided wherever possible.

Existing water-oriented recreation opportunities along the San Francisco Waterfront include cruising, wakeboarding, kayaking, sailing, windsurfing, kiteboarding, Ferry and boating excursions, as well as fishing both from land and boat. South Beach is a full-service marina, and the Pier 52 boat launch is the only public motorized boat launch in San Francisco, providing public access to the Bay.

Available water-based recreation opportunities may experience temporary, localized adverse impacts during construction of the project. Short-term impacts are likely to occur in the immediate vicinity of the project area where construction related equipment, activities, and dust could be visible and audible to observers. During the construction period, recreationists would experience an increase in noise from operation of

equipment that could impact their ability to seek solitude or may reduce the success of wildlife-dependent recreation activities. However, similar recreation opportunities would remain available on adjacent lands and elsewhere in the study area that could be accessed during times of construction. Operations and maintenance activities may generate dust, and visible or audible disturbances that may be unpleasant in the vicinity of the action area. Overall, these would be minimal and be on a much smaller scale than the construction impacts.

While the project does not specifically provide new or additional water-oriented recreational facilities or opportunities, its flood risk and seismic resiliency objectives would likely have long-term ***beneficial*** impacts to recreation and access by protecting recreational infrastructure from erosion, damage, and loss by repeated storm events and RSLC. Accordingly, the Proposed Action is consistent with Policy 1 to the greatest extent practicable.

5.14.2 Policy 3

Recreational facilities, such as waterfront parks, trails, marinas, live-aboard boats, non-motorized small boat access, fishing piers, launching lanes, and beaches, should be encouraged and allowed by the Commission, provided they are located, improved and managed consistent with the following standards:

a. ***General Recreational facilities*** *should:(1) Be well distributed around the shores of the Bay to the extent consistent with the more specific criteria below. Any concentrations of facilities should be as close to major population centers as is feasible; (2) Not pre-empt land or water area needed for other priority uses, but efforts should be made to integrate recreation into such facilities to the extent that they are compatible.; (3) Be feasible from an engineering viewpoint; and (4) Be consistent with the public access policies that address wildlife compatibility and disturbance. In addition: (5) Different types of compatible public and commercial recreation facilities should be clustered to the extent feasible to permit joint use of ancillary facilities and provide a greater range of choices for users. (6) Sites, features or facilities within designated waterfront parks that provide optimal conditions for specific water-oriented recreational uses should be preserved and, where appropriate, enhanced for those uses, consistent with natural and cultural resource preservation. (7) Access to marinas, launch ramps, beaches, fishing piers, and other recreational facilities should be clearly posted with signs and easily available from parking reserved for the public or from public streets or trails. (8) To reduce the human health risk posed by consumption of contaminated fish, projects that create or improve fishing access to the Bay at water-oriented recreational facilities, such as fishing piers, beaches, and marinas, should include signage that informs the public of consumption advisories for the species of Bay fish that have been identified as having potentially unsafe levels of contaminants. (9) Complete segments of the Bay and Ridge Trails where appropriate, consistent with Policy 4-a-6.*

b. ***Marinas.*** *(1) Marinas should be allowed at any suitable site on the Bay. Unsuitable sites are those that tend to fill up rapidly with sediment and require frequent dredging; have insufficient upland; contain valuable tidal marsh or tidal flat, or important subtidal areas; or are needed for other water-oriented priority uses. At suitable sites, the Commission should encourage new marinas, particularly those that result in the creation of new open water through the excavation of areas not part of the Bay and not containing valuable wetlands. (2) Fill should be permitted for marina facilities that must be in or over the Bay, such as breakwaters, shoreline protection, boat berths, ramps, launching facilities, pumpout and fuel docks, and short-term unloading areas. Fill for marina support facilities may be permitted at sites with difficult land configurations provided that the fill in the Bay is the minimum necessary and any unavoidable loss of Bay habitat, surface area, or volume is offset to the maximum amount feasible, preferably at or near the site. (3) No new marina or expansion of any existing marina should be approved unless water quality and circulation will be adequately protected and, if possible, improved, and an adequate number of vessel sewage pumpout facilities that are convenient in location and time of operation to recreational boat users should be provided free of charge or at a reasonable fee, as well as receptacles to dispose of waste oil. (4) In addition, marinas should include public amenities, such as viewing areas, restrooms, public mooring docks or floats and moorages for transient recreational boaters, non-motorized small boat launching facilities, public parking; substantial physical and visual access; and maintenance for all facilities.*

c. ***Live-aboard boats.*** *Live-aboard boats should be allowed only in marinas and only if: (1) The number would not exceed ten percent of the total authorized boat berths unless the applicant can demonstrate clearly that a greater number of live-aboard boats is necessary to provide security or other use incidental to the marina use; (2) The boats would promote and further the recreational boating use of the marina (for example, providing a degree of security), and are located within the marina consistent with such purpose; (3) The marina would provide, on land, sufficient and conveniently located restrooms, showers, garbage disposal facilities, and parking adequate to serve live-aboard boat occupants and guests; (4) The marina would provide and maintain an adequate number of vessel sewage pumpout facilities in locations that are convenient in location and time of operation to all boats in the marina, particularly live-aboard boats, and would provide the service free of charge or at a reasonable fee; and (5) There would be adequate tidal circulation in the marina to mix, dilute, and carry away any possible wastewater discharge. Live-aboard boats moored in a marina on July 1, 1985, but unauthorized by the Commission, should be allowed to remain in the marina provided the tests of (2), (3), (4), and (5) above are met. Where existing live-aboard boats in a marina exceed ten percent of the authorized berths, or a greater number is demonstrated to be clearly necessary to provide security or other use incidental to the marina use, no new live-aboard boats should be*

authorized until the number is reduced below that number and then only if the project is in conformance with tests (1), (2), (3), (4), and (5) above.

d. ***Launching Lanes.*** *(1) Launching lanes should be placed where wind and water conditions would be most favorable for smaller boats. (2) Some launching lanes should be located near prime fishing areas and others near calm, clear water suitable for waterskiing. (3) Additional launching facilities should be located around the Bay shoreline, especially where there are few existing facilities. These facilities should be available free or at moderate cost. Launching facilities should include adequate car and trailer parking, restrooms, and public access. (4) In marinas, launching facilities should be encouraged where there is adequate upland to provide needed support facilities. (5) New ramps and improvements to existing ramps should provide for use by a wide variety of boats, including power boats and non-motorized small boats. (6) Fill for ramps into the water, docks, and similar facilities should be permitted. Other fill should not be permitted.*

e. ***Non-Motorized Small Boats.*** *(1) Where practicable, access facilities for non-motorized small boats should be incorporated into waterfront parks, marinas, launching ramps and beaches, especially near popular waterfront destinations. (2) Access points should be located, improved and managed to avoid significant adverse affects on wildlife and their habitats, should not interfere with commercial navigation, or security and exclusion zones or pose a danger to recreational boaters from commercial shipping operations, and should provide for diverse, water-accessible overnight accommodations, including camping, where acceptable to park operators. (3) Sufficient, convenient parking that accommodates expected use should be provided at sites improved for launching non-motorized small boats. Where feasible, overnight parking should be provided. (4) Site improvements, such as landing and launching facilities, restrooms, rigging areas, equipment storage and concessions, and educational programs that address navigational safety, security, and wildlife compatibility and disturbance should be provided, consistent with use of the site. (5) Facilities for boating organizations that provide training and stewardship, operate concessions, provide storage or boathouses should be allowed in recreational facilities where appropriate. (6) Design standards for non-motorized small boat launching access should be developed to guide the improvement of these facilities. Launching facilities should be accessible and designed to ensure that boaters can easily launch their watercraft. Facilities should be durable to minimize maintenance and replacement cost.*

f. ***Fishing Piers.*** *Fishing piers should not block navigation channels, nor interfere with normal tidal flow.*

g. ***Beaches.*** *Sandy beaches should be preserved, enhanced, or restored for recreational use, such as swimming, consistent with wildlife protection. New beaches should be permitted if the site conditions are suitable for sustaining a beach without excessive beach nourishment.*

h. ***Water-oriented commercial-recreation.*** *Water-oriented commercial recreational establishments, such as restaurants, specialty shops, private boatels, recreational equipment concessions, and amusements, should be encouraged in urban areas adjacent to the Bay. Public docks, floats or moorages for visiting boaters should be encouraged at these establishments where adequate shoreline facilities can be provided. Effort should be made to link commercial-recreation centers and waterfront parks by ferry or water taxi.*

As discussed in recreation Policy 1 above, construction and ongoing operations and maintenance of project features may have temporary, localized impacts to recreation opportunities, both water- and land-oriented. No feature is proposed to be constructed over or through a large park (e.g., Mission Bay Park System, Sue Bierman Park) which occupy several acres in the study area. However, while the project does not specifically provide new or additional recreational facilities or opportunities, its flood risk and seismic resiliency objectives would likely have long-term ***beneficial*** impacts to recreation by protecting recreation-related infrastructure including waterfront parks and trails from erosion, damage, and loss by repeated storm events and RSLC. Therefore, the Proposed Action is consistent to the greatest extent practicable with Policy 3.

5.14.3 Policy 6

To enhance the appearance of shoreline areas, and to permit maximum public use of the shores and waters of the Bay, flood control projects should be carefully designed and landscaped and, whenever possible, should provide for recreational uses of channels and banks.

The project has been carefully designed and utilizes EWN solutions where practicable. EWN features include marsh and coarse beach restoration, rocky intertidal bluffs, living seawalls, planted levees with EWN features, and sheet pile walls with EWN features. These features would functionally work to provide flood risk and RSLC resiliency while also providing visual appeal and potential increased recreational uses. Other project components such as the curb wall, T-wall, and seawalls would not improve visual appeal, but would not take away from the appearance of shoreline areas or availability of recreational uses of channels and banks. Thus, the Proposed Action is consistent to the greatest extent practicable with Policy 6.

5.14.4 Policy 7

Because of the need to increase the recreational opportunities available to Bay Area residents, small amounts of Bay fill may be allowed for waterfront parks and recreational areas that provide substantial public benefits and that cannot be developed without some filling.

Approximately 9 acres of bay fill are anticipated under the proposed project. During project design, the introduction of new fill was minimized to the greatest extent practicable while still achieving project goals and objectives. The Ferry Building and

bulkhead buildings would be raised in place following construction of new pile supported foundations (wharves), resulting in 4.6 acres of bay fill. The Ferry Building provides numerous diverse recreation opportunities to the public, including Ferry passage, shopping, a farmer's market, walking, and general socializing. While increasing the Ferry Building's resiliency against flooding and RSLC does not create new recreational opportunities, it ensures the building and its amenities' longevity for public access and enjoyment.

Construction at Rincon Park would have approximately 0.5 acres of bay fill to accommodate some utility and transportation needs; however, an additional 3.5 acres of bay fill is needed to construct the coarse beach (EWN feature) that will be placed over the utility/transportation bay fill and use ecological processes to protect the site rather than using hardened structures such as rip rap. Over the long-term, adding a coarse beach would be a net gain in a different habitat type (beach or intertidal habitat) in this reach, benefitting nearshore ecology. This new beach would provide visual, ecosystem, and recreation benefits to the public. Therefore, the Proposed Action is consistent with Policy 7 to the greatest extent practicable.

5.15 Public Access

Four of the Bay Plan's policies related to public access are applicable to the Proposed Action: Policies 1, 2, 3, and 6. The Proposed Action's consistency with these policies is discussed in the following sections.

5.15.1 Policy 1

A proposed fill project should increase public access to the Bay to the maximum extent feasible, in accordance with the policies for Public Access to the Bay.

Approximately 9 acres of bay fill will be utilized to raise the Ferry Building and adjacent bulkhead buildings (4.6 acres), accommodate utilities and transportation needs at Rincon Park (0.5 acres), and provide for coarse beach construction at Rincon Park over the utility/transportation bay fill at Rincon Park (3.5 acres) as discussed above in recreation Policy 7. The fill proposed at the Ferry Building does not necessarily increase public access to the Bay; however, by making the Ferry Building and surrounding areas more resilient to flood risk and RSLC, it protects public access to the building by protecting the building's infrastructure itself, from erosion, damage, and loss by repeated storm events and RSLC. Bay fill at Rincon Park is necessary for utility and transportation infrastructure, ensuring amenities are available for public access to and use of Bay facilities. Additionally, the fill required to create coarse beach habitat above the Rincon Park utility/transportation fill would allow for public enjoyment of the new habitat and access to the Bay itself. Therefore, the Proposed Action is consistent to the maximum extent practicable with Policy 1.

5.15.2 Policy 2

In addition to the public access to the Bay provided by waterfront parks, beaches, marinas, and fishing piers, maximum feasible access to and along the waterfront and on any permitted fills should be provided in and through every new development in the Bay or on the shoreline, whether it be for housing, industry, port, airport, public facility, wildlife area, or other use, except in cases where public access would be clearly inconsistent with the project because of public safety considerations or significant use conflicts, including unavoidable, significant adverse effects on Bay natural resources. In these cases, in lieu access at another location preferably near the project should be provided. If in lieu public access is required and cannot be provided near the project site, the required access should be located preferably near identified vulnerable or disadvantaged communities lacking well-maintained and convenient public access in order to foster more equitable public access around the Bay Area.

While no new public access infrastructure is proposed under the project, the Proposed Action bolsters existing public access infrastructure along the Bay as discussed in Policy 1 above. The flood risk and seismic resiliency features of the Proposed Action would likely have long-term ***beneficial*** impacts to public access by protecting related infrastructure including roadways and pedestrian trails from erosion, damage, and loss by repeated storm events and RSLC.

Public access to public lands would be maintained during construction with temporary access routes. Detours around construction areas would be included where appropriate. Recreation would resume in a manner like the existing condition after construction is complete. During O&M activities, access should not be readily, but it is likely that detours may be set where appropriate or restricted access during activities may be instilled for public safety. Once maintenance is complete, recreational activities would resume normally. Construction Transportation Management Plans will be prepare to mitigate impacts during construction, including to public access infrastructure such as pedestrian trails. See mitigation measures under Transportation Policy 4 for more information. For these reasons, the Proposed Action is consistent with Policy 2 to the maximum extent practicable.

5.15.3 Policy 3

Public access to some natural areas should be provided to permit study and enjoyment of these areas. However, some wildlife are sensitive to human intrusion. For this reason, projects in such areas should be carefully evaluated in consultation with appropriate agencies to determine the appropriate location and type of access to be provided.

Natural areas proposed under the project are EWN features including marsh and coarse beach restoration, rocky intertidal bluffs, living seawalls, planted levees with EWN features, and sheet pile walls with EWN features. These features are described in 4.2 Measure Descriptions. The USACE has and will continue to coordinate with resource

agencies including USFWS, NMFS, and BCDC, among others, to ensure that the appropriate location and type of access is provided to these areas so as to balance public usage with environmental protection. Therefore, the Proposed Action is consistent with Policy 3 to the maximum extent practicable.

5.15.4 Policy 6

Public access should be sited, designed, managed and maintained to avoid significant adverse impacts from sea level rise and shoreline flooding.

The intent of the Proposed Action aligns directly with Policy 6. The flood risk RSLC components of the project would protect public access infrastructure including roadways and pedestrian trails from erosion, damage, and loss by repeated storm events and RSLC. This will be achieved by elevating the shoreline and some structures; relocating or removing structures; constructing a curb wall; constructing a seawall at the Bulkhead, Ferry Building, and Rincon Park areas; constructing a T-wall; elevating and rebuilding wharf; constructing ground improvements; and utilizing EWN solutions, as described in Section 4.2 Measure Descriptions above. All of these measures are collectively designed and would be managed and maintained to reduce adverse impacts to the Bay area, including public access, that may result from sea level rise and shoreline flooding, thereby complying with Policy 6 to the maximum extent practicable.

5.16 Appearance, Design, and Scenic Views

Three of the Bay Plan's appearance, design, and scenic view policies are applicable to the Proposed Action: Policies 1, 2, and 3. The Proposed Action's consistency with these policies is discussed in the following sections.

5.16.1 Policy 1

To enhance the visual quality of development around the Bay and to take maximum advantage of the attractive setting it provides, the shores of the Bay should be developed in accordance with the Public Access Design Guidelines.

Effort was made to minimize unnecessary and unnatural features and designs for project components along the Bay. The project itself is a large scale effort to preserve views of the Bay and shoreline by protecting it from erosion, damage, and loss by repeated storm events and RSLC. As addressed in the response to Public Access Policy 1 in Section 5.15.1, the Proposed Action includes a bay fill measure, however that fill is not for the purpose of creating new public access or new public access infrastructure. Instead, it is to make existing infrastructure and its uses more resilient to flood risks, and to create NNBF features to benefit aquatic ecosystems while providing flood risk management benefits, with the ancillary benefit of improving visual aesthetics along the Bay. As more detailed designs for shoreline features are formulated during PED, the visual appeal of bayside features will comply with the BCDC's Public Access Design Guidelines for the San Francisco Bay to the greatest extent possible, such that

aesthetics choices are compliant with USACE policy and do not detract from flood risk management function. For these reasons, the Proposed Action is consistent to the greatest extent practicable with Policy 1.

5.16.2 Policy 2

All bayfront development should be designed to enhance the pleasure of the user or viewer of the Bay. Maximum efforts should be made to provide, enhance, or preserve views of the Bay and shoreline, especially from public areas, from the Bay itself, and from the opposite shore. To this end, planning of waterfront development should include participation by professionals who are knowledgeable of the Commission's concerns, such as landscape architects, urban designers, or architects, working in conjunction with engineers and professionals in other fields.

Effort was made to minimize unnecessary and unnatural features and designs for project components along the Bay. The project itself is a large scale effort to preserve views of the Bay and shoreline by protecting it from erosion, damage, and loss by repeated storm events and RSLC. Not only are existing infrastructure including historic buildings, parks, and public access points being bolstered, but EWN features have been integrated as possible. EWN features are described in Section 4.2 and include planting levees with native vegetation and covering utility lines with the creation of new coarse beach habitat instead of utilizing rip rap. The utilization of EWN features instead of more traditional engineering solutions provides the same flooding and RSLC protections while also improving the visual appeal of the infrastructure, in line with Policy 2.

Professional's knowledgeable of the Commission's concerns including planners, anthropologists, urban designers partook in the development of the Proposed Action. Environmental engineers and biologists knowledgeable of EWN also worked to implement these solutions over more traditional, less aesthetically pleasing designs where possible.

The construction-related activities would have temporary visual impacts intrusive to the surrounding viewscape during construction (multi-year). Long-term presence of the elevated structures and new features (naturalized or embankment shorelines and pump stations) would change the viewscape; however, design elements of each feature incorporate the use of materials and architecture that blends with the surrounding landscape and with what was historically present, where appropriate (e.g., historic districts, along the Embarcadero). Some coastal views may be impacted or diminished but would still be available from other vantage points along the waterfront. With the design elements, the impacts are to be less than significant over the long-term. Therefore, the proposed action is consistent with Policy 2 to the maximum extent practicable.

5.16.3 Policy 3

In some areas, a small amount of fill may be allowed if the fill is necessary—and is the minimum absolutely required—to develop the project in accordance with the Commission's design recommendations.

As discussed in Recreation Policy 7 above, approximately 9 acres of fill are required to construct the Proposed Action. During project design, the introduction of new fill was minimized to the greatest extent practicable while still achieving project goals and objectives. The Ferry Building and bulkhead buildings would be raised in place following construction of new pile supported foundations (wharves), resulting in 4.6 acres of bay fill. The Ferry Building is an iconic, historic landmark with great cultural significance and aesthetic value. Existing fill will be removed and replaced with new fill to elevate the building and increase its resilience against RSLC and flooding, ensuring the aesthetic value it provides remains.

Construction at Rincon Park would have approximately 0.5 acres of bay fill to accommodate some utility and transportation needs; however, an additional 3.5 acres of bay fill is needed to construct the coarse beach (EWN feature) that will be placed over the utility/transportation bay fill and use ecological processes to protect the site rather than using hardened structures such as rip rap. Over the long-term, adding a coarse beach would be a net gain in a different habitat type (beach or intertidal habitat) in this reach, benefitting nearshore ecology. The additional 3.5 acres for the creation of a new beach instead of utilizing rip rap would greatly improve Rincon Park's aesthetic value by providing a setting natural to the area that is visually appealing to onlookers. Therefore, the Proposed Action is consistent with Policy 3 to the greatest extent practicable.

5.17 Managed Wetlands

There are two wetlands and associated water resources in the study area – Pier 94 wetlands and Heron's Head Park. However, neither of these wetlands meet BCDC's definition of managed wetlands, nor do the related policies apply to the project. The project is consistent to the maximum extent practicable with the Bay Plan's policies related to managed wetlands.

5.18 Other Uses of the Bay and Shoreline

The Proposed Action would not involve any of the other uses of the Bay and shoreline described in the Bay Plan; therefore, such policies are not applicable. The project is consistent to the maximum extent practicable with the Bay Plan's policies related to other uses of the Bay and shoreline.

5.19 Fills in Accord with the Bay Plan

The Bay Plan's fill in accord with the Bay Plan Policy 1 is applicable to the Proposed Action. The Proposed Action's consistency with this policy is discussed in the following section.

5.19.1 Policy 1

Fills in accord with the Bay Plan. A proposed project should be approved if the filling is the minimum necessary to achieve its purpose, and if it meets one of the following three conditions:

a. *The filling is in accord with the Bay Plan policies as to the Bay-related purposes for which filling may be needed (i.e., ports, water-related industry, and water-related recreation) and is shown on the Bay Plan maps as likely to be needed; or*
b. *The filling is in accord with Bay Plan policies as to purposes for which some fill may be needed if there is no other alternative (i.e., airports, roads, and utility routes); or*
c. *The filling is in accord with the Bay Plan policies as to minor fills for improving shoreline appearance or public access.*

Bay fill is recommended under the Proposed Action at the Ferry Building and bulkhead buildings to largely replace existing fill, Rincon Park to accommodate utility and transportation needs, and Rincon Park to construct a coarse beach (EWN feature) atop the utility/transportation fill. The quantity of fill is the minimum necessary to achieve its purpose. Bay fill for the first two features is in accordance with stipulation (b) of this policy as there are no other alternatives to fulfill the flood and RSLC resiliency infrastructure needs in these locations. Fill for the third feature is in accordance with stipulation (c) of this policy as it improves shoreline appearance by creating new beach habitat instead of utilizing a hard, unnatural material such as riprap. For these reasons, the Proposed Action is consistent with Policy 1 to the maximum extent practicable.

5.20 Mitigation

Nine of the Bay Plan's policies related to mitigation are applicable to the Proposed Action: Policies 1, 2, 3, 5, 6, 7, 8, 9 and 10. The Proposed Action's consistency with these policies is discussed in the following sections.

5.20.1 Policy 1

Projects should be designed to avoid adverse environmental impacts to Bay natural resources such as to water surface area, volume, or circulation and to plants, fish, other aquatic organisms and wildlife habitat, subtidal areas, or tidal marshes or tidal flats. Whenever adverse impacts cannot be avoided, they should be minimized to the greatest extent practicable. Finally, measures to compensate for unavoidable adverse impacts to the natural resources of the Bay should be required. Mitigation is not a substitute for meeting the other requirements of the McAteer-Petris Act.

Water surface area, volume, and circulation

Impacts to Bay natural resources resulting from the Proposed Action have been avoided and minimized to the greatest extent practicable. Project features were sited on the

landward side of the Bay on previously disturbed, impervious surfaces as much as possible to avoid impacts to Bay natural resources. See Attachment 1 for more details on avoidance and minimization measures

Despite these efforts, unavoidable impacts to subtidal habitat and Bay aquatic resources are expected as a result of measures requiring bay fill. As discussed in Section 5.3.2 Water Surface Area and Volume Policy 2, temporary, localized impacts during construction as well as long-term changes to water circulation will result from the implementation of the Proposed Action. Localized, temporary impacts from the in-water measures such as bulkhead walls/seawalls, wharfs, and bay fill are also anticipated to adversely impact currents due to increased velocities at the toe of the structural measures, which may change wave energy in the bay. Wave energies could increase at the hardened structures which may increase tidal current velocities and lead to temporary indirect impacts from sedimentation or scour. The waterfront is highly urbanized at present; however, some new hardened structures may be introduced to protect against flood risks. Temporary impacts during construction include physical seabed disturbance that increase current velocities such as foundation installation, excavation, and fill activities. Further modeling is required to truly understand the long-term effects of project features, particularly fill, on water circulation, and this will be completed during PED.

Permanent impacts from bay fill will detract from total Bay volume as discussed in Section 5.3.1 Water Surface Area and Volume Policy 1. However, the removal and replacement of existing bay fill and removal of piles under the mitigation plan will result in a net positive impact on subtidal habitat as discussed below.

Upland resources, including plants and wildlife habitat

Impacts to upland resources have also been avoided and minimized to the greatest extent practicable, however some impacts, particularly during construction, were unavoidable. During construction, vegetation removal would be required for construction equipment mobilization, staging areas, and haul routes. Where possible, existing disturbed areas would be used to avoid additional vegetation removal and surface disturbing activities. Where not possible, existing vegetation would be removed and disposed of off-site. The area would be restored to pre-construction conditions once use of the area is complete. Similar vegetation removal practices would also be required in and around areas where excavation, grading, or constructed structures are being implemented. However, the extent of vegetation restoration would be dependent on whether the site has been converted to an impervious surface or not.

Adverse effects may occur to vegetation outside of the proposed project area during construction from fugitive dust emissions produced by construction machinery and worker traffic along unpaved roads/routes. Dust emissions could impede photosynthesis by reducing light penetration into plant leaves and increase the risk of growth of plant fungal disease (Farmer 1993). Impacts from dust generated during construction activities would be short-term and controlled by dust suppression measures (e.g., water

spraying) as required by regulations. After construction, local off-site vegetation is expected to recover with no long-term losses.

Use of construction equipment and surface disturbance could contribute to the establishment and spread of non-native plants by transporting species between work areas. Aggressive non-native species could become established if ground disturbance during construction is extensive and lengthy. These potential impacts can be reduced through typical construction BMPs such as minimizing soil disturbances, cleaning equipment of plants prior to moving between project areas, stabilizing disturbed soils as soon as possible, and using certified weed-free seed for revegetation.

Construction activities are anticipated to adversely impact resident, migrant, or incidental wildlife within or near the project area. Impacts include loss of habitat through removal or alteration of vegetation, habitat fragmentation, and avoidance (e.g., Jackson and Griffin 2000). Vegetation would be removed within the construction zone which would result in temporary or permanent loss, or alteration of available habitat. Mobile wildlife would be capable of relocating to adjacent suitable habitats, whereby such displacement may cause temporary declines in local populations as individuals move to neighboring territories. This dislocation may induce competition between displaced individuals and established populations of the same species, or related species with similar habitat and food requirements, for limited resources. In a highly urbanized environment, like the study area, resources are already scarce and likely stressed, thus may not be capable of supporting a higher population density, which could have cascading impacts leading to further displacement or mortality of wildlife. In general, wildlife would be expected to return and resume use of disturbed areas after construction ceases and habitat recovers or is restored, except where long-term impacts are expected as described in each of the Action Alternative sections. Sessile species, species with small home ranges, or those with specialized habitat requirements, may not be as capable of seeking suitable habitat outside of the construction zone and would likely result in mortality of individuals.

Short-term, localized, adverse effects to wildlife are expected to occur during construction from noise, light pollution, and general physical disturbance of the environment. Wildlife relies on meaningful sounds for communicating, navigating, reproduction, avoiding danger, and foraging. The level of impact from noise on wildlife depends on decibel levels, durations, the physical characteristics of the environment, and the species threshold to disturbance (Sordello et al. 2020). These impacts are referred to as noise pollution, which can harm the health, reproduction, survivorship, habitation, distribution, abundance, and biodiversity of wildlife. Noise pollution can also lead to changes in behavior, including avoidance and disturbance of normal patterns. For example, noise pollution can lead to intrusion-induced behavioral changes among birds such as nest abandonment and decreased nest attentiveness, which have led to species declines (Knight and Gutzwiller 1995). Overall, impacts from noise would be localized to the general vicinity of the construction zone and limited to the duration of the construction activity. In most instances, work would not be concentrated in any one area in exceedance of one year, limiting impacts to breeding and migration seasonally. This reduces the likelihood of long-term population declines resulting from construction activities. Any wildlife displaced by noise would likely return to remaining habitat once

construction is complete. The study area is highly urbanized, thus anthropogenic noise is omnipresent, stemming from traffic and other industrial and commercial activities on a regular basis. Noise generated from construction activities would be temporary and localized but would be expected to increase the ambient city noise.

Direct injury and/or mortality of birds, small mammals, reptiles, amphibians, and invertebrates may occur during construction through inadvertent destruction of dens, nests, cryptic organisms, or trampling of slower moving or sessile species by heavy equipment or personal vehicles. Mobile species are expected to be capable of avoiding injury or death while crossing haul roads and by avoiding the construction area.

The severeness and duration of these impacts to wildlife is dependent on the final design of each measure, type of equipment used, length of construction activities, and mitigation, if required. Construction-related impacts are expected to be localized and cease once construction completes, thereby are not anticipated to have population-level effects on any species.

Aquatic resources, including plants, fish, other aquatic organisms, and wildlife habitat

Impacts to aquatic resources have also been avoided and minimized to the greatest extent practicable, however some impacts, particularly during construction, were unavoidable. Short-term direct impacts from construction-related activities are anticipated to adversely affect aquatic habitat and wildlife, whether they occur as a resident, migrant, or incidental, within or near the project area. Impacts include habitat removal and/or fragmentation and habitat avoidance due to increased noise, dust generation, vibrations, debris, accidental discharge, and overall lower quality habitat. Impacts to water quality are described above in Section 5.2.

Temporary in-water impacts include increased turbidity during construction activities and resuspension of sediments into the water column during pile driving, placement of concrete blocks, dewatering, and excavation and fill activities. Temporary and localized impacts to aquatic habitats from vessel anchoring and dewatering activities may occur but are expected to return to pre-existing conditions following active construction. Spills or leaks of fuels, lubricants, and coolant from construction equipment could significantly impact water resources as described in the Water Quality section. Additionally, sheetpiles would be treated with corrosion-resistant coating prior to installation, which may require application by hand as necessary to touch-up areas potentially damaged during the installation process. These activities could pose a temporary risk of exposing resident aquatic organisms to toxic contaminants and non-edible forage. A site-specific spill prevention control and countermeasure plan (SPCC) would be developed and implemented to prevent spills and minimize the potential impacts for any inadvertent spills. With implementation of the SPCC and BMPs, impacts from spills or leaks are anticipated to be minor. Water quality is anticipated to return to baseline conditions after construction activities are completed.

Impacts to fish during construction are the same as those described for similar EFH-designated species (demersal and pelagic) in the Special Status Species section and

are primarily associated with in-water measures such as wharfs, bulkhead/seawalls, sheetpile walls, and NNBFs (e.g., marsh enhancement/creation, ecological armoring). Temporary direct impacts include altered habitats associated with noise, vibration, sediment suspension, physical disturbance, and impaired water quality (e.g., lower dissolved oxygen). Permanent adverse impacts include habitat loss through measures such as bulkhead wall construction and wharf extensions. Fish are expected to actively avoid most in-water work areas, opting for another appropriate habitat nearby. This avoidance behavior would occur only in those areas where construction is underway. Fish species are expected to return to the area when construction is completed.

Losses of slow moving and less mobile species (e.g., aquatic invertebrates, benthic species) are anticipated within the construction footprint due to burial of individuals and/or increased turbidity. Suspension/filter feeding organisms could be impacted due to clogging of gills and feeding mechanisms, which would cause death or reduce growth and reproduction. Visual predators would have a reduced success rate at catching prey due to lower visibility levels. Following construction activities, water quality is expected to return to pre-construction conditions.

In general, most fish, wildlife, and benthic species would become habituated to the work and adapt to the habitat changes; however, species with low tolerance are anticipated to be displaced for the duration of activities. The severity of the impacts is dependent on the final design of features, type of equipment used, and duration of construction activities. Once construction is complete, it is anticipated that construction-related impacts to aquatic organisms would cease. These adverse impacts would be minimized and controlled by implementing the best available practical techniques and BMPs during construction.

Long-term beneficial impacts to aquatic resources are expected with NNBFs such as enhanced or created wetlands, ecological armoring, and vertical shorelines/living seawalls, as they would result in improved habitat conditions and an expansion of available habitat for aquatic species, including special status fish. Wetlands improve water quality, flood control, and ecological benefits to aquatic resources. The NNBFs would allow for improved diversity and provide refuge for aquatic plant and animal species to promote higher abundances than would likely be supported in their absence. Wetlands, ecological armoring, and vertical shorelines would provide surface area to colonize, which establishes a more sufficient food supply to support primary (i.e., herbivores) and secondary (i.e., carnivores) consumers. Intertidal marsh and marsh edge would provide increased foraging opportunities for shorebirds and wading birds using the shoreline habitats. Nesting habitat would be improved as the enhanced/created marsh would provide more desirable nesting habitat in an area that would otherwise be inhabitable for nesting under FWOP conditions. The increase in vegetative structure would also provide shelter for prey species to evade predators.

Subtidal areas, tidal marshes, tidal flats

Impacts to subtidal areas, tidal marshes, and tidal flats were avoided and minimized to the greatest extent possible. Temporary, localized impacts during construction and permanent impacts as a result of habitat conversion will result from the use of bay fill under the Proposed Action as discussed under the subtidal habitat policies (Section

5.8). However, the 9.0 acres of bay fill that will convert existing subtidal habitat will be fully mitigated. The removal and replacement of existing bay fill as part of some Proposed Action features and the removal of piers and/or piles under the proposed mitigation plan would result in a net positive impact on subtidal habitat as discussed below.

No unavoidable adverse impacts to tidal marshes and tidal flat and marsh panne habitats are expected as a result of the Proposed Action, as described in Section 5.4 Tidal Marshes and Tidal Flats. Some features may abut existing habitat and are not expected to result in any impacts, but site-specific habitat surveys should be completed during PED to confirm that this assumption remains valid. The integration of new EWN features may provide habitat enhancements and result in a net increase in the quality and quantity of tidal marsh habitats.

Mitigation

While bay fill quantity was minimized to the greatest extent practicable, it was still deemed required to meet project objectives, resulting in unavoidable adverse impacts to subtidal habitat due to bay fill. A compensatory habitat mitigation plan for the unavoidable impacts associated with the Proposed Action has been prepared as part of the study's documentation. The document details the work performed, including coordination, plan formulation, and environmental compliance to develop the compensatory mitigation plan. Further information on the mitigation plan is provided in response to mitigation policies in the sections below. No other resources would experience significant adverse impacts that would require mitigation under the Proposed Action.

Because the Proposed Action is designed to avoid and minimize adverse environmental impacts to Bay natural resources, and where adverse impacts cannot be avoided or minimized compensatory mitigation will be performed, the Proposed Action is therefore consistent to the maximum extent practicable with Policy 1.

5.20.2 Policy 2

Individual compensatory mitigation projects should be sited and designed within a Baywide ecological context, as close to the impact site as practicable, to: (1) compensate for the adverse impacts; (2) ensure a high likelihood of long-term ecological success; and (3) support the improved health of the Bay ecological system. Determination of the suitability of proposed mitigation locations should be guided in part by the information provided in the Baylands Ecosystem Habitat Goals report.

The proposed compensatory mitigation plan involves removing 9.1 acres of abandoned, derelict, or unnecessary piers from the San Francisco waterfront between Aquatic Park and Heron's Head, encompassing shoreline off the entirety of the project's footprint. The Baylands Ecosystem Habitat Goals report, among other local plans and reports, was consulted to aid in mitigation measure identification. The Waterfront Plan and Design & Access Element includes policies for removal of a portion of the Pier 23 shed and Pier

64. Other piers identified in the Waterfront Plan have already been completed. One additional pier not identified in the Waterfront Plan but that the Port has expressed interest in removing is just west of the 4th Street Bridge in Mission Creek. This location would result in 2.0 acres (999,998 DSAY) of pier removal benefits. These known and available locations provide a total of 5.5 acres (2,749,995 DSAY), which would require an additional 3.6 acres (1,799,996 DSAY) of pier removal options along the waterfront or outside the study area will need to be investigated during the design phase to implement this alternative.

The locations identified and to be identified in PED would be sited as close to the impact sites (locations of bay fill) as possible off the San Francsico coast. The quantity of piers and/or pilings that would be removed would fully compensate for the 9.0 acres of subtidal habitat lost to bay fill. Pile removal is considered a restoration measure and entails removing abandoned and derelict piles from the waterfront, with a primary focus on known locations with creosote piles. Pier removal is considered a restoration measure and entails removing abandoned, derelict, or unused piers and overwater structures to include removal of all decking, pilings, and other materials associated with the structure. These measures meet the objective of restoring subtidal habitat and support the improved health of the Bay ecological system by:

- Reducing shading of the bottom and water column;
- Reducing restrictions to flow and sediment movement ;
- Restoring, re-creating, or realigning intertidal mudflats, sand flats, rock, shellfish, and macroalgal beds, and soft bottoms; and,
- Reducing toxic effects of creosote and other contaminants.

The likelihood of long-term ecological success is high because the benefit is nearly immediate and does not require extensive monitoring and adaptive management actions like mitigation for other habitat types would. After removal of the piles and/or piers, the open water area and bay bottom should be monitored to ensure that no fill or debris remains at the removal site. Additionally, the site should be monitored to confirm that any holes in the bay bottom have been adequately filled in so that scouring or deep holes do not form or remain after construction is complete. Monitoring for these success criteria and implementation of adaptive management strategies, if needed, is expected to be completed in two years, after which the mitigation is anticipated to be deemed successful. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 2.

5.20.3 Policy 3

For major and appropriate minor projects that require compensatory mitigation, communities surrounding both the project and the compensatory mitigation site should be meaningfully involved in an equitable and culturally-relevant manner. In particular, vulnerable, disadvantaged, and/or underrepresented communities should be involved.

This should include consultation with the community in the identification and prioritization of potential projects, and in the monitoring and programming of a mitigation site. If such previous outreach and engagement did not occur, further outreach and engagement should be conducted prior to Commission action.

There has been extensive outreach to the local community related to the project as discussed in Section 5.9.1 above. Since 2017, the Port, through the Waterfront Resilience Program, has engaged with tens of thousands of people, including engaging community members at local events and Port-hosted meetings and walking tours, businesses and merchants, advisory committees, non-profit groups, youth, and others. The community engagement and outreach strategies are intended to respond to the needs and priorities of San Francisco's waterfront communities and targeted community groups, including youth, seniors, and communities historically excluded from planning processes.

The Draft Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS) (including the draft mitigation plan) was publicly released on January 26, 2024, starting a 60-day public comment period running from January 26 through March 29, 2024. During this period, the Port and USACE performed robust public outreach and engagement activities to gather public feedback on the Draft plan. Engagement and outreach included four in-person community workshops (NEPA meetings), two in-language community workshops, four walking tours, two public webinars, presentations to community-based organizations (CBOs) across the city, and dozens of briefings to community advisory committees (CACs), Port tenants, and City agency leadership. USACE received 154 public comments on the Draft IFR/EIS that were thoroughly evaluated and applied to the study as appropriate.

Engagement strategies to solicit feedback on the project, including mitigation program, have been inclusive, culturally nuanced, and available in multiple languages, allowing communities, especially those who do not or have never participated in the public process, to participate and provide their input. Therefore, the Proposed Action is consistent with Policy 3 to the maximum extent practicable.

5.20.4 Policy 5

The amount and type of compensatory mitigation should be determined for each mitigation project based on a clearly identified rationale that includes an analysis of: the probability of success of the mitigation project; the expected time delay between the impact and the functioning of the mitigation site; and the type and quality of the ecological functions of the proposed mitigation site as compared to the impacted site.

A compensatory habitat mitigation plan for the unavoidable impacts associated with the Proposed Action has been prepared as part of the study's documentation. The document details the work performed, including coordination, plan formulation, and environmental compliance to develop the compensatory mitigation plan. It is important to note that the recommended mitigation plan will be further refined during the design phase, and it is fully anticipated that the mitigation site size, cost, and potentially even

site location could be modified during subsequent planning phases, especially if these sites are unavailable in 10 years when construction would begin. Therefore, the level of detail that is provided in the mitigation plan is higher level than typical USACE mitigation plans. The intent of the plan is to provide a worst-case scenario cost estimate to confirm that sufficient mitigation exists in the area to offset the worst-case scenario losses, and document the most likely avenues for mitigation, monitoring, and adaptive management.

The Proposed Action would result in a total net loss of 9.0 acres of subtidal habitat. The impact is the result of fill material being placed within the open water column to allow for construction of a new seawall at the Ferry Plaza (Pier 0), Rincon Park, and Pier 96. Based upon the type of habitat in the project area it was determined that the Habitat Equivalency Analysis (HEA) would be an appropriate tool to assess the project's impacts on fish and wildlife habitat and other ecological resources. HEA is a method developed by the NOAA to scale compensation for habitat damage resulting from oil spills and other damage-related impacts (NOAA 1997). HEA is currently only approved on a project-by-project basis. The study has received single-use model certification from the Ecosystem Restoration Center of Expertise (Eco-PCX). HEA focuses on complete, in-kind replacement of services lost between the time of impact and when the restored or created habitat becomes fully functional. HEA accomplishes this by incorporating the concept of discounting from economic theory (i.e. services for future years have a lower value on benefits because they take longer to accrue). Model outputs are in a discounted-service-acre-year (DSAY).

For purposes of this phase of feasibility, the worst-case scenario of implementation was assumed and included construction and long-term operation of the Recommended Plan measures. Because this is a worst-case scenario conceptual mitigation plan, there is no consideration of the net benefits from implementation of EWN features or the likely decrease in fill from wharf rebuilding. Additional coordination with the resource agencies will occur during the design phase to better understand what an appropriate assumption for the quantity of tidal marsh and intertidal habitat that would be restored/created and how that could contribute to project benefits that would offset the impacts of bay fill as part of the total project design. As a result, only the bay fill impacts to subtidal habitats were modeled.

The HEA results indicate that for 1.0 acre of bay fill, a total of 500,000 DSAY are lost, which totals 4,500,000 DSAY lost for the 9.0 acres of bay fill associated with implementing the Proposed Action.

USACE, in coordination with resource agencies, evaluated multiple different mitigation planning strategies, which are different means employed to develop an alternative plan or plans to achieve a project goal. The use of one or more strategies helps teams focus on an approach to developing a plan. For mitigation planning work, strategies may range from the purchase of mitigation bank credits to the construction of a project or projects to achieve the objectives and compensate for unavoidable habitat impacts. Strategies may also involve different approaches to site selection such as the use of public lands or identifying contiguous sites to enhance wildlife corridors or expand wildlife populations. In addition, Section 2036(c) of WRDA 2007, as amended, requires

USACE to consider mitigation banks and in-lieu fee programs where appropriate. Consideration of these options as mitigation strategies may be helpful when available. The strategies considered for planning this mitigation project include: the purchase of mitigation bank credits, purchase of in-lieu fee program credits, construction of a mitigation project, non-structural mitigation methods, and partnership opportunities.

Management measures are actions or activities that work towards accomplishing planning objectives. Each measure is linked to one or more stressors or drivers in the conceptual ecological model. A measure may stand alone as a single activity that serves as an alternative plan. Two or more individual measures may be combined to form an alternative plan.

Measures were identified based on resource agency feedback and were further developed and guided by the goals established in several conservation and management plans developed by various partnerships and coordination efforts in San Francisco Bay. Within these plans, the common restoration goals applicable to habitats along the waterfront and that align with the mitigation objective include:

- Improve biodiversity, resilience, and water quality
- Limit disturbances to soft substrates and discourage the use of bay fill
- Remove artificial structures that have negative impacts on soft bottom habitat function, contribute to water quality degradation and that provide minimal habitat benefit
- Remove marine debris from intertidal or subtidal areas
- Minimize the impacts of aquatic invasive species on native subtidal habitats

Most of these plans focus on restoration actions in habitats that would not meet the mitigation objective, such as tidal marsh restoration. Other restoration actions include measures that may be considered out-of-kind mitigation such: preserving remaining natural habitats (e.g. eelgrass and oyster beds and soft bottoms); protecting areas for future expansion, restoration or creation of natural habitats; restoration of natural habitats; or improving water quality for discharges directly into the Bay. While each of these would provide an overall benefit to subtidal habitat, other measures are available that would meet the restoration goals stated above. If for some reason sufficient in-kind measures cannot be found when the mitigation plan is finalized, consideration of these out-of-kind mitigation measures should be considered in coordination with the resource agencies.

A total of 10 measures were identified as meeting the planning objective; however, of these only two were carried forward as potential mitigation measures that could be implemented to offset the impacts to subtidal habitat. The measures and the rationale for carrying forward or eliminating from further consideration is documented in Table 8.

Table 8. Potential Mitigation Measures

Measure	Description	Carried Forward	Rationale
Mitigation Bank Credits	(In-kind) Purchase mitigation credits from an approved mitigation bank.	No	No approved mitigation banks currently exist in the primary, secondary, or tertiary service area that provide open water or subtidal habitat credits.
In-Lieu Fee Credits	(In-Kind) Purchase ILF credits from an approved bank.	No	No approved ILF credits are available in the primary, secondary, or tertiary service area that provide open water or subtidal habitat credits.
Restoration-Pile Removal	(In-Kind) Remove abandoned and derelict piles from the waterfront, with a primary focus on known locations with creosote piles.	Yes	These measures meet the objective of restoring subtidal habitat by: • Reducing shading of the bottom and water column • Reducing restrictions to flow and sediment movement • Restoring, re-creating, or realigning intertidal mudflats, sand flats, rock, shellfish, and macroalgal beds, and soft bottoms • Reducing toxic effects of creosote and other contaminants
Restoration-Pier Removal	(In-Kind) Remove abandoned, derelict, or unused piers and overwater structures to include removal of all decking, pilings, and other materials associated with the structure.	Yes	
Restoration-Restore Shoreline	(In-Kind) Remove shoreline fill in abandoned or unused areas.	No	As of now, there does not appear to be any areas that would be suitable to restore the shoreline along the 7.5-mile waterfront or in other adjacent areas. However, as conditions changes over the next decade, this measure should be reconsidered during the design phase.
Restoration-Trash and debris removal	(Out-of-Kind) Remove trash and debris (e.g. abandoned boats, fishing gear) from the open water areas along the waterfront.	No	This would require a reoccurring program to be set up in perpetuity and would not be a permanent improvement to water quality due to the recurring nature of trash input. There would be uncertainty whether the measure would fully compensate for the loss in perpetuity.

Measure	Description	Carried Forward	Rationale
Restoration-Increase diversity	(Out-of-kind) Addition of living seawalls or texture to existing artificial structures and incorporating troughs into deepwater habitats	No	Small-scale efforts have been completed and shown success; however, the long-term benefits are still assumed. Additionally, there are significant challenges in quantifying how much each of these measures could offset one acre of subtidal habitat loss. These are acknowledged as extremely valuable tools for increasing diversity; however, for purposes of mitigation there is risk and uncertainty in knowing that the impact has been sufficiently offset and will provide benefits in perpetuity. This measure should be reconsidered in the design phase when many of the pilot projects have been completed.
Restoration-Invasive Species Removal	(Out-of-Kind) Remove at least two invasive species from the waterfront	No	The potential for eradication or reduction to acceptable levels may or may not occur within a reasonable time frame (for example, no longer than 10 years). There is also no guarantee whether the proposed methods for treatment are going to work or whether there is reasonable assurance that no identifiable vector will re-introduce the species proposed for control or eradication, making this an extremely difficult task and introduces significant uncertainty whether the measure would fully compensate for the loss in perpetuity.
Preservation – Open Water	(Out-of-Kind) Permanently protect areas of open water in or near ecologically important habitat through the implementation of appropriate legal and physical mechanisms.	No	Areas that could meet this purpose are found on publicly owned lands and actions which could affect habitat is regulated under various Federal and State laws. The State, City, and Port have implemented several actions to minimize impacts that is also contributing to existing habitat protection.
Preservation – Future Uses	(Out-of-Kind) Protect submerged land as it may become available to incorporate transition zones into restoration designs.	No	This measure would be dependent on other activities that would not be associated with the mitigation action. Additionally, the considerations for Open Water preservation are also applicable here.

The two measures carried forward (Pile and Pier Removal) were further assessed to determine the potential to combine it with other measures to form alternative plans. Both measures can stand alone as a plan or be combined to form another plan. Neither of

these measures have any restrictions that would prevent its combination with another measure.

HEA was used to calculate the benefit of pile and pier removal to determine the DSAY of units gained and determine the total acreage needed for compensatory mitigation. One acre of pile removal results in 299,999 DSAY of subtidal habitat, while one acre of pier removal results in a gain of 499,999 DSAY of subtidal habitat. Three alternatives were then formed that would fully offset impacts to subtidal habitats:

- **Alternative 1.** Remove 15.1 acres of abandoned and derelict piles from the San Francisco waterfront between Aquatic Park and Heron's Head. The Warme et al. Creosote Piling Geodatabase identifies at least 8.5 acres (2,549,992 DSAY). Approximately 1.8 acres of additional pile removal (524,999 DSAY) can be conducted at the Concrete Plant at Pier 90 where the new seawall would being constructed landward of the existing dilapidated wharf that will not be rebuilt. These known and available locations provide a total of 10.3 acres (3,089,990 DSAY), which would require an additional 4.8 acres (1,439,995 DSAY) of pier removal options will need to be investigated during the design phase to implement this alternative.
- **Alternative 2.** Remove 9.1 acres of abandoned, derelict, or unnecessary piers from the San Francisco waterfront between Aquatic Park and Heron's Head. The Waterfront Plan and Design & Access Element includes policies for removal of a portion of the Pier 23 shed and Pier 64. These options equate to about 3.5 acres of pier removal (1,749,997 DSAY). Other piers identified in the Waterfront Plan have already been completed. One additional pier not identified in the Waterfront Plan but that the Port has expressed interest in removing is just west of the 4th Street Bridge in Mission Creek. This location would result in 2.0 acres (999,998 DSAY) of pier removal benefits. These known and available locations provide a total of 5.5 acres (2,749,995 DSAY), which would require an additional 3.6 acres (1,799,996 DSAY) of pier removal options along the waterfront or outside the study area will need to be investigated during the design phase to implement this alternative.
- **Alternative 3.** Combination of pile and pier removal. Some locations offer the opportunity for removal of pier and pile from the same location, while a combination of pier and pile removal may be necessary in order to mitigate within the study area. By combining the identified locations in Alternative 1 and Alternative 2 a total of 5,824,986 DSAY would be available for compensatory mitigation, leaving an excess and options for identifying priority areas or if the pile polygons, in particular, are smaller than mapped.

From there, a Cost Effective, Incremental Cost Analysis (CE-ICA) was performed, comparing the cost of each alternative to its DSAY output. Based on the CE-ICA analysis, the least cost alternative plan that provides full mitigation of losses specified in the planning objectives was identified as Alternative 2. Therefore, Alternative 2 as

described above has been thoughtfully selected in coordination with resource agencies including BCDC as the recommended mitigation plan.

The likelihood of long-term ecological success of the pier and/or removal measure is high because the benefit is nearly immediate and does not require extensive monitoring and adaptive management actions like mitigation for other habitat types would. After removal of the piers and/or piles, the open water area and bay bottom should be monitored to ensure that no fill or debris remains at the removal site. Additionally, the site should be monitored to confirm that any holes in the bay bottom have been adequately filled in so that scouring or deep holes do not form or remain after construction is complete. Monitoring for these success criteria and implementation of adaptive management strategies, if needed, is expected to be completed in two years, after which the mitigation is anticipated to be deemed successful.

The mitigated habitat would be subtidal, and it would function similar to the impacted site as it would:

- Reduce shading of the bottom and water column;
- Reduce restrictions to flow and sediment movement;
- Restore, re-create, or realign intertidal mudflats, sand flats, rock, shellfish, and macroalgal beds, and soft bottoms; and,
- Reduce toxic effects of creosote and other contaminants.

In summary, the amount of mitigation was determined based on the HEA analysis certified by the Eco-PCX, and the type of mitigation was determined in coordination with resource agencies through a thorough analysis of potential mitigation strategies and measures that meet mitigation goals and objectives. The mitigation project has a high probability of success, almost immediately realizes habitat benefits, and provides similar type and quality of the ecological functions compared to the impacted sites. For these reasons, the Proposed Action is consistent to the greatest extent practicable with Policy 5.

5.20.5 Policy 6

To increase the potential for the ecological success and long-term sustainability of compensatory mitigation projects, resource restoration should be selected over creation where practicable, and transition zones and buffers should be included in mitigation projects where feasible and appropriate. In addition, mitigation site selection should consider site specific factors that will increase the likelihood of long-term ecological success, such as existing hydrological conditions, soil type, adjacent land uses, and connections to other habitats.

The proposed mitigation project as described under Policy 5 in Section 5.20.4 is considered a resource restoration project, not creation. The mitigation entails removing existing piers and/or piles that are abandoned, derelict, and/or unused. This type of subtidal habitat restoration would not require transition zones or buffers. Long-term

ecological success is likely to be high as benefits of implementation are realized almost immediately and adaptive management actions required to meet success criteria are expected to be minimal. Success criteria should be met within a maximum of two years of initial action. Because the mitigation sites are within open water, the subtidal habitat created through mitigation would be adjacent to like habitat, increasing its success and benefit by maximizing contiguous open bottom and water column. Hydrological conditions in the areas would already be supporting subtidal habitat and are expected to have the same effects on the newly-created subtidal habitat. Thus, the Proposed Action is consistent to the maximum extent practicable with Policy 6.

5.20.6 Policy 7

Mitigation should, to the extent practicable, be provided prior to, or concurrently with those parts of the project causing adverse impacts.

Section 906(a) of the Water Resources Development Act of 1986 states that water resources project requiring mitigation for fish and wildlife losses, "including the acquisition of lands or interest in lands to mitigate losses to fish and wildlife" as a result of the project "(A) shall be undertaken or acquired before any construction of the project (other than such acquisition) commences, or (B) shall be undertaken or acquired concurrently with lands and interests in lands for project purposes (other than mitigation of fish and wildlife losses), whichever the Secretary determines is appropriate, except that any physical construction required for the purposes of mitigation may be undertaken concurrently with the physical construction of such project."

This policy requires USACE projects to acquire lands or interests in lands for mitigation before construction of the project commences or concurrently with acquisition of lands and interests in lands for other project purposes; and the physical construction of the mitigation work is required to be carious out before or concurrently with project construction. This policy will be adhered to, therefore the Proposed Action is consistent to the maximum extent practicable with Policy 7.

5.20.7 Policy 8

When compensatory mitigation is necessary, a mitigation program should be reviewed and approved by or on behalf of the Commission as part of the project. Where appropriate, the mitigation program should describe the proposed design, construction and management of mitigation areas and include:

- *Clear mitigation project goals;*
- *Clear and measurable performance standards for evaluating the success of the mitigation project, based on measures of both composition and function, and including the use of reference sites;*
- *A monitoring plan designed to identify potential problems early and determine appropriate remedial actions. Monitoring and reporting should be of adequate*

frequency and duration to measure specific performance standards and to assure long-term success of the stated goals of the mitigation project;

- *A contingency plan to ensure the success of the mitigation project, or provide means to ensure alternative appropriate measures are implemented if the identified mitigation cannot be modified to achieve success. The Commission may require financial assurances, such as performance bonds or letters of credit, to cover the cost of mitigation actions based on the nature, extent and duration of the impact and/or the risk of the mitigation plan not achieving the mitigation goals; and*
- *Provisions for the long-term maintenance, management and protection of the mitigation site, such as a conservation easement, cash endowment, and transfer of title*.

A compensatory habitat mitigation plan for the unavoidable impacts associated with the Proposed Action has been prepared as part of the study's documentation, as discussed under Policy 1 in Section 5.20.1. Because the proposed mitigation plan consists of mitigating for unavoidable impacts to subtidal habitat by removing 9.1 acres of abandoned, derelict, or unnecessary piers from the San Francisco waterfront. The following paragraphs discuss how the mitigation plan addresses the requirements of Policy 8.

The goal of the mitigation plan is to fully compensate for the unavoidable impacts to subtidal habitats that would occur with project implementation. The objectives of the mitigation plan are defined by the results of the HEA (discussed in Policy 2 in Section 5.20.2). HEA was also used to estimate potential project impacts and potential outputs of mitigation measures. The objective of this mitigation plan is to compensate for the loss of 9.0 acres of subtidal habitat (4,500,000 DSAY) along the San Francisco Waterfront in San Francisco Bay.

For open/water subtidal habitat and the type of compensatory mitigation measures being considered, the benefit is nearly immediate and has a very high success potential. As a result, ecological success criteria will not be as complex or require significant long-term monitoring like other habitat types. After removal of the piles and/or piers, the open water area and bay bottom should be monitored to ensure that no fill or debris remains at the removal site. Additionally, the site should be monitored to confirm that any holes in the bay bottom have been adequately filled in, so that scouring or deep holes do not form or remain after construction is complete (Table 8).

Table 9. Ecological Success Criteria, Monitoring, and Adaptive Management of Mitigation Features

Metric	**Success Criteria**	**Monitoring Methodology**	**Adaptive Management, if needed**
Fill Material	0% of fill material (old piles, decking, debris, etc.) remains on site	Visual Inspection, post-construction and 1 year after	Remove all remaining fill material
Bay Bottom Profile	95% of the bay bottom profile is consistent with	Visual Inspection/ Subsurface	- Grade the bay bottom

	the surrounding bay bottom, with no deep holes or areas of scouring.	Profiling, post-construction and annually for 2 years	- Fill in holes places, as needed

A suite of foreseeable implementation risk factors across each phase of implementation (Pre-Construction Engineering and Design, Construction, and Operations) have been identified (Table 9). These factors are based upon experience from similar projects and the consideration of regional risks generally associated with design and construction work in wet environments. Each risk was assessed and assigned a significance level. Potential risk management measures were identified and will be considered should the need arise during implementation or adaptive management.

Table 10. Mitigation Implementation Risks

Risk Factor	Risk Potential	Risk Rating	Risk Management Measures
Planning, Engineering, and Design Phase			
Decrease in Habitat Impacts	Moderate	High	Incorporate avoidance, minimization, and EWN into the designs
Increase in Total Project Habitat Benefits	High	Moderate	Revise habitat modeling and recalculate mitigation need
Sites no longer available (completed by others)	Moderate	High	- Complete mitigation efforts as soon as practicable - Coordinate with resource agencies, USACE regulatory, and special interest groups in the Bay to identify other sites.
Costs Change	High	High	Consider alternative mitigation sites or methods to construction.
Construction			
Construction Management	Moderate	Varies	Monitor use of BMPs during construction work. Confirm construction as-built requirements are met. Document all pre- and post-construction at site.
Long-Term Operation			
None			Once construction is complete, no long-term O&M is necessary.

As discussed above, the type of mitigation measures being considered result in a near immediate benefit and have very high success potential. Therefore, long-term monitoring and excessive maintenance is not required like other habitat type mitigation programs may necessitate. Monitoring would occur after removal of the piles and/or

piers to ensure no fill or debris remains at the removal site, and that any holes in the bay bottom have been adequately filled in so that scouring or dep holes do not form or remain. Monitoring is only expected to be required post-construction and annually for two years after construction until success criteria are deemed met. No long-term maintenance or management is anticipated. Because the mitigation measures would be located off the Bay in open water, no protection measures are anticipated.

In summary, the proposed mitigation plan describes clear mitigation project goals; clear and measurable performance standards; a monitoring and adaptive management plan; potential risks and risk management measures; and does not require provisions for long-term maintenance, management, or protection of the mitigation site. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 8.

5.20.8 Policy 9

Mitigation programs should be coordinated with all affected local, state, and federal agencies having jurisdiction or mitigation expertise to ensure, to the maximum practicable extent, a single mitigation program that satisfies the policies of all the affected agencies.

Two interagency teams (Resource Agency Working Group [RAWG] and Engineering with Nature Working Group [EWNG]) met throughout the study and resource agencies contributed expertise and information to support the identification of significant resources, impacts, and avoidance, minimization and potential compensation (mitigation) measures. The RAWG includes more than 50 members from agencies including: San Francisco Bay Conservation and Development Commission (BCDC), California Department of Fish and Wildlife, City of San Francisco Planning Department, Environmental Protection Agency, National Park Service, National Marine Fisheries, Regional Water Quality Control Board, California State Lands Commission, USACE, US Fish and Wildlife, and Port of San Francisco. The EWNG was set up to identify where and which NNBFs should be considered within the study area and to help describe how NNBFs contribute to regional habitat goals and project benefits. The EWNG included 15 individuals from Federal, state, and local agencies, universities, non-governmental organizations, and private industry who have been identified as experts in the field of Engineering with Nature and ecological restoration.

The cooperating and participating agencies are listed below. An early interagency coordination meeting was held to comply with the provisions of the Water Resources Reform and Development Act of 2014 Section 1001. The meeting afforded agencies an opportunity to learn about the project and to provide initial input into the study.

- **Cooperating Agencies**: Environmental Protection Agency Region 9 (Formally Accepted), Federal Emergency Management Agency Region IX (Planning and Implementation Branch), National Marine Fisheries Service (Formally Accepted), National Park Service, US Fish and Wildlife Service

- **Participating Agency:** California Department of Fish and Wildlife, California Regional Water Quality Control Board, California State Lands Commission, San Francisco Bay Conservation and Development Commission, and San Francisco Planning Department

The views of each of the resource agencies were considered in the development of the draft plan and this draft compensatory mitigation plan. The RAWG and EWNG were provided an opportunity to review the draft compensatory mitigation plan during the 45-day agency and public review period that began January 26, 2024. The Water Board, BCDC, and EPA each provided written comments on the mitigation plan during the public review period. Each of these organizations will be offered an opportunity to continue to play a role in the finalization of the mitigation plan and design and implementation phases of the mitigation work when the project is authorized and funded. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 9

5.20.9 Policy 10

If more than one mitigation program is proposed, the Commission should consider the cost of the alternatives in determining the appropriate program, as well as equitably consider the priorities and concerns of surrounding communities.

USACE, in coordination with resource agencies, evaluated multiple different mitigation planning strategies and potential mitigation measures that met the objectives of the mitigation plan. Three action alternatives were identified as described under Policy 5 in Section 5.20.4. From there, a Cost Effective, Incremental Cost Analysis (CE-ICA) was performed, comparing the cost of each alternative to its DSAY output. Based on the CE-ICA analysis, the least cost alternative plan that provides full mitigation of losses specified in the planning objectives was identified as Alternative 2. Please see discussion under Policy 5 in Section 5.20.4 for a detailed description of how the cost analysis resulted in the proposed mitigation plan selection. Therefore, Alternative 2 as described above has been thoughtfully selected in coordination with resource agencies including BCDC as the recommended mitigation plan. Further refinements to the compensatory mitigation selected plan may be made during PED in coordination with resource agencies.

Priorities and concerns of surrounding communities were solicited during the Draft IFR/EIS public comment period, and comments related to the mitigation program were thoroughly considered and addressed in the mitigation plan. Additionally, priorities and goals as described in the Bayland Ecosystem Goals Project report and San Francisco Bay Subtidal Habitat Goals Report, Conservation Planning for the Submerged Areas of the Bay report were taken into account to identify mitigation measures.

The mitigation program recommended under the Proposed Action was carefully selected in coordination with BCDC and other resources agencies by considering the cost of alternatives and priorities and concerns of surrounding communities. Any refinements and/or changes that may be made to the mitigation plan during PED would

be coordinated with BCDC and other resource agencies. For these reasons, the Proposed Action is consistent to the maximum extent practicable with Policy 10.

5.21 Public Trust

The Bay Plan's public trust Policy 1 is applicable to the Proposed Action. The Proposed Action's consistency with this policy is discussed in the following section.

5.21.1 Policy 1

When the Commission takes any action affecting lands subject to the public trust, it should assure that the action is consistent with the public trust needs for the area and, in case of lands subject to legislative grants, should also assure that the terms of the grant are satisfied and the project is in furtherance of statewide purposes.

The Proposed Action would involve lands in the San Francisco Bay that are subject to the public trust. The project would strengthen the San Francisco Bay shoreline's resilience against rising sea level, increasing life and property safety and ensuring the longevity of institutions along the Bay. Accordingly, the project is consistent to the maximum extent practicable with Policy 1.

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ATTACHMENT 1: AVOIDANCE AND MINIMIZATION MEASURES

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Acronyms

Acronym	Definition
ADA	Americans with Disabilities Act
AMM	avoidance, minimization, and mitigation
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BMP	best management practice
CARB	California Air Resources Board
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
City	City of San Francisco
CTMP	Construction Traffic Management Plan
EPA	Environmental Protection Agency
ER	Engineer Regulation
ft	foot
GHG	greenhouse gas
HRA	health risk assessment
HTRW	hazardous, toxic, and radioactive waste
MOU	Memorandum of Understanding
mph	miles per hour
MTC	Metropolitan Transportation Commission
MUNI	Municipal Railway
MY	Model Year
NEPA	National Environmental Policy Act

NMFS	National Marine Fisheries Service
NNBF	Natural and Nature-Based Features
NOAA	National Oceanic and Atmospheric Administration
PA	Programmatic Agreement
PED	Preconstruction engineering and design
Port	Port of San Francisco
ROG	reactive organic gas
SFBAAB	San Francisco Bay Area Air Basin
SFMTA	San Francisco Municipal Transportation Agency
SHPO	State Historic Preservation Office
SWPPP	Stormwater Pollution Prevention Plan
USACE	United States Army Corps of Engineers
USC	United States Code
VOC	volatile organic compound
WETA	Water Emergency Transportation Authority

1.0 Initial Avoidance and Minimization Measures by Reach

The Proposed Action avoids a significant amount of adverse impacts to ecological habitats by placing the line of defense at or landward of the existing shoreline and designing the project to avoid bay fill to the greatest extent practicable and integrating Natural and Nature-Based Features (NNBFs) where feasible. The following is a brief assessment of the avoidance and minimization measures by reach and action. The avoidance and minimization measures for the project are described in this section separated by first and subsequent actions. Table 1 provides a high-level overview of first and subsequent actions based on Relative Sea Level Change (RSLC) scenarios by reach.

Table 1. First and Potential Subsequent Actions, Recommended Plan

Reach	***First Action***		***Subsequent Action***			
	Crest Elevation[1]	***Description[2]***	***Crest Elevation[1]***			***Description[2]***
			Low	***Intermediate***	***High***	
1	--	Floodproofing buildings, phased over time (Alternative B)	--	Only nonstructural action	New defense structure: 19.0 ft NAVD88	*Intermediate:* Floodproof more buildings, phased over time (Alternative B) *High:* Defend at existing shoreline (Alternative G)
2	15.5 feet NAVD88		--	--	19.0 ft NAVD88	*High:* Increase crest elevation of defense structure along existing shoreline (Alternative G)
3	13.5 feet NAVD88		--	15.5 feet NAVD88	19.0 ft NAVD88	Increase crest elevation of defense structure along existing shoreline (Intermediate: Alternative D; High: Alternative E)

4	13.5 feet NAVD88		--	15.5 feet NAVD88	19.0 ft NAVD88	Increase crest elevation of defense structure along existing shoreline (Intermediate: Alternative D; High: Alternative E)

NAVD88 = North America Vertical Datum of 1988

[1]Crest elevation columns indicate the assumed structural measures crest elevation for purposes of alternatives evaluation. Actual crest elevations would vary along the waterfront based on local wave conditions, pending further analysis in PED.

[2]First and Subsequent Actions include a mix of structural and nonstructural measures, and NNBFs. The brief description here is intended to highlight key differences by reach.

1.1.1 Reach 1

1.1.1.1 First Actions

All measures are considered nonstructural, meaning the measure attempts to reduce the flood risk and the damages associated with flooding rather than focusing on reducing or modifying how the water moves through the area. By design, the nonstructural measures realize impacts at the immediate site of the measure which is often isolated to the structure itself (e.g. floodproofing, building demolition) and do not involve disturbance of ecological habitats. Construction of the concrete curbs around the piers involves minimal construction efforts that would be completed from the pier and would not involve any in-water work which avoids impacts to any aquatic habitats.

Additionally, demolition of two piers would remove approximately 1.0 acre of piles, bay fill, and decking and allow the area to restore to higher quality open water and subtidal habitat.

1.1.1.2 Subsequent Actions

Under the intermediate RSLC scenario, the subsequent actions would include additional non-structural components. Nonstructural measures would not impact any location except at the immediate structure. One acre of building demolition would be completed that would allow the area to be flooded and taken over by RSLC. Here, it is anticipated that intertidal habitat would be naturally created.

For the Subsequent Actions measures under a high RSLC scenario, the seawall alignment and associated seismic ground improvements are landward of the existing shoreline and behind the existing seawall where one currently exists. This design would not require any bay fill or in-water work to construct the features. To maintain the aesthetic quality and accessibility of the waterfront, a gradual slope has been incorporated into the design that will promote unity throughout waterfront that would generally be unnoticeable to the average visitor when the pre-construction and post-construction conditions are compared. The design allows accessibility to all (i.e. fewer steps and gentle slopes) and incorporates and maintains the historic features unique to the waterfront buy ensuring the architectural design and materials are consistent with the surrounding environment. This design creates more transportation impacts to achieve the target slope and seawall elevation but fully avoids any impact to aquatic habitats.

With the increase in ground elevation, approximately 3.25 acres of existing wharf would need to be rebuilt to the higher elevation resulting in temporary localized impacts to the aquatic environment during construction. Because of the design, there would be no increase in the footprint of the wharf, all existing wharf material would need to be removed and replaced with new, more eco-friendly materials, and fewer piles would be necessary per square foot than currently exists. Overall long-term benefits to the aquatic environment are expected from the net decrease in bay fill and removal of old materials (e.g. creosote piles) that contribute to poor water quality.

1.1.2 Reach 2

1.1.2.1 First Actions

Similar to the subsequent actions in Reach 1, the First Actions in Reach 2 involves constructing a seawall landward of the existing seawall and rebuilding approximately 6.3 acres of wharf. The design and construction methodology would be identical to Reach 1 Subsequent Actions and all the same avoidance and minimization efforts and long-term benefits described above would be applicable here. The difference here is that the action would be completed as a First Actions and not a subsequent action.

All NNBFs minimize the long-term adverse impacts of the engineered structure despite some temporary aquatic impacts during construction. By incorporating NNBF into the design, natural processes and materials are used to reduce wave hazards, support nearshore ecology, and provide public water access in lieu of more traditional engineered designs and materials such as concrete, rip rap, or monoculture turf grass, which do not provide any long-term ecological or recreational benefits and are generally less visually desirable. Additionally, implementation of the NNBF avoids conversion of existing habitats into impervious surfaces.

1.1.2.2 Subsequent Actions

The Recommended Plan does not include Subsequent Actions in this reach under the intermediate RSLC scenario since the First Action is being constructed at a higher initial scale, unlike the other three reaches. By completing the 3.5-foot target elevation in the First Actions, the significant disturbance to the Embarcadero including transportation, recreation and cultural resource impacts and costs associated with reworking the same area twice are avoided. Under the high RSLC scenario, the Recommended Plan includes increasing the elevation of structures by an additional 3.5-feet in this reach. The First Actions measures have each been designed to be adaptable to future design modifications to address RSLC conditions. Based on the designs at this time, the high RSLC Subsequent Actions would not abandon the First Actions structures and thereby avoids the need for construction or conversion of lands to impervious surfaces outside the First Actions construction footprint. As with the other measures, the designs and construction methodology avoid all aquatic impacts.

1.1.3 Reach 3

1.1.3.1 First Actions

In Reach 3, measures constructed landward of the existing shoreline would not require any in-water work, thus avoiding the need for bay fill and adverse impacts to aquatic habitats. Additionally, all impacts from construction have been avoided on approximately 7,500 linear feet of shoreline because the design was aligned to take advantage of existing high ground to avoid unnecessary construction of additional features. Instead of raising the bridges, deployables are proposed which avoids a significant amount of in-water work and disturbance associated with replacing two bridges.

Approximately 4.5 acres of wharf would need to be rebuilt which would involve some temporary impacts, but overall result in long-term benefits from removal of old construction materials and a reduction in bay fill as described for Reach 1 Subsequent Actions. The footprint would not be increased and therefore long-term changes from a footprint increase have been avoided. Also, the modified design in this location avoids disruptions and reconfiguration of the light rail system.

1.1.3.2 Subsequent Actions

The First Actions measures have each been designed to be adaptable to future design modifications to address RSLC conditions. Based on the designs at this time, the Subsequent Actions would not abandon the First Actions structures and thereby avoids the need for construction or conversion of lands to impervious surfaces outside the First Actions construction footprint. As with the other measures, the designs and construction methodology avoid all aquatic impacts.

1.1.4 Reach 4

1.1.4.1 First Actions

Like the other reaches, all measures are constructed landward of the existing shoreline and would not require any in-water work, thus avoiding the need for bay fill and adverse impacts to aquatic habitats. Additionally, all impacts from construction have been avoided on approximately 6,500 linear feet of shoreline because the design was aligned to take advantage of existing high ground to avoid unnecessary construction of additional features. Similar to Reach 3, the impacts of raising of existing bridges would be avoided by relying on deployables for flood defense. Similar to Reach 1 first action, approximately 0.75 acres of building demolition would occur allowing these areas to convert to intertidal or sub-tidal habitat, while an additional 2.0 acres of building demolition would occur and be converted to open space.

A small area of gradual retreat along the creek in incorporated, resulting in long-term ecological benefits and avoidance of engineered structures and permanent impacts at or near the existing shoreline. These areas would be allowed to flood and be overtaken by RSLC, which is expected to convert to marsh, intertidal or sub-tidal habitat. Long-term conversion of existing habitats into impervious surfaces would be avoided. As well, this conversion of some industrial lands and public facilities would provide public water access and additional open space.

1.1.4.2 Subsequent Actions

The subsequent actions avoidance and minimization measures described for Reach 3 also apply in Reach 4. Additionally, NNBF features have been incorporated into the designs that allow for ecological enhancements while supporting and enhancing the performance of the flood defense structures.

2.0 Avoidance and Minimization Measures by Resource

2.1 Air Quality

The following AMMs would be necessary to reduce impacts resulting from the Proposed Action.

AMM-AQ-1: Implement BAAQMD's Basic and Enhanced Best Management Practices for Construction

The following list of strategies is informed by measures recommended by the BAAQMD (2023) to reduce construction-generated criteria pollutant emissions:

- All exposed surfaces (e.g., unpaved parking and staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day, except during rainy days.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph).
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
- All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.
- All trucks and equipment, including their tires, shall be washed off prior to leaving the active site.
- Unpaved roads providing access to sites located 100 feet or more from a paved road shall be treated with a 6- to 12-inch layer of compacted wood chips, mulch, or gravel.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The air district's general air pollution complaints number shall also be visible to ensure compliance with applicable regulations. In addition, the construction schedule and mitigation measures shall be posted. Notices shall be multilingual.
- Limit the simultaneous occurrence of excavation, grading, and ground-disturbing construction activities.

- Install wind breaks (e.g., trees, fences) on the windward side(s) of actively disturbed areas of construction. Wind breaks should have a maximum of 50 percent air porosity.
- Plant vegetative ground cover (e.g., fast-germinating native grass seed) in disturbed areas as soon as possible and water appropriately until the vegetation is established.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than 1 percent.
- Minimize the amount of excavated material or waste materials stored at the site.
- Hydroseed or apply non-toxic soil stabilizers to construction areas, including previously graded areas, that are inactive for at least 10 calendar days.
- Implement other measures to reduce emissions as they become available in the future.

AMM-AQ-2: Implement Additional Control Strategies to Reduce Criteria Pollutant Emissions

Prior to construction, a quantitative air quality analysis will be completed for construction, including the identification of any and all measures necessary to reduce criteria pollutant emissions to levels below *de minimis* thresholds. Reductions in emissions can be accomplished by the following measures, as feasible:

- Requiring that all construction equipment, diesel trucks, marine equipment, and generators be equipped with best available control technology for reductions in nitrogen oxides and particulate matter emissions to the greatest extent feasible. Acceptable options for reducing emissions include the use of late-model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as they become available.
- Use coatings that are low in volatile organic compounds (VOCs) or reactive organic gases (ROGs) and go beyond local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings)
- Modify the construction schedule to minimize simultaneous construction activity when possible.
- Use of zero-emission electric equipment to the degree feasible to reduce emissions, maintain air quality, and reduce noise impacts.
- Implement other measures to reduce emissions as they become available in the future.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding complaints. This person shall

respond and take corrective action within 48 hours. The air district's general air pollution complaints number shall also be visible to ensure compliance with applicable regulations. In addition, the construction schedule and mitigation measures shall be posted. Notices shall be multilingual.

AMM-AQ-3: Implement Control Strategies to Reduce Greenhouse Gas Emissions

After detailed construction assessments are conducted, and impacts are identified, if necessary, include measures to reduce greenhouse gas (GHG) emissions. Reductions in emissions can be accomplished by the measures listed below, as feasible. The list of strategies is informed by measures recommended by the BAAQMD (2023) to reduce construction-generated GHG emissions; as such, these measures should be updated as project-specific analyses are conducted.

- Require all on-road heavy-duty trucks, and marine equipment (where used), to be zero-emission or meet the most stringent emissions standard as feasible at the time of construction, such as a model-year (MY) standard, as a condition of contract.
- Minimize idling time, either by shutting equipment off when not in use or reducing the time of idling to no more than 2 minutes (a 5-minute limit is required by the State airborne toxics control measure [Title 13, Sections 2449(d)(3) and 2485 of the California Code of Regulations]). Provide clear signage that posts this requirement for workers at the entrances to the sites and develop an enforceable mechanism to monitor idling time and ensure compliance with this measure.
- Prohibit off-road diesel-powered equipment from being in the "on" position for more than 10 hours per day.
- Use CARB-approved renewable diesel fuel in off-road construction equipment and on-road trucks.
- Use EPA SmartWay-certified trucks for deliveries and equipment transport.
- Require all construction equipment to be maintained and properly tuned in accordance with manufacturer's specifications. Equipment should be checked by a certified mechanic and determined to be running in proper condition prior to operation.
- Where grid power is available, prohibit portable diesel engines and provide electrical hook-ups for electric construction tools, such as saws, drills, and compressors; use electric tools whenever feasible.
- Encourage and provide carpools, shuttle vans, transit passes, and/or secure bicycle parking to construction workers and offer meal options on-site or shuttles to nearby meal destinations for construction employees.

- Reduce electricity use in construction offices by using LED bulbs, powering off computers every day, and replacing heating and cooling units with more efficient ones.
- Minimize energy used during site preparation by deconstructing existing structures to the greatest extent feasible instead of demolishing structures and discarding all materials.
- Recycle or salvage non-hazardous construction and demolition debris, with a goal of recycling at least 15 percent more by weight than the diversion requirement in Title 24.
- Use locally sourced or recycled materials for construction materials (goal of at least 20 percent, based on costs for building materials and volume for roadway, parking lot, sidewalks, and curb materials). Wood products used should be certified through a sustainable forestry program.
- Use low-carbon concrete, minimize the amount of concrete used, and produce concrete on-site if it is more efficient and lower emitting than transporting ready-mix.
- Develop a plan to efficiently use water for adequate dust control because substantial amounts of energy can be consumed during the pumping of water.
- Purchase carbon offsets.
- Implement other measures to reduce emissions as they become available in the future.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding complaints. This person shall respond and take corrective action within 48 hours. The air district's general air pollution complaints number shall also be visible to ensure compliance with applicable regulations. In addition, the construction schedule and mitigation measures shall be posted. Notices shall be multilingual.
- For Alternatives B through G, the mitigation measures that follow would be necessary to reduce impacts.

AMM-AQ-4: Offset Construction-Generated Criteria Pollutants in the San Francisco Bay Area Air Basin

Offset construction-generated emissions that exceed federal *de minimis* levels to net zero. The preferred means of undertaking such offsite mitigation will be through a memorandum of understanding (MOU) with the Bay Area Clean Air Foundation (Foundation), a public nonprofit and supporting organization for the BAAQMD, or with the approval of BAAQMD, a partner agency that manages emissions incentive programs. The mitigation offset fee amount will be determined at the time of mitigation to fund one or more emissions reduction projects within the San Francisco Bay Area Air

Basin (SFBAAB). The primary goal for emission reduction projects is to implement them as close to the source of emissions as possible. If this is not feasible, the next preference is to carry out these projects within the city, prioritizing areas that are heavily burdened by pollution. This can be determined using data from the air pollutant exposure zone, CalEnviroScreen, or similar sources. If these options are not viable, the projects should be executed within the larger SFBAAB. The terms and conditions of the MOU will be negotiated prior to groundbreaking of each future construction phase. To qualify under this mitigation measure, the specific emissions reduction project(s) must result in emissions reductions in the SFBAAB that are real, surplus, quantifiable, and enforceable and will not otherwise be achieved through compliance with existing regulatory requirements or any other legal requirement. Funding will need to be received prior to contracting with participants and should allow enough time to receive and process applications to fund off-site reduction projects prior to commencement of the project activities that are being offset.

AMM-AQ-5: Conduct Site-Specific Health Risk Assessments and Implement Measures to Reduce Public Exposure to Emissions

Require future construction located within 1,000 feet of sensitive receptors to perform a health risk assessment (HRA). Sensitive receptors are defined as facilities or land uses that include members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses, who are at a heightened risk of negative health outcomes due to exposure to air pollution. Locations where sensitive receptors congregate are considered sensitive receptor locations, such as housing units, parks, and schools. HRAs would be conducted during PED when construction specifics and sequencing are known. HRAs recommended for multiple mitigation measures may be consolidated for resource efficiency based on specific sites and in alignment with construction sequencing. If the HRA demonstrates health risks would be significant, additional feasible on- and off-site mitigation shall be analyzed to help reduce risks to the greatest extent practicable. Potential measures may include the following:

- Create buffers between residences and construction (e.g., vegetative barriers or other temporary buffers).
- Use construction equipment, including marine equipment, with the highest commercially available tier of emissions controls to the greatest extent practicable (in 2023, this is Tier 4).
- Use equipment during times when receptors are not present (e.g., when school is not in session or during non-school hours), as feasible.
- Establish staging areas for the construction equipment that are as distant as possible from off-site receptors, including existing residences.
- Where feasible, use haul trucks with on-road engines instead of off-road engines, even for on-site hauling.

- Provide financial assistance for high-efficiency air filtration systems to those affected for use in residences.
- Implement dust-suppression site controls to limit the exposure to potential contaminated soils, as necessary. Refer to the Hazardous, Toxic, and Radioactive Waste (HTRW)/soil quality section, as needed.
- Implement other measures to reduce emissions as they become available in the future.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding complaints. This person shall respond and take corrective action within 48 hours. The air district's general air pollution complaints number shall also be visible to ensure compliance with applicable regulations. In addition, the construction schedule and mitigation measures shall be posted. Notices shall be multilingual.

2.2 Changing Meteorological Conditions and Relative Sea Level Change

After detailed construction assessments are conducted, and impacts are identified, if necessary, measures to reduce GHG emissions would be included. Reductions in emissions can be accomplished by the measures listed below, as feasible. The list of strategies were informed by measures recommended by the BAAQMD (2023) to reduce construction-generated GHG emissions; as such, these measures should be updated as project-specific analyses are conducted.

- Require all on-road heavy-duty trucks to be zero-emission vehicles or meet the most stringent emissions standard at the time of construction, such as a model-year (MY) standard, as a condition of contract.
- Minimize idling time, either by shutting equipment off when not in use or reducing the time of idling to no more than 2 minutes (a 5-minute limit is required by the State airborne toxics control measure [Title 13, Sections 2449(d)(3) and 2485 of the California Code of Regulations]). Provide clear signage that posts this requirement for workers at the entrances to the sites and develop an enforceable mechanism to monitor idling time and ensure compliance with this measure.
- Prohibit off-road diesel-powered equipment from being in the "on" position for more than 10 hours per day.
- Use CARB-approved renewable diesel fuel in off-road construction equipment and on-road trucks.
- Use EPA SmartWay-certified trucks for deliveries and equipment transport.
- Require all construction equipment to be maintained and properly tuned in accordance with manufacturer's specifications. Equipment should be checked

by a certified mechanic and determined to be running in proper condition prior to operation.

- Where grid power is available, prohibit portable diesel engines and provide electrical hook-ups for electric construction tools, such as saws, drills, and compressors; use electric tools whenever feasible.
- Encourage and provide carpools, shuttle vans, transit passes, and/or secure bicycle parking to construction workers and offer meal options on-site or shuttles to nearby meal destinations for construction employees.
- Reduce electricity use in construction offices by using LED bulbs, powering off computers every day, and replacing heating and cooling units with more efficient ones.
- Minimize energy used during site preparation by deconstructing existing structures to the greatest extent feasible instead of demolishing structures and discarding all materials.
- Recycle or salvage non-hazardous construction and demolition debris, with a goal of recycling at least 15 percent more by weight than the diversion requirement in Title 24.
- Use locally sourced or recycled materials for construction materials (goal of at least 20 percent, based on costs for building materials and volume for roadway, parking lot, sidewalks, and curb materials). Wood products used should be certified through a sustainable forestry program.
- Use low-carbon concrete, minimize the amount of concrete used, and produce concrete on-site if it is more efficient and lower emitting than transporting ready-mix.
- Develop a plan to efficiently use water for adequate dust control because substantial amounts of energy can be consumed during the pumping of water.

When applicable, purchase local carbon offsets to the greatest extent practicable as required by Federal regulations or USACE policy. Future construction located within 1,000 feet of sensitive receptors would be required to perform a health risk assessment (HRA). If the HRA demonstrates health risks would be significant, additional feasible on- and off-site mitigation shall be analyzed to help reduce risks to the greatest extent practicable. Potential measures may include the following:

- Create buffers between residences and construction (e.g., vegetative barriers or other temporary buffers).
- Use construction equipment with the highest commercially available tier of emissions controls (in 2023, this is Tier 4).
- Use equipment during times when receptors are not present (e.g., when school is not in session or during non-school hours), as feasible.

- Establish staging areas for the construction equipment that are as distant as possible from off-site receptors, including existing residences.
- Where feasible, use haul trucks with on-road engines instead of off-road engines, even for on-site hauling.
- Provide financial assistance for high-efficiency air filtration systems to those affected for use in residences.
- Implement dust-suppression site controls to limit the exposure to potential contaminated soils, as necessary. Refer to the Hazardous, Toxic, and Radioactive Waste (HTRW)/soil quality section, as needed.

2.3 Geology

Avoidance and minimization measures would be used to reduce impacts to soils, sediments, and geology to the greatest extent practicable.

BMPs would be used to manage sediment and erosion during the construction of any of the alternatives. Construction period preparedness and weather condition BMPs control erosion and sediment through management and monitoring that includes:

- Ensuring the contractor has the appropriate equipment and materials available at the start of construction to complete the project within the planned time frame.
- All disturbed areas are treated with erosion control measures.
- Coordination between vegetative planting and grading is in place prior to construction.
- Daily weather monitoring for possible precipitation events and a plan in case of significant rainfall.
- Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control erosion, storm water runoff, sedimentation, and other construction-related pollutants during all phases of construction, until the construction is complete and all disturbed areas are permanently stabilized throughout the project area.

The short-term increase in sediment would be reduced by implementing the following erosion control measures during construction:

- All soils would be stabilized within 14 days of completed work.
- Construction equipment would be limited to the actual area being disturbed and vehicles may not travel in areas outside of designated staging areas or access routes.
- Short-term staging of soil material (less than 1 week) would be surrounded by a silt fence, fiber rolls, or other perimeter.

- Long-term staging of soil material (longer than 1 week) would be placed away from surface waters, vegetated, and surrounded by a levee perimeter to control runoff and erosion.
- Excavation would be limited to the extent practicable. All excavated material that is not relocated to another portion of the project area would be completely removed to a disposal site located outside the study area.
- Existing vegetation would be left in place to the maximum extent possible.
- Bare ground would be monitored for dryness and watered, if necessary, to reduce wind and water erosion.
- The contractor would be required to conduct water quality tests specifically for increases in turbidity and sedimentation caused by in-water construction activities. Water samples for determining background levels would be collected in San Francisco Bay in the vicinity of the construction site. Testing to establish background levels would be performed at least once per day when construction activity is in progress. The contractor would monitor turbidity and settleable solids at least daily and turbidity at least hourly when a turbidity plume is visible. If turbidity limits are exceeded, the contractor would slow the rate of earthwork or use other means to comply with the requirements, including stopping construction activities until the plume has cleared.
- Sediment barriers would be installed on graded or other disturbed slopes, as needed, to prevent sediment from leaving the project sites and entering nearby surface waters.
- The contractor would have a designated vehicle and equipment maintenance staging area that is self-contained to protect groundwater, surface water, and soils from contamination.
- Construction traffic would be restricted to predetermined routes.
- Traffic during wet weather or within the wet zone would be minimized.
- Pivoting excavators would be used within the wet zone to prevent rutting and excess erosion.
- A spill prevention and containment countermeasure plan that addresses all potential mechanisms of contamination would be developed. Suitable containment materials would be on site in the event of a spill. All discarded material and any accidental spills would be removed and disposed of at approved sites.
- Equipment and vehicles operated within the floodway would be checked and maintained daily to leaks of fuels, lubricants, and other fluids to surface

waters. Hardened armoring would be used in areas susceptible to high erosion rates as identified by hydrologic and sedimentation modeling.

2.4 Soils and Mineral Resources

The BMPs described in the Geology Mitigation section is also applicable to reduce impacts to soils in the study area.

2.5 Hydrology and Hydraulics

To reduce overall impacts of in-water construction activities, BMPs described in Geology and Water Quality would be used.

2.6 Water Quality

In order to avoid and/or minimize potential impacts to waters of the U.S. and state, water quality, and biological resources, the following minimum construction BMPs would be implemented as part of the proposed project. These minimum measures would be subject to modification and additions based upon regulatory and resource agency review.

- No debris, trash, creosote-treated wood, soil, silt, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products shall be placed in a location where it would be subject to erosion by rain, wind, or waves and allowed to enter jurisdictional waters, including as a result of fueling activities and storage of hazardous materials.
- No fresh concrete or concrete washings shall enter into jurisdictional waters. Fresh concrete would be isolated until it no longer poses a threat to water quality using appropriate measures, including exclusion of poured concrete from jurisdictional waters, such as open San Francisco Bay waters. Contractor(s) shall use only designated concrete transit vehicle cleanout stations for cleanout.
- Protective measures shall be utilized to prevent accidental discharges to waters during fueling, cleaning, and maintenance.
- Floating booms shall be used to contain debris discharged into waters and any debris shall be removed as soon as possible, no later than the end of each workday.
- Machinery or construction materials not essential for project improvements shall not be allowed at any time in the intertidal zone. The construction contractor shall be responsible for checking daily tide and current reports.
- Well-maintained equipment shall be used.

- A spill prevention contingency plan for hazardous waste spills into San Francisco Bay shall be prepared for review and approval. The plan shall include, at a minimum, floating booms, and absorbent materials to recover hazardous wastes.
- Contractors shall prepare an anchoring plan that applies to all ships, barges, and other open water vessels and describes procedures for deploying, using, and recovering anchorages.

BMPs for construction water-handling procedures and requirements for dewatering discharges in the study area include:

- Dischargers shall not violate any discharge prohibitions contained in applicable Basin Plans or statewide water quality control panels.
- The discharge does not cause or contribute to a violation of any water quality standard.
- The discharge is not prohibited by the applicable Basin Plan.
- The discharger has included and implemented specific BMPs required by their permit to prevent or reduce the contact of the non-stormwater discharge with construction materials or equipment.
- The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants.
- The discharge is monitored and meets the applicable numeric action levels.

2.7 Groundwater

Mitigation and BMPs would be the same as those described in the Water Quality section.

2.8 Aquatic Resources

In order to avoid and/or minimize potential impacts to aquatic resources, the following minimum construction BMPs would be implemented as part of the proposed project. These minimum measures would be subject to modification and additions based upon regulatory and resource agency review.

- Prevent fish entrapment and entrainment during dewatering, such that fish rescue operations shall occur where dewatering and resulting isolation of fish may occur. Fish rescue and salvage operations shall occur prior to and during dewatering. If the enclosed area is wadable (less than 3 ft deep), fish can be herded out of the enclosure by dragging a seine (net) through the enclosure, starting from the enclosed end and continuing to the opening. After completing fish herding, the net or an exclusion screen shall be positioned at

the opening to prevent fish from reentering the enclosure. Screens shall be checked periodically and cleaned of debris to permit free flow of water.

- Sheetpiles, block nets, or other temporary exclusion methods (e.g., silt curtains) could be used to exclude fish or isolate the construction area prior to a fish removal process.
- A dewatering plan shall be submitted as part of the SWPPP and Water Pollution Control Program, detailing the location of dewatering activities, equipment, and discharge point. Dewatering pump intakes shall be screened to prevent entrainment of fish in accordance with the NMFS screen criteria.
- A qualified fish biologist or fish rescue team shall be onsite during the dewatering process to minimize the number of fish that become trapped in isolated areas or impinged on pump screen(s) or isolation nets.
- Prior to any in-water construction that would require pile driving, a NMFS-approved sound attenuation monitoring plan to protect fish and marine mammals, and the approved plan shall be implemented during construction.
- All in-water construction shall be conducted within the environmental work window between June 1 and November 30, designed to avoid potential impacts to fish species.
- A soft start technique (release of pile-driving hammer without hydraulic pressure) to impact hammer pile driving shall be implemented, at the start of each workday or after a break in impact hammer driving of 30 minutes or more, to give fish and marine mammals an opportunity to vacate the area.
- During in-water installation of piles, when feasible, vibratory hammers should be used in place of impact hammers, as well as cushion blocks should be used.
- During in-water installation of piles, when feasible, bubble curtains will be considered for use with impact hammers to reduce impacts to fish.
- Functional grating or glass prisms will be considered in the design for new wharf decking to maximize light transmittance in nearshore zones (first 10-15 feet from the bulkhead).
- During construction near the water, artificial light should be directed away from sensitive habitats and species, to include shielding and/or downward-directed, to prevent disruption to aquatic species.
- Ecological armoring features will be designed to the extent feasible to include tide pools or water-retaining shapes over flat textured panels where practicable to increase surface area for invertebrate prey colonization.

- Rocky intertidal bluffs will be designed to the extent feasible include variable slopes, rather than uniform, to create micro-habitats and velocity refugia for fish.

The USACE and its contractors shall minimize impacts on waters of the U.S. and waters of the state, including wetlands, by implementing the following measures:

- The proposed project shall be designed to avoid, to the extent practicable, work within wetlands and/or waters under the jurisdiction of the USACE, the regional waterboard, the CDFW, and BCDC. If applicable, permits or approvals shall be sought from the regulating agencies as required. Where wetlands or other water features must be disturbed, the minimum area of disturbance necessary for construction shall be identified and the area outside avoided.
- Prior to construction within 50 ft of any wetlands and drainages, appropriate measures shall be taken to ensure protection of the wetland from construction runoff or direct impact from equipment or materials, such as installation of a silt fence, and signs indicating the require avoidance. No equipment mobilization, grading, clearing, or storage of equipment or machinery, or similar activity, shall occur until a qualified biologist has inspected and approved the fencing installed around these features. The contractor shall ensure the temporary fencing is maintained until construction activities cease.
- Where disturbance to jurisdictional wetlands or waters cannot be avoided, any temporarily affected areas shall be restored to pre-construction conditions or better at the end of construction, in accordance with regulating agencies.

2.9 Upland Resources

BMPs described in the Geology and Water Quality mitigation sections would be used to reduce overall impacts to upland resources during construction and maintenance activities.

2.10 Special Status Species

2.10.1 Endangered Species Act

For the purposes of this consultation, the minimum qualifications for a “Qualified Biologist” include a bachelor’s degree in biological or environmental science, natural resources management, or related discipline; field experience in the habitat types that may occur in or adjacent to the work areas; familiarity with the Consultation Species that may occur in or adjacent to the work areas; and prior preconstruction survey, construction monitoring, or construction oversight experience (relevant to the activity to be conducted).

2.10.1.1 General and All Species Measures

1. Construction Hours. Construction activities will be limited to daylight hours, to the maximum extent practicable. If nighttime construction is necessary, including in tidally influenced waters where tides may limit daylight access and work schedules, all project lighting (e.g., staging areas, equipment storage sites, roadway, and construction footprint) will be selectively placed and directed onto the roadway or work area and away from sensitive habitats. Light glare shields will be used to reduce the extent of illumination into sensitive habitats. If the work area is near surface waters, the lighting will be shielded so that it does not shine directly into the water.

2. Environmental Awareness Training. Existing and new personnel engaging in construction activities (construction personnel) will participate in environmental awareness training conducted by a Qualified Biologist prior to engaging in construction activities. Construction personnel will be informed regarding the identification, potential presence, habitat requirements, legal protections, avoidance and minimization measures, and applicable conservation measures for Consultation Species with the potential to occur in or immediately adjacent to the work area. Construction personnel will be informed of the procedures to follow should a Consultation Species be encountered during construction activities. Training may be provided in an online/virtual meeting and a training video developed under the supervision of the Qualified Biologist may be used to train new personnel, as long as a Qualified Biologist is available by phone to answer questions about the training.

3. Environmental Monitoring. A Qualified Biologist(s) will perform work area clearance at the beginning of each day and will monitor construction activities throughout the day in, or immediately adjacent to, sensitive resources and/or Consultation Species habitat, as necessary. The Qualified Biologist will confirm that all applicable conservation measures are implemented during project construction. The Qualified Biologist will have the authority to stop any work if they determine that any permit requirement is not fully implemented or if it is necessary to protect Consultation Species. The Qualified Biologist will prepare and maintain a biological monitoring log of construction work area conditions and observations, which will be kept on file.

4. Work Area and Speed Limits. Construction work and materials staging will be restricted to the smallest area practicable in designated work areas, routes, staging areas, temporary interior roads, or the limits of existing roadways. Prior to initiating construction or grading activities, brightly colored fencing or flagging or other practical means will be erected to demarcate the limits of the project activities, including the boundaries of designated staging areas; ingress and egress corridors; stockpile areas for spoils disposal, soil, and materials; and equipment exclusion zones. Flagging or fencing will be maintained in good repair for the duration of project activities. Posted speed limits on public roadways will be adhered to and speeds will be limited to 20 miles per hour (mph) in the project area on unpaved surfaces and unpaved roads (to reduce dust and soil erosion), or in areas where Consultation Species have the potential

to occur. Speeds greater than 20 mph may be permitted in the project area where Consultation Species are not expected to occur (e.g., in areas where Consultation Species have been excluded) and there is no risk of generating excessive dust (e.g., surfaces are paved, saturated, or have been treated with other measures to prevent dust).

5. Prevent Spread of Invasive Species. The spread or introduction of nonnative, invasive plant species will be avoided. Equipment will be cleaned of any sediment or vegetation at designated wash stations before entering or leaving work areas to avoid spreading pathogens or nonnative invasive species. Wash sites must be in confined areas that limit runoff to any surrounding habitat, and on a flat grade. Upland areas will use rice straw or invasive species-free local slash/mulch for erosion control; the remainder of the project area will use certified, weed-free erosion control materials. Mulch must be certified weed-free. Construction personnel will be educated on weed identification and the importance of controlling and preventing the spread of invasive weeds.

6. Equipment Maintenance and Materials Storage. Vehicle traffic will be confined to existing roads and the proposed access route(s). All machinery must be in good working condition, showing no signs of fuel or oil leaks. Oil, grease, or other fluids will be washed off at designated wash stations prior to entering work areas. Inspection and evaluation for the potential for fluid leakage will be performed daily during construction. All fuel and chemical storage, servicing, and refueling will be done in an appropriate staging area with secondary containment to prevent spills from traveling to surface water or drains. Staging areas for equipment storage and maintenance, construction materials, fuels, lubricants, solvents, and other possible contaminants, will have a stabilized entrance and exit and will be at least 100 feet from waterbodies, unless site-specific circumstances do not provide such a setback; in such cases, the maximum setback possible will be used. Fluids will be stored in appropriate containers with covers and will be properly recycled or disposed of off-site. Machinery stored in work areas will have pans or absorbent mats placed underneath potential leak areas.

7. Material Disposal. All refuse, debris, unused materials, and supplies that cannot reasonably be secured will be removed daily from the work area and deposited at an appropriate disposal or storage site. All construction debris will be removed from the work area immediately on project completion.

8. Fugitive Dust Reduction. To reduce dust, construction vehicles will be speed-restricted as described in #4, Work Area and Speed Limits, when traveling on nonpaved surfaces. Stockpiled materials susceptible to wind-blown dispersal will be covered with plastic sheeting or other suitable material to prevent movement of the material. During construction, water (e.g., trucks, and portable pumps with hoses) or other approved methods will be used to control fugitive dust as needed. Dust suppression activities must not result in a discharge to waterbodies.

9. Trash Removed Daily. During project activities all trash, especially food-related refuse that may attract potential predators or scavengers, will be properly contained in sealed containers, removed from the work area, and disposed of daily.

10. Project Cleanup after Completion. Work pads, temporary falsework, and other construction items will be removed from the work area by the end of the construction window. Removal of materials must not result in discharge to waterbodies.

11. Preconstruction Surveys. If Consultation Species and/or their habitat is present in or adjacent to a work area, a Qualified Biologist will conduct visual preconstruction surveys within 5 days prior to beginning construction to protect the species and habitat from avoidable construction-related disturbance. If construction activities at a given work area cease for more than 24 hours, and there is potential for Consultation Species to reoccupy habitat in or adjacent to that work area, the Qualified Biologist will resurvey the work area prior to resuming construction and implement applicable protection measures.

12. Airborne Noise Reduction. Equipment (including the noise abatement systems) will be maintained in good working order. Muffler (or spark arrester) damage must be promptly remedied.

13. Encounters with Species. If Consultation Species are observed, the Qualified Biologist will notify the Service within 24 hours of the observation, and a Qualified Biologist will monitor all construction activities conducted in or adjacent to the species habitat.

2.10.1.2 California Ridgway's Rail Specific Measures

Rail 1. If the rail is detected during preconstruction surveys, activities adjacent to tidal marsh areas will be avoided during the rail breeding season from February 1 through August 31 each year.

2.10.1.3 Salt Marsh Harvest Mouse Specific Measures

Mouse 1. Where a work area is in or adjacent to suitable habitat for the mouse, vegetation within the footprint of the work area plus a two-foot buffer will be removed under the supervision of a Qualified Biologist using only hand tools and operated equipment (e.g., string trimmers, high brush mowers, rakes). Only the minimum amount of vegetation necessary to implement effective mouse exclusion will be removed.

2.10.1.4 Longfin Smelt (San-Francisco Bay-Delta DPS) Specific Measures

Smelt 1. In-water work will be conducted during the general in-water work window for the San Francisco Bay: June 1 to November 30. This will avoid and minimize effects to migratory and spawning adults, incubation, and larval transport phases. Note: Once a cofferdam is in place and dewatered, the dry side of the site is no longer subject to the in-water work window.

Smelt 2. Dewatering activities will be monitored by a Qualified Biologist and any water intakes will be screened down to 20mm (> ¼ inch). The Qualified Biologist will have the authority to stop work if any smelt are observed.

2.10.1.5 California Seablite Specific Measures

Seablite 1. A minimum 50-foot work avoidance buffer around all seablite plants will be clearly delineated with flagging or field markers, and a buffer of at least 300 feet will be used for any staging areas of all equipment for storage, fueling, and maintenance.

2.10.2 Essential Fish Habitat

This section outlines avoidance and minimization measures (AMMs), best management practices (BMPs), and conservation measures proposed by the USACE to avoid and minimize potential project effects on federally listed species and their habitat within the action area, including steelhead, chinook salmon, green sturgeon, critical habitat, and EFH.

These proposed measures are reflective of criteria established by the USACE for standard practices in construction activities and conditions of Biological Opinions for other San Francisco projects with similar activities.

2.10.2.1 Aquatic Resources

- Prevent fish entrapment and entrainment during dewatering, such that fish rescue operations shall occur where dewatering and resulting isolation of fish may occur. Fish rescue and salvage operations shall occur prior to and during dewatering. If the enclosed area is wadable (less than 3 ft deep), fish can be herded out of the enclosure by dragging a seine (net) through the enclosure, starting from the enclosed end and continuing to the opening. After completing fish herding, the net or an exclusion screen shall be positioned at the opening to prevent fish from reentering the enclosure. Screens shall be checked periodically and cleaned of debris to permit free flow of water.
- Sheet piles, block nets, or other temporary exclusion methods (e.g., silt curtains) could be used to exclude fish or isolate the construction area prior to a fish removal process.
- A dewatering plan shall be submitted as part of the SWPPP and Water Pollution Control Program, detailing the location of dewatering activities, equipment, and discharge point. Dewatering pump intakes shall be screened to prevent entrainment of fish in accordance with the NMFS screen criteria.
- A qualified fish biologist or fish rescue team shall be onsite during the dewatering process to minimize the number of fish that become trapped in isolated areas or impinged on pump screen(s) or isolation nets.

- Prior to any in-water construction that would require pile driving, a NMFS-approved sound attenuation monitoring plan to protect fish and marine mammals shall be implemented during construction.
- All in-water construction shall be conducted within the environmental work window between June 1 and November 30, designed to avoid or minimize potential impacts to fish species.
- A soft start technique (release of pile-driving hammer without hydraulic pressure) to impact hammer pile driving shall be implemented, at the start of each workday or after a break in impact hammer driving of 30 minutes or more, to give fish and marine mammals an opportunity to vacate the area.
- During in-water installation of piles, when feasible, vibratory hammers should be used in place of impact hammers, as well as cushion blocks should be used.
- During in-water installation of piles, when feasible, bubble curtains will be considered for use with impact hammers to reduce impacts to fish.
- Functional grating or glass prisms will be considered in the design for new wharf decking to maximize light transmittance in nearshore zones (first 10-15 feet from the bulkhead).
- During construction near the water, artificial light should be directed away from sensitive habitats and species, to include shielding and/or downward-directed, to prevent disruption to aquatic species.
- Ecological armoring features will be designed to the extent feasible to include tide pools or water-retaining shapes over flat textured panels where practicable to increase surface area for invertebrate prey colonization.
- Rocky intertidal bluffs will be designed to the extent feasible include variable slopes, rather than uniform, to create micro-habitats and velocity refugia for fish.

The USACE and its contractors shall minimize impacts on waters of the U.S. and waters of the state, including wetlands, by implementing the following measures:

- The Recommended Plan shall be designed to avoid, to the extent practicable, work within wetlands and/or waters under the jurisdiction of the USACE, the regional waterboard, the California Department of Fish and Wildlife, and the Bay Area Conservation and Development Commission. Permits or approvals shall be sought from the regulating agencies as required. Where wetlands or other water features must be disturbed, the minimum area of disturbance necessary for construction shall be identified and the area outside avoided.
- Prior to construction within 50 ft of any wetlands and drainages, appropriate measures shall be taken to ensure protection of the wetland from construction

runoff or direct impact from equipment or materials, such as installation of a silt fence, and signs indicating the required avoidance. No equipment mobilization, grading, clearing, or storage of equipment or machinery, or similar activity, shall occur until a qualified biologist has inspected and approved the fencing installed around these features. The contractor shall ensure the temporary fencing is maintained until construction activities cease.

- Where disturbance to jurisdictional wetlands or waters cannot be avoided, any temporarily affected areas shall be restored to pre-construction conditions or better at the end of construction, in accordance with regulating agencies.

2.10.2.2 Water Quality

In order to avoid and/or minimize potential impacts to waters of the U.S. and state, water quality, and biological resources, the following minimum construction BMPs would be implemented as part of the proposed project. These minimum measures would be subject to modification and additions based upon regulatory and resource agency review.

- Unless otherwise specified in the project biological opinion, in-water construction activities shall be restricted to the NOAA approved environmental work window (June 1 to November 30).
- No debris, trash, creosote-treated wood, soil, silt, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products shall be placed in a location where it would be subject to erosion by rain, wind, or waves and allowed to enter jurisdictional waters, including as a result of fueling activities and storage of hazardous materials.
- No fresh concrete or concrete washings shall enter into jurisdictional waters. Fresh concrete would be isolated until it no longer poses a threat to water quality using appropriate measures, including exclusion of poured concrete from jurisdictional waters, such as open San Francisco Bay waters. Contractor(s) shall use only designated concrete transit vehicle cleanout stations for cleanout.
- Protective measures shall be utilized to prevent accidental discharges to waters during fueling, cleaning, and maintenance.
- Floating booms shall be used to contain debris discharged into waters and any debris shall be removed as soon as possible, no later than the end of each workday.
- Machinery or construction materials not essential for project improvements shall not be allowed at any time in the intertidal zone. The construction contractor shall be responsible for checking daily tide and current reports.
- Well-maintained equipment shall be used.

- A spill prevention contingency plan for hazardous waste spills into San Francisco Bay shall be prepared for review and approval. The plan shall include, at a minimum, floating booms, and absorbent materials to recover hazardous wastes.
- Contractors shall prepare an anchoring plan that applies to all ships, barges, and other open water vessels and describes procedures for deploying, using, and recovering anchorages.

BMPs for construction water-handling procedures and requirements for dewatering discharges in the project area include:

- Dischargers shall not violate any discharge prohibitions contained in applicable Basin Plans or statewide water quality control panels.
- The discharge does not cause or contribute to a violation of any water quality standard.
- The discharge is not prohibited by the applicable Basin Plan.
- The discharger has included and implemented specific BMPs required by their permit to prevent or reduce the contact of the non-stormwater discharge with construction materials or equipment.
- The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants.
- The discharge is monitored and meets the applicable numeric action levels.

2.10.2.3 Sediments and Erosion Control

BMPs would be used to manage sediment and erosion during the construction. Construction period preparedness and weather condition BMPs control erosion and sediment through management and monitoring that includes:

- Ensuring the contractor has the appropriate equipment and materials available at the start of construction to complete the project within the planned time frame.
- All disturbed areas are treated with erosion control measures.
- Coordination between vegetative planting and grading is in place prior to construction.
- Daily weather monitoring for possible precipitation events and a plan in case of significant rainfall.
- Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control erosion, storm water runoff, sedimentation, and other construction-related pollutants during all phases of construction, until the

construction is complete and all disturbed areas are permanently stabilized throughout the project area.

The short-term increase in sediment would be reduced by implementing the following erosion control measures during construction:

- All soils would be stabilized within 14 days of completed work.
- Construction equipment would be limited to the actual area being disturbed and vehicles may not travel in areas outside of designated staging areas or access routes.
- Short-term staging of soil material (less than 1 week) would be surrounded by a silt fence, fiber rolls, or other perimeter.
- Long-term staging of soil material (longer than 1 week) would be placed away from surface waters, vegetated, and surrounded by a levee perimeter to control runoff and erosion.
- Excavation would be limited to the extent practicable. All excavated material that is not relocated to another portion of the project area would be completely removed to a disposal site located outside the project area.
- Existing vegetation would be left in place to the maximum extent possible.
- Bare ground would be monitored for dryness and watered, if necessary, to reduce wind and water erosion.
- The contractor would be required to conduct water quality tests specifically for increases in turbidity and sedimentation caused by in-water construction activities. Water samples for determining background levels would be collected in San Francisco Bay in the vicinity of the construction site prior to construction. Water samples in the San Francisco Bay in the vicinity of the construction site would be collected at least once per day when construction activity is in progress to compare with background/base levels. The contractor would monitor turbidity and settleable solids at least daily and turbidity at least hourly when a turbidity plume is visible. If turbidity limits are exceeded, the contractor would slow the rate of earthwork or use other means to comply with the requirements, including stopping construction activities until the plume has cleared.
- Sediment barriers would be installed on graded or other disturbed slopes, as needed, to prevent sediment from leaving the project sites and entering nearby surface waters.
- The contractor would have a designated vehicle and equipment maintenance staging area that is self-contained to protect groundwater, surface water, and soils from contamination.
- Construction traffic would be restricted to predetermined routes.

- Traffic during wet weather or within the wet zone would be minimized.
- Pivoting excavators would be used within the wet zone to prevent rutting and excess erosion.
- A spill prevention and containment countermeasure plan that addresses all potential mechanisms of contamination would be developed. Suitable containment materials would be on site in the event of a spill. All discarded material and any accidental spills would be removed and disposed of at approved sites.
- Equipment and vehicles operated within the floodway would be checked and maintained daily to leaks of fuels, lubricants, and other fluids to surface waters. Hardened armoring would be used in areas susceptible to high erosion rates as identified by hydrologic and sedimentation modeling.

2.10.2.4 Noise

Best practices to minimize construction noise include the following:

- Limiting heavy equipment use to daytime hours not regulated by San Francisco, between 7:00 a.m. and 8:00 p.m.
- Limiting pile driving to times of day that would be least disruptive to residences, hotels, motels, hospitals, or convalescent homes.
- Locating stationary equipment (e.g., generators, pumps, cement mixers, idling trucks) as far as possible from noise-sensitive land uses.
- Requiring that all construction equipment powered by gasoline or diesel engines have sound-control devices, such as exhaust mufflers, that are at least as effective as those originally provided by the manufacturer and that all equipment be operated and maintained to minimize noise generation.
- Using equipment powered by electric motors instead of gasoline- or diesel-powered engines.
- Preventing excessive noise by shutting down idle vehicles or equipment.
- Using noise-reducing enclosures around noise-generating equipment.
- Using noise-reducing shrouds for impact pile drivers, where feasible.
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (e.g., terrain, structures) to block sound transmission to noise-sensitive land uses. The barriers should be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment.

2.10.2.5 Vibration

Measures to reduce ground-borne vibration from pile driving include:

Using smaller, lower vibration generating equipment within 100 feet of potentially affected buildings.

- Using alternative pile-driving methods such as vibratory hammers, hydraulic press-in driving, or use of predrilled pile holes.
- Preparing a pile driving schedule that includes driving method(s), locations, pile types, sizes, number of blows and times of day that driving would be done.
- Conducting vibration monitoring at potentially affected buildings to measure levels from vibration-producing activities.
- Prepare a building conditions report prior to and after construction for potentially affected buildings. If new cracks or damages are found, the construction contractor would remediate building damages found to occur during construction.
- Coordinating with managers of buildings containing sensitive equipment to determine actions for avoiding impacts on vibration-sensitive equipment, based on specifications of equipment and hourly/daily schedule of use.

2.10.3 Marine Mammal Protection Act

NOAA Fisheries Office of Protected Resources and USACE have agreed to complete Marine Mammal Protection Act consultation during PED when additional project details are known and a complete application for Incidental Take Authorization can be made. Conservation measures, avoidance and minimization measures, and BMPs related to species protected by the Marine Mammal Protection Act with the potential to occur in or near the project area will be developed during PED.

2.11 Noise and Vibration

The following AMMs can be implemented to reduce impacts due to construction noise and vibration.

AMM-NOI-1 Use Best Noise Control Practices during Construction

The U.S. Army Corps of Engineers will prepare a noise control plan that will specify methods the contractor will implement to minimize construction equipment noise levels at sensitive receptors (i.e. residences, hotels, schools, parks, outdoor recreational use areas, and outdoor commercial use areas). Additional analysis on construction phasing, duration, and the location of measures will inform a site-specific evaluation of the noise control measures most appropriate for implementation.

Best practices to minimize construction noise include the following.

- Limiting heavy equipment use to daytime hours not regulated by the City, between 7:00 a.m. and 8:00 p.m.
    - Limiting pile driving to times of day that would be least disruptive to residences, hotels, motels, hospitals, or convalescent homes.
- Locating stationary equipment (e.g., generators, pumps, cement mixers, idling trucks) as far as possible from noise-sensitive land uses.
- Requiring that all construction equipment powered by gasoline or diesel engines have sound-control devices, such as exhaust mufflers, that are at least as effective as those originally provided by the manufacturer and that all equipment be operated and maintained to minimize noise generation.
- Using equipment powered by electric motors instead of gasoline- or diesel-powered engines.
- Preventing excessive noise by shutting down idle vehicles or equipment.
- Using noise-reducing enclosures around noise-generating equipment.
- Using noise-reducing shrouds for impact pile drivers, where feasible.
- Selecting haul routes that affect the fewest number of people.
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (e.g., terrain, structures) to block sound transmission to noise-sensitive land uses. The barriers should be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment.
- Notifying adjacent residents in advance of construction work regarding duration of construction and mitigation employed. Notices would include liaison contact information and would be multilingual.

AMM-NOI-2 Vibration Control

Prior to construction, the construction contractor will designate a community liaison to respond to complaints about vibration caused by construction of adaptation measures. Through the community liaison, the contractor will provide notification to all property owners and occupants of buildings within 200 feet of pile-driving locations at least 10 days prior to the start of construction informing them of the estimated start date and duration of vibration-generating construction activities. These notifications will also be provided to buildings containing vibration sensitive equipment within 800 feet of pile-driving locations.

For demolition of structures, the contractor will provide notification through the community liaison to all property owners and occupants of buildings within 25 feet of demolition areas at least 10 days prior to the start of construction, informing them of the estimated start date and duration of demolition at the site. Notices would include liaison

contact information and would be multilingual. These notifications will also be provided to buildings containing vibration sensitive equipment within 125 feet of demolition sites.

- The following measures will be implemented on a case-by-case basis to address potential vibration impacts to structures during construction:
- Evaluate potential for damage to individual buildings from ground borne vibration based on vibration criteria in Table 1-3. This evaluation should be done for buildings within 200 feet of pile driving sites and/or buildings within 25 feet of demolition sites.
- At vibration-sensitive buildings identified to be potentially affected during pile-driving or demolition, conduct vibration monitoring during pile-driving or demolition as applicable.
- Prepare a building condition report prior to and after pile-driving or demolition for potentially affected buildings. If new cracks or damages are found, the contractor will remediate building damages found to occur.
- Coordinate with managers of buildings containing sensitive equipment to determine actions for avoiding impacts on vibration-sensitive equipment, based on specifications of equipment and hourly/daily schedule of use.
- Additional measures to reduce groundborne vibration from pile driving include:
- Using smaller, lower vibration generating equipment within 200 feet of potentially affected buildings.
- Using alternative pile-driving methods such as vibratory hammers, hydraulic press-in driving, or use of predrilled pile holes.
- Preparing a pile driving schedule that includes driving method(s), locations, pile types, sizes, number of blows and times of day that driving would be done.

2.12 Cultural Resources

The USACE is executing a Programmatic Agreement (PA) that outlines the procedures for the identification, discovery, evaluation, and mitigation of historic properties. The PA stipulates that after the initiation of the PED Phase, and upon receipt of funding, the USACE will prepare a Research Design that would provide an overarching research framework for Section 106 compliance and agreement implementation undertaken for the project. The Research Design would be developed in consultation with the SHPO, the Tribes, and all consulting parties, and would provide implementation guidelines for developing historic property treatment plans, which would be used to address resource specific mitigation measures.

The USACE and the Port of San Francisco have conducted a preliminary inventory of known cultural resources, both aboveground and archaeological. Investigations to be conducted prior to construction may result in the identification of previously unrecorded historic properties. Furthermore, construction activities may result in the discovery of

historic properties. The mitigation of historic properties may be necessary following an evaluation of impacts to determine if any historic properties would be adversely affected. Adverse effects may include direct physical impacts from construction, noise, changes to resource settings, degradation of resource integrity, and other impacts that may affect the character of historic properties. If there are known sites in the construction area, USACE would implement mitigation measures, follow stipulations of the PA, and develop plans in the Research Design that would set forth the means for protecting historic properties or specifying treatment measures to minimize or mitigate the adverse effects. USACE may implement mitigation or treatment measures described in the Research Design prior to construction, during construction, or after construction is completed, as appropriate. If previously unidentified archaeological sites are found during construction, USACE would adhere to the stipulations of the PA to determine NRHP eligibility and effects findings. For properties eligible for NRHP listing, USACE will identify and implement mitigation measures in consultation with the parties to the PA. If unmarked burials are encountered during construction, the stipulations in the PA for respectful treatment and steps for notifying authorities will be followed.

Because the project includes non-Federal lands, it must conform to State of California procedures for the treatment of human remains. Therefore, any human remains, or related items, discovered during implementation of this project would be treated in accordance with the requirements of Section 7050.5(b) of the California Health and Safety Code. If, pursuant to Section 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are or may be of Native American origin, then the discovery would be treated in accordance with the provisions of Section 5097.98(a)–(d) of the Public Resources Code. USACE shall ensure that the remains are not damaged or disturbed further until all stipulations in Section 7050.5 and Section 5097.98 have been met.

If USACE determines that there are no viable plans that would avoid an adverse effect finding, the USACE shall work with Consulting Parties to identify possible mitigation measures to resolve adverse effects. Creative mitigation measures shall be considered when possible in order to provide meaningful mitigation for the stakeholders and the public. Plans for mitigation will be detailed in a Historic Properties Treatment Plan (HPTP). The HPTP will outline the minimization and mitigation measures necessary to resolve the adverse effects to historic properties. Development of appropriate measures shall include consideration of historic property types and provisions for avoidance or protection of historic properties where possible.

Possible mitigation measures may include, but are not limited to, data recovery; HABS/HAER/HALS documentation; preservation of selected eligible archaeological sites and incorporating them into heritage tourism plans while allowing others to be lost; burying sites under fill or incorporating them into the undertaking; syntheses of existing information of similar archaeological properties, periods, or types in a region or area; educational programs; virtual or web-based reports or educational media that otherwise would not be produced; preservation plans; public education and outreach, including signage and museum exhibits; interpretive documents; the use of digital and other media technologies including films and scanning of resources and artifacts; inclusion of cultural landscape perspectives; use of paleoenvironmental data to develop landscape

evolution models for both scientific and public information and/or to inform native planting or landscape plans as part of the undertaking; new historical contexts, including indigenous perspectives, of areas or regions; combinations of any of these or other mitigations as agreed upon by the Signatories and Consulting Parties.

HPTPs may be developed for individual or multiple historic properties and will include the agreed-upon methods for mitigating adverse effects.

2.13 Socioeconomics and Community

The following avoidance, minimization, and mitigation measures would be required for all alternatives.

AMM-CIA-1: EIS Outreach and Communication

Outreach and communication of impacts throughout the design and construction phases during the following stages: (1) Consideration of adverse effects and potential project design modifications; (2) Identification of substantial effects, and; (3) Development of mitigation. The Port and/or USACE will also conduct additional outreach and communication to unhoused persons during the design and construction phases. An outreach plan for unhoused persons will be developed, in coordination with local agencies and non-profit organizations that work with underserved communities and those experiencing homelessness.

AMM-CIA-2: *Note: Redundant with AMM TR-1, TR-2, TR-3, and TR-4 (see Annex D.1.4, Transportation). Reference kept to maintain numbering, but text deleted.*

AMM-CIA-3: Construction Loading Zones

Loading areas within active construction zones will be relocated as close to the construction zone as practical. Temporary loading zones may be possible under some circumstances.

AMM-CIA-4: Access Change Notices and Coordination

Advanced notice and coordination with emergency service providers and school officials will minimize potential temporary impacts from access changes, routing and scheduling. USACE and the City will coordinate with service providers as design and phasing is further developed.

AMM-CIA-5: Utility Relocation and Notification

Utility lines will be relocated by the utility companies, in coordination with the City. Potentially affected utility customers will be notified of potential service disruptions before relocation.

AMM-CIA-6: Targeted Outreach

Targeted outreach to businesses in the project area will take place to accommodate the loading/unloading needs of each business.

AMM-CIA-7: Homeless Outreach

The City will conduct targeted outreach to homeless persons within the construction area to notify them at least three days in advance of construction activities.

AMM-CIA-8: Property Acquisition

Where project construction requires displacement, the City will ensure fair and equitable treatment of affected persons related to relocation assistance and real property acquisition per the Uniform Relocation Assistance and Real Property Acquisition Policies Act.

AMM-CIA-9: Relocation Implementation Plan

If required, a relocation implementation plan will be prepared to support affected property owners in the event of real property acquisition (could apply to utilities).

2.14 Transportation

In order to avoid or minimize impacts to transportation during construction and operations, the following measures would be implemented as part of the project alternatives. The design, construction sequencing, and operations and maintenance of the project would be revisited during the preconstruction, engineering, and design phase (PED), which develops detailed designs to prepare the project for construction, to determine if the potential impacts were considered and disclosed in the Final Environmental Impact Statement from the study, and that mitigation measures were developed appropriately. If it is determined during PED that any new reasonably foreseeable environmental effects could occur as a result of the project, supplemental National Environmental Policy Act (NEPA) analysis may be required.

AMM-TR-1: Prepare Construction Transportation Management Plans (CTMP) for construction of the Project.

A series of CTMPs would be prepared as the actions are planned, in consultation with appropriate agencies (City of San Francisco, SFMTA, WETA, Caltrans, BART, SamTrans, Golden Gate Transit, Muni, Caltrain and HSR) to determine safe access to and movement through the Project area during construction for all transportation uses. Mitigation for traffic and transit disruption will be developed under coordination with the impacted agencies. As the project is further refined and advanced, implementation and responsible agencies would be identified. These plans will be prepared based on the specific location, duration, and work space needed for a given project activity. Plans will include a communication plan for agencies and public. The communication plan would include details for notifying persons adjacent to construction activities, construction duration, mitigations implemented, persons to call for questions or complaints, and should be multilingual.

The CTMP would include project-specific information on expected hours of construction, duration of construction at a given location, and will include measures such as:

compliance with SFMTA blue book for Regulations for Working in San Francisco Streets

identification of road and/or lane, bike path, sidewalk closures; bus and transit route or stop modification, if any; bus bridges if needed for rail transit; and identification of any detour routes or temporary infrastructure for different travel modes

emergency services alternative routes for essential services

delivery vehicle access to local businesses

coordination with San Francisco Unified School District and other local schools to ensure safe access to school for students, faculty, and the public

identify construction truck haul routes for transport of construct materials, waste disposal for heavy construction vehicles

identify off-street parking for construction related vehicles

coordination with SFMTA and other City agencies on the development of a robust public outreach plan

when detours for transit, other vehicles, and/or pedestrians and bicyclists are implemented, require that police officers or parking control officers monitor critical locations along the detour to promote unobstructed travel by vehicular traffic, transit, and people walking and bicycling as needed

require contractors to provide carpool, bicycle, walk and transit access for construction workers that meets Americans with Disabilities Act (ADA) requirements; and

the construction contractor(s) shall submit a project corridor segment-specific emergency access response plan as part of compliance with bid specifications. This plan shall include fire department and emergency service access to construction areas and maintain access for emergency services such as fire hydrants.

Please see AMM-CIA-3 regarding Construction Loading Zones; AMM-CIA-4 regarding Access Change Notices and Coordination; and AMM-CIA-6 for Targeted outreach to local businesses.

AMM-TR-2: Include Pedestrian Access in CTMP

Maintain access on existing sidewalks and trails in the waterfront area. Provide suitable detour routes if construction will obstruct pedestrian routes. Any pedestrian detours would need to comply with Americans with Disabilities Act (ADA). Coordinate with SFMTA on pedestrian access and potential obstructions to pedestrian movement. Coordinate with MTC on Bay Trail access and potential detours. A performance standard would be developed with SFMTA to evaluate whether adequate pedestrian access is provided during construction.

AMM-TR- 3: Include Bicycle Access in CTMP

Maintain access on existing bike lanes and pathways through the Project area during construction or provide a satisfactory detour for bicycles. Coordinate with SFMTA on bicycling routing and any potential detours. Coordinate with MTC on Bay Trail access

and potential detours. A performance standard would be developed with SFMTA to evaluate whether adequate bicycle access provides is provided during construction.

AMM- TR- 4: Include Transit Access in CTMP

Maintain access or provide alternative route and stops to transit within the waterfront area. Coordinate with SFMTA, BART, SamTrans, Golden Gate Transit, Muni, and any other local transit service providers. The public will be notified of any changes in transit routes or access during construction. A performance standard would be developed with SFMTA to evaluate whether alternative transit access, including paratransit access, provides adequate service to transit users of the affected routes during construction.

AMM- TR-5: Include water traffic management in CTMP

Maintain access or provide temporary locations to docks and piers utilized for boarding and operations of public ferries, public recreational vessels, private vessels, and freight boats. Include coordination with relevant parties including WETA, Golden Gate Ferry, and San Francisco Bay Ferry.

AMM- TR-6: Restrict Construction Hours

Limit construction work that must occur between 8:00 p.m. and 7:00 a.m. Any work that is needed between these times will need to comply with applicable noise and vibration measures.

AMM-TR-7: Coordinate with the City of San Francisco for major public events

Coordinate with the City of San Francisco on major public events that may reduce or restrict construction to allow efficient transportation for larger crowds.

AMM-TR-8: Coordinate with the City of San Francisco and Transit Agencies for roadway access

This measure could include coordination on elements that increase redundancy in the transportation network, such as epanding transit, bike and pedestrian infrastructure.

For Alternatives where transit and roadway access has changed substantially, the USACE and the Port will coordinate closely with the City and transit agencies on the need for modifications to the City's transportation system in response to areas that might otherwise be isolated by construction of the measures. During the PED phase, design engineers will coordinate with transportation agencies and where minor changes can be made to minimize impacts, these will be incorporated into the design. This could include, for instance, minor modifications to alignment of levees to one side of an existing road so as not to affect traffic once constructed. Prior to implementation of any measures that cause permanent changes or lengthy construction disruptions to the roadway system, coordination will occur to identify modifications to the transit and roadway system and incorporate planning for these measures into the future City and Caltrans transportation network. Examples of areas to be evaluated would include areas such as reconfiguration of the I-280 on/off ramps at Cesar Chavez Street, or to the approaches to the Bay Bridge, as well as changes to circulation patterns with narrowing

of the Embarcadero or incorporation of changes to Terry Francois Blvd, or the bridges over Mission and Islais Creeks.

AMM-TR-9: Coordinate with the City of San Francisco and rail agencies for rail access

For Alternatives where railroad access and related infrastructure are changed substantially, the USACE and the Port will coordinate closely with the City and agencies that utilize railroad tracks throughout the project area. These agencies include, but are not limited to, SFMTA, Caltrain, BART, and Union Pacific Railroad. During the PED phase, design engineers will coordinate with the appropriate transportation agencies and where minor changes can be made to minimize impacts, these will be incorporated into the design. These design changes should aim to increase redundancy in the transportation network for rail, bicycle and pedestrian infrastructure to avoid significant impacts during construction. This coordination will include transit route and operations and maintenance facility access. Operations and maintenance facilities could include railroad access to vehicle storage yards, maintenance-of-way infrastructure, vehicle service and cleaning facilities. The Kirkland Yard and Muni Metro East (MME) facility access are of particular importance to service vehicles and infrastructure. This coordination would also include minor changes to designs to minimize impacts to related transit infrastructure, such as communication systems, electrical supply, and safety systems, among other transportation infrastructure, for existing transit operations.

2.15 Utilities

No mitigation for utilities would be needed for implementation of this project.

2.16 Recreation and Access

No mitigation for recreation and access would be needed for the implementation of the project.

2.17 Aesthetics

No mitigation measures were identified for aesthetic resources. Elements were considered during the design of the features that would mitigate overall aesthetic impacts.

2.18 Hazardous, Toxic, and Radioactive Waste

Hazardous, toxic, and radioactive waste (HTRW) considerations are rigorously governed by Federal, state and local laws. These include the Pollution Prevention Act (42 USC 13101 et seq.), Clean Water Act Section 311, Occupational Safety and Health Act (29 USC 651 et seq./29 CFR Part 1910), Comprehensive Environmental Response, Compensation, and Liability Act 42 USC 9601 et seq./40 CFR Part 300), Resource Conservation and Recovery Act (42 USC 6901 et seq./40 CFR Part 261-265), Toxic Substances Control Act (15 USC 2601 et seq./40 CFR Parts 700-799), Local Bay

Protection and Toxic Cleanup Program Legislation of 1989, and USACE Engineering Regulation (ER) 1165-2-132.

ER 1165-2-132 sets forth policy guidelines related to investigation and treatment and handling of HTRW:

- Civil Works project funds are not to be employed for HTRW related activities except as provided herein, or otherwise specifically provided in law.
- Construction of Civil Works projects in HTRW-contaminated area should be avoided where practicable.
- Where HTRW contaminated areas or impacts cannot be avoided, response actions must be acceptable to EPA and applicable state regulatory agencies.
- For cost-shared projects, the local sponsor shall be responsible for ensuring that the development and execution of Federal, state, and/or locally required HTRW response actions are accomplished at 100 percent non-project cost. No cost sharing credit will be given for the cost of response actions.
- During the Feasibility Phase, alternative project plans may consider avoidance of HTRW as well as possible responses. At least one alternative plan should be formulated to avoid HTRW sites to the maximum extent possible, consistent with project objectives. These assessments, conducted during the feasibility stage, are shared with the local sponsor for cost-shared studies.

All requirements, avoidance and minimization measures, and BMPs set forth in these laws and regulations will be strictly adhered to.

2.19 Land Use Planning

The following avoidance, minimization, and mitigation measures would be required for all alternatives. AMMs in other sections including Noise, Air Quality, Socioeconomics and Communities, and Transportation will minimize effects on land uses during project construction.

AMM-LU-1: Planning Agency Coordination and Plan Revisions

The USACE and Port would coordinate with SF Planning and appropriate agencies such as BCDC to coordinate plan revisions and public outreach regarding any land uses that will be changed as a result of the project. This would include planning for parcels or portions of parcels that are planned for retreat and inundation by San Francisco Bay waters and may be removed from the City of San Francisco's plans or plans modified to acknowledge the foreseen changes in zoning areas or to modify current designations.

AMM-LU-2: Public Outreach and Communication

Outreach and communication with the public will be required throughout the life of the project, in particular as construction approaches and during construction. Preparation of a living Communication Plan to coordinate public outreach and communication of project activities including construction schedules and attendant road, lane, or sidewalk

closures, and identification of community liaisons for contact during construction will be coordinated with USACE, Port and City.

2.20 Public Health and Safety

No mitigation for public health and safety would be needed for implementation of the project.

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CA

ANNEX D.5.2 BAY CONSERVATION AND DEVELOPMENT COMMISSION COMMITMENT LETTER

JANUARY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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U.S. Army Corps of Engineers
Galveston District
2000 Fort Point Road
Galveston, Texas 77550
Attn: Raven Blakeway

Re: San Francisco Waterfront Coastal Flood Study Coastal Zone Management Act consistency determination, Letter of Support from the San Francisco Bay Conservation and Development Commission

Dear Ms. Blakeway,

The San Francisco Waterfront Coastal Flood Study (SFWCFS) is a feasibility study being undertaken by the U.S. Army Corps of Engineers (USACE) in partnership with the Port of San Francisco (the Port), with the San Francisco Bay Conservation and Development Commission (BCDC) as a participating California State agency, among other agencies. This feasibility study analyzes the coastal flooding risk and effects of sea level rise for the 7.5 miles of waterfront within the Port's jurisdiction, from Aquatic Park to Heron's Head Park. The SFWCFS is one of several coordinated waterfront resilience activities being undertaken in partnership with federal, state, and local agencies to plan for anticipated seismic activity, flooding, and sea level rise. The study identifies waterfront vulnerabilities and recommended strategies to reduce current and future seismic and flood risks for consideration for federal investment and implementation along the Port's entire 7.5-mile jurisdiction.

The SFWCFS Recommended Plan adaptively manages seismic and coastal flood risk through a suite of structural and non-structural measures that function as a system and are implemented over time, based on risk along the San Francisco waterfront. The plan is divided into four reaches based on geomorphology and hydrology and risk. Reach 1 relies primarily on non-structural measures such as floodproofing, building demolition and relocation, while reaches 2, 3, and 4 each prioritize shoreline protection with several structural measures including raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. The system will be designed to comply with seismic standards and includes soil and ground stability improvements for all structural measures. Since the Recommended Plan is adaptive to future conditions, an adaptive management plan has been developed to monitor future conditions and provide thresholds when adaptive measures should be implemented.

BCDC, USACE, and the Port have coordinated on the proposed study. BCDC has reviewed the general concepts for each reach of the San Francisco waterfront and the proposed measures. As evidenced by our letter of support for the inclusion of the project in the Water Resources Development Act, BCDC supports the project moving through the feasibility phase into the

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environmental review, and planning, engineering, and design (PED) phase. We are committed to working with the Port and USACE to refine the project so that it is consistent with the San Francisco Bay Coastal Zone Management Program, which includes the McAteer Petris Act, and the San Francisco Bay Plan applicable and enforceable policies.

As the study has not reached the pre-engineering, design, and construction (PED) stage and the concepts are very preliminary, detailed information about project design and construction, and the potential effects to the Coastal Zone have not yet been identified or analyzed. Consistency determinations, broadly, are prepared when sufficient information has been developed to reasonably determine the consistency of the activity with BCDC's approved coastal management plan. We believe a phased consistency determination would be appropriate for this project as it would allow the USACE and the Port to provide complete information on areas for which it has analyzed and developed plans and designs, while allowing further planning and development to occur on other sections of the Waterfront.

In order to review a consistency determination, it must include a detailed description of the proposed activity and foreseeable effects to the Coastal Zone, comprehensive data, analysis, and information sufficient to support consistency determination review. When this level of detail is not available, a phased consistency approach provides that the federal activity is consistent at the early stage of planning, while anticipating that additional information and decisions will be developed in later phases, such as PED, and will be subject to further consistency review. The phased consistency affords the USACE and BCDC the opportunity to work towards full consistency as project design proceeds. Each specific measure in the recommended plan will have details of design and construction which must be determined before effects on the coastal zone can be fully evaluated. Also, over the period of implementation, adaptive management responses to changes in technology, varied site conditions, and project performance might result in refinements to the plan measures. The phased consistency will help expedite future efforts to evaluate effects to the coastal zone and ensure compliance with BCDC's coastal management plan.

Continued close collaboration between USACE and BCDC staff can ensure the project is consistent with the Commission's San Francisco Bay Coastal Zone Management Program. Proceeding by way of the phased consistency determination assures that both our agencies can be successful in meeting our missions.

I look forward to continuing a close collaboration between our organizations. If you have any questions, please contact me at (415) 352-3653 or via email at larry.goldzband.bcdc.ca.gov, or my staff, Ben Dorfman at (415) 352-3627 and benjamin.dorfman@bcdc.ca.gov and Brenda Goeden at (415) 352-3623 and brenda.goeden@bcdc.ca.gov.

Sincerely,

Larry Goldzband

9/24/2025

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LAWRENCE J. GOLDZBAND
Executive Director
San Francisco Bay Conservation
and Development Commission

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Browsers (for SIGNERS):	Internet Explorer 6.0?, Mozilla FireFox 1.0, NetScape 7.2 (or above)
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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

SUB-APPENDIX D.6

ENDANGERED SPECIES ACT AND MAGNUSON-STEVENS FISHERY CONSERVATION MANAGEMENT ACT COMPLIANCE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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D.6.1: U.S. Fish and Wildlife Services (USFWS) Biological Assessment

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.6.1
U.S. FISH AND WILDLIFE SERVICES BIOLOGICAL ASSESSMENT

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
2488 E 81ST ST
TULSA, OKLAHOMA 74137

July 8, 2025

Dr. Stephanie Millsap
U.S. Fish and Wildlife Service
San Francisco Bay Delta Fish and Wildlife Office
650 Capital Mall, Suite 8-300
Sacramento, CA 95814

Dear Dr. Millsap,

The U.S. Army Corps of Engineers Tulsa District (USACE), in partnership with the Port of San Francisco, is conducting the San Francisco Waterfront Coastal Flood Study (SFWCFS) as authorized under Section 110 of the Rivers and Harbors Act of 1950, Public Law (Pub. L.) 515, 64 stat. 163, Section 142 of the Water Resources Development Act (WRDA) of 1976, Pub. L. 94-587, 90 stat. 2917, 2930, as amended by Section 705 of WRDA 1986, Pub. L. 99-662, 100 stat. 4082, 4158, and Section 203 of WRDA 2020. The study's purpose is to recommend an alternative to reduce flooding risks along the waterfront by considering coastal storms, extreme high tides, and relative sea level change scenarios.

A Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR/EIS) was prepared to present the findings and recommendations and disclose the potential impacts on the human and natural environment if the Tentatively Selected Plan (TSP) were implemented (Enclosure). The DIFR/EIS was released for public and agency review from January 26 through March 29, 2024. Since publication of the draft, the USACE has been preparing the Final Integrated Feasibility Report and Environmental Impact Statement (FIFR/EIS). The Recommended Plan (i.e., TSP in the DIFR/EIS), the Total Net Benefits Plan, is a hybridization of alignments that maximized cost effectiveness and benefits across the study area. The Recommended Plan manages coastal flood risk through a suite of structural (e.g., wharfs, seawalls, floodwalls, levees) and non-structural (e.g., floodproofing, retreat, building demolition) measures that function as a system and are implemented over time, based on the risk of rising sea levels.

A Biological Assessment (BA) was prepared to analyze the impacts of implementing the project and surrounding action area (Enclosure). The USACE requests to initiate informal consultation under Section 7(a)(2) of the Endangered Species Act for the SFWCFS (Project Code: 2022-0082557). Based on the enclosed analysis, the USACE has determined the action ***may affect but is not likely to adversely affect*** California ridgeway's rail (*Rallus obsoletus obsoletus)*, California least tern (*Sterna antillarum browni*), marbled murrelet (*Brachyrampuhus marmoratus*), longfin smelt (*Spirinchus thaleichthys)*, salt marsh harvest mouse (*Reithrodontomys raviventris)*, and California seablite (*Suaeda californica*) because all effects to the species and their habitat would be insignificant and discountable. The USACE reviewed the impacts to proposed Northwestern pond turtle (*Actinemys marmorata*) and monarch butterfly (*Danaus plexippus*) and determined the project ***would not jeopardize the continued existence*** of either species due to the lack of suitable habitat in the action area.

In addition to those, the USACE made ***no effect*** determinations for Western snowy plover (*Charadrius nivosus nivosus*), Alameda whipsnake (*Masticophis lateralis euryxanthus*), San Francisco garter snake (*Thamnophis sirtalis tetrataenia*), green sea turtle (*Chelonia mydas*), California red-legged frog (*Rana draytonii*), Tidewater goby (*Eucyclogobius newberryi*), Franciscan manzanita (*Arctostaphylos franciscana),* Marin dwarf-flax (*Hesperolinon congestum*), presidio clarkia (*Clarkia franciscana*), presidio manzanita (*Arctostaphylos hookeri var. ravenii*), robust spineflower (*Chorizanthe robusta var. robusta*), San Francisco lessignia (*Lessingia germanorum*), showy Indian clover (*Trifolium amoenum*), Sonoma sunshine (*Blennosperma bakeri*), and white-rayed pentachaeta (*Pentachaeta bellidiflora*) due to lack of suitable habitat and use of the action area. As such, the USACE is requesting concurrence on the effects determination of the enclosed BA through informal consultation.

If you have any questions or need additional information to conduct your review, please contact Dr. Raven Blakeway, Biologist, Environmental Branch, Regional Planning and Environmental Center, at 409-790-9058 or Raven.Blakeway@usace.army.mil.

Sincerely,

Brandon Wadlington on behalf of

Robert Morrow
Chief, Environmental Branch
Southwestern Regional Planning and
Environmental Center

Enclosures

San Francisco Waterfront Coastal Flood Study, CA

Biological Assessment for U.S. Fish and Wildlife Service Federally-listed Threatened and Endangered Species

San Francisco

San Francisco County, California

July 2025

Prepared by:

United States Army Corps of Engineers

Southwestern Regional Planning and Environmental Center

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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EXECUTIVE SUMMARY

This project intends to investigate the feasibility of managing tidal and fluvial flooding and relative sea level change (RSLC) along 7.5-miles of the San Francisco Waterfront, from Aquatic Park to Heron's Head Park, in the City of San Francisco, San Francisco County, California. The San Francisco Waterfront Coastal Flood Study (SFWCFS) was originally authorized under Section 110 of the Rivers and Harbors Act of 1950, Public Law (Pub. L.) 515, 64 stat. 163. The project was subsequently authorized under Section 142 of the Water Resources Development Act (WRDA) of 1976, Pub. L. 94-587, 90 stat. 2917, 2930, as amended by Section 705 of WRDA 1986, Pub. L. 99-662, 100 stat. 4082, 4158 and Section 203 of WRDA 2020. An array of alternatives was formulated that would reduce flooding risks along the waterfront by considering the three U.S. Army Corps of Engineers (USACE) RSLC curve scenarios (low, intermediate, high), coastal storms, extreme high tides, alignment of the line of defense relative to the existing shoreline, and adaptability of the design to address higher sea levels if certain thresholds are triggered after construction.

The proposed action is the Total Net Benefits Plan (TNBP), a hybridization of alignments that maximized cost effectiveness and benefits across the study area. The TNBP, or Recommended Plan, manages coastal flood risk through a suite of structural and non-structural measures that function as a system and are implemented over time, based on the risk of rising sea levels. The system is divided into four reaches based on hydrology and risk. Reach 1 relies primarily on non-structural measures such as floodproofing, retreat, and building demolition, while reaches 2, 3, and 4 each prioritize protection at the existing shoreline with several structural measures including raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. Additionally, the system will be designed to comply with seismic standards and includes ground improvements for all structural measures. This Biological Assessment discusses the presence and status of Endangered Species Act listed threatened and endangered species in the Action Area by U.S. Fish and Wildlife (USFWS), evaluates the impacts expected to these species for the proposed action, and makes a final determination on the effects anticipated for those species.

INTRODUCTION

This Biological Assessment (BA) has been prepared to assess effects of the proposed action to U.S. Fish and Wildlife Service (USFWS) protected species under Section 7 of the Federally Endangered Species Act (ESA) to fulfill requirements of the U.S. Army Corps of Engineers, Tulsa District (USACE) to evaluate impacts of Federal actions of ESA species and designated critical habitats.

The Proposed Action requiring this assessment is a Department of Army feasibility study that is investigating the viability of alternatives and recommending proposed activities for the purposes of managing tidal and fluvial flooding and relative sea level change (RSLC) along 7.5-miles of the San Francisco Waterfront, San Francisco County, California. The purpose of this BA is to review USACE's study in sufficient detail to determine to what extent the proposed activities may affect species listed as threatened, endangered, or candidate along with any designated or proposed critical habitat in the Action Area. This BA presents technical information about the proposed actions and assesses potential effects to ESA species and their habitats, as well as identifies ESA species that have the potential to be directly or indirectly affected by the proposed project. The proposed project is located along 7.5-miles of the San Francisco Waterfront, from Aquatic Park to Heron's Head Park, in the City of San Francisco, San Francisco County, California. The study is authorized under Section 110 of the Rivers and Harbors Act of 1950, Section 142 of the Water Resources Development Act (WRDA) of 1976, as amended by Section 705 of WRDA 1986, and Section 203 of WRDA 2020.

This BA is prepared in accordance with legal requirements set forth under regulations implementing Section 7 of the ESA (50 CFR Part 402; 16 U.S.C. 1536 (c)).

Project Location

The study area extends approximately 7.5 miles from Aquatic Park in the northeast to just past Heron's Head Park in the south. The study area is divided into four reaches for evaluating environmental impacts (Figure 1). These reaches were chosen based on hydrologic separability, identifiable geographic references, specific wave action within each reach, and major differences in physical structure inventory. These reaches also provide a neighborhood-scale approach to communicate risks, impacts, and alternatives. Reach delineations included:

- **Reach 1:** Covers Aquatic Park, Fisherman's Wharf, Pier 31 to Pier 35, and the North Beach neighborhood.
- **Reach 2:** Includes the Northeast Waterfront and Financial District. This area comprises a significant portion of the Embarcadero Historic District and includes popular sites such as the Exploratorium, Embarcadero Promenade, and the San Francisco Ferry Building.
- **Reach 3:** Contains South Beach, Mission Creek, Mission Rock, Mission Bay and Pier 70, and includes the South Beach, SoMa, and Mission Bay neighborhoods. This area is known for the Giants' baseball stadium, Chase Center, and access to Mission Creek and the Bay. It is one of the densest residential areas within the study area.

- **Reach 4:** Encompasses Pier 80, Islais Creek, Cargo Way, Pier 96, and Heron's Head Park. This area is comprised of industrial uses along the waterfront and provides critical industrial, maritime, and commercial Port functions.

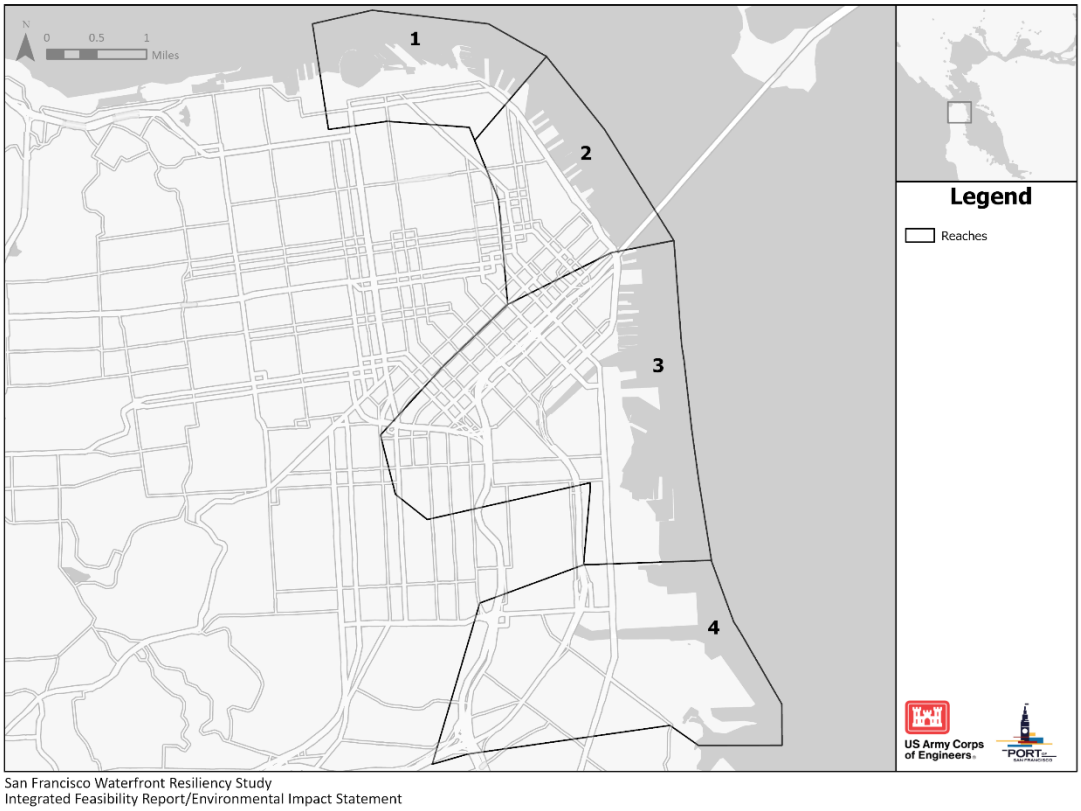


Figure 1. Project location in San Francisco, CA outlining the four reaches of the study area.

Definition of the Action Area

The regulations governing consultations under the ESA define the "Action Area" as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (51 F.R. 19957). Therefore, the Action Area is typically larger than the project area directly affected by the Proposed Action. The Action Area includes the project area and an additional 1.5-mile buffer into San Francisco Bay (Figure 2).

The Action Area contains two wetland areas at Pier 94 and Heron's Head Park. In addition to these wetland areas, the Action Area is largely developed urban land areas including commercial, residential, and industrial infrastructure, with man-made parks and green spaces in distinct locations. All construction operations are expected to occur within the Action Area.

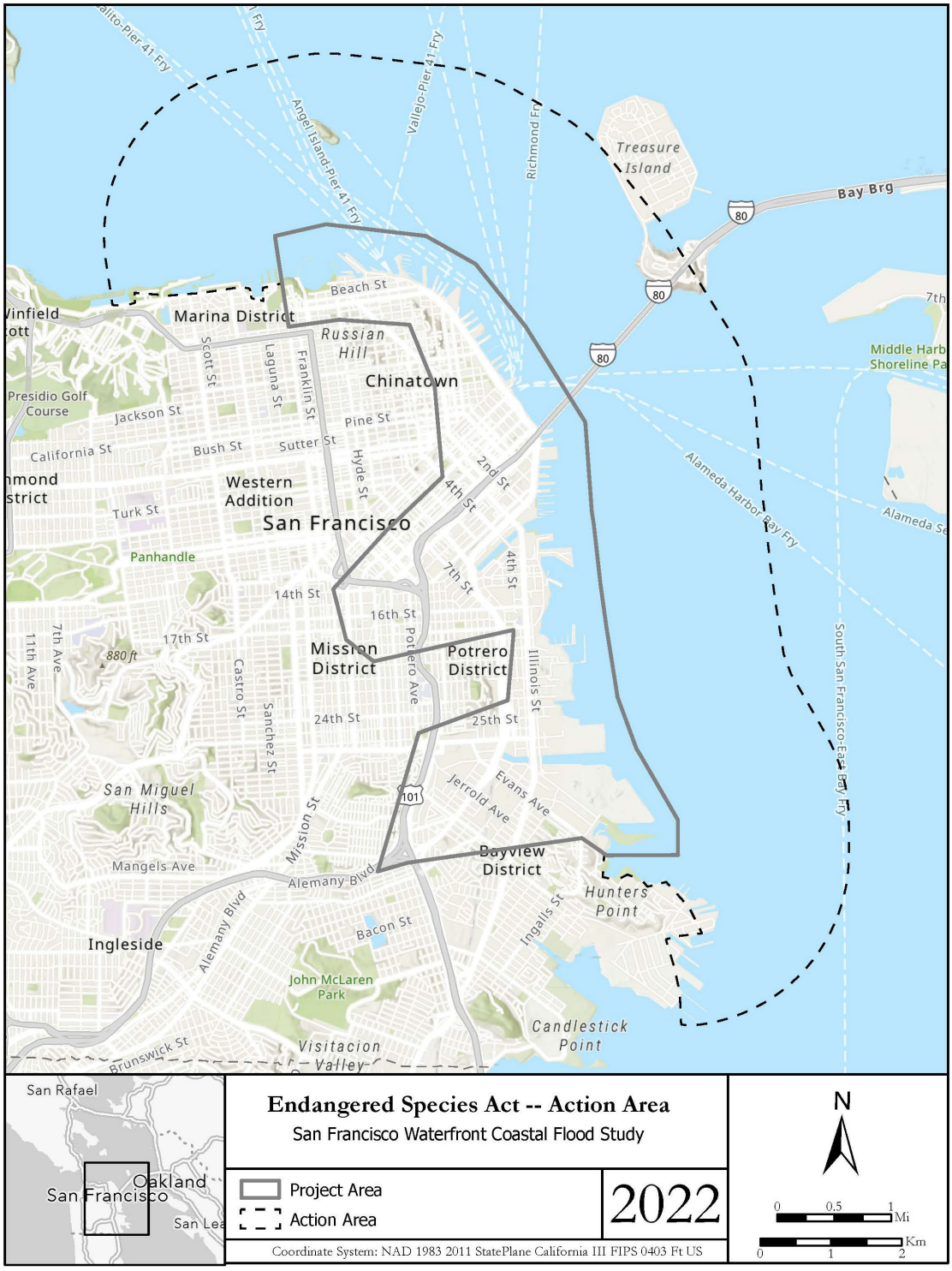


Figure 2. Action Area for the proposed project. Solid grey line shows the study area while the hashed black line indicates the buffer to comprise the Action Area.

PROPOSED ACTION

As mentioned above, the proposed action includes a combination of measures: non-structural methods (i.e., floodproofing, retreat, building demolition); raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. Table 1 provides a summary of the measures proposed within each reach of the Recommended Plan.

Table 1. Measures within each reach of the Recommended Plan

Measure	Reach 1	Reach 2	Reach 3	Reach 4
Floodproofing	•	•	•	
Deployable		•	•	•
Elevate Structures		•	•	•
Relocate Structures				•
Remove Structures				•
Curb Wall	•	•	•	
Elevate Shoreline		•	•	
Seawall		•	•	•
T-wall			•	•
Elevate/Rebuild Wharf		•	•	•
Paved Levee			•	
Planted Levee with EWN Features		•	•	•
Sheet Pile Wall with EWN Features				•
EWN – Marsh/Coarse Beach Restoration			•	•
EWN – Rocky Intertidal Bluff		•		
EWN – Living Seawalls		•	•	•
Bay Fill		•		
Ground Improvements		•	•	•

The project map provides an overview of where proposed features would occur along the San Francisco waterfront, simplified to polygons of the construction footprint (Figure 3). Detailed maps are provided in the following sections that define the measures occurring in each reach,

with anticipated construction footprint, and include a description of how measures are assumed to be constructed.

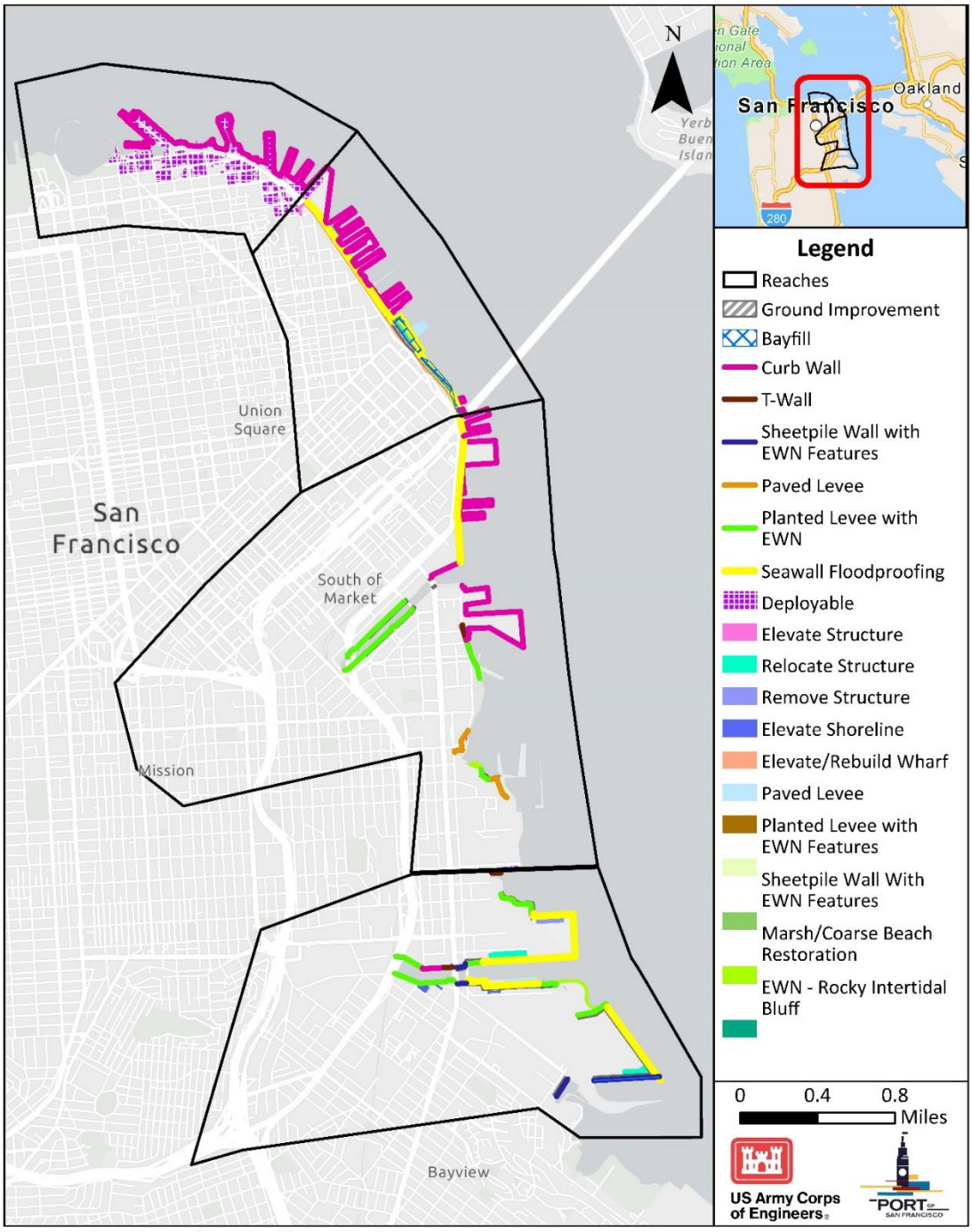


Figure 3. Overview of footprint for the Recommended Plan

A description of the construction activities for the proposed action are provided in the following sections below. Approximate spatial extent (e.g., linear feet, acres) for the construction footprint

are provided in Table 2. A general description of the construction methods and equipment, as well as anticipated duration for construction is provided below.

Table 2. Recommended Plan measure quantities.

Measure	Linear Feet (LF)	Square feet (ft^2)	Acres
Floodproofing	--	2,835,000	65
Deployable	--	50,000	1
Elevate Structures	--	750,000	17
Relocate Structures	--	175,000	4
Remove Structures	--	195,000	4
Curb Wall	51,200	--	--
Elevate Shoreline	11,500	1,030,000	24
Seawall	21,000	--	--
T-wall	1,000	--	--
Elevate/Rebuild Wharf	10,900	660,000	15
Paved Levee	1,800	80,000	2
Planted Levee with EWN Features	11,800	865,000	20
Sheet Pile Wall with EWN Features	2,900	20,000	0
EWN – Marsh/Coarse Beach Restoration	--	225,000	5
EWN – Rocky Intertidal Bluff	--	85,000	2
Living Seawalls	TBD	--	--
Bay Fill	--	395,000	9
Ground Improvements	38,400	--	--

**Note: Linear feet (LF) are rounded to the nearest 100 feet, square feet (ft^2) are rounded to the nearest 5,000 ft^2, and acres are rounded to the nearest whole number. Values denoted as "—" indicate the measurement was not calculated or applicable.*

There are common construction techniques that would be applied across an array of measures, thus, are summarized here to avoid repetitive descriptions:

- **Cast-in-place concrete** is poured into removable forms (or castings) erected on site and cured in the concrete's finished position. Temporary forms or castings would be constructed on site and would be reinforced with steel. Most formwork would be composed of steel, aluminum, and wood. Ready mixed concrete would be delivered via large cement trucks and poured into the castings with a truck chute, bucket, or pump. The concrete is left to cure in the castings before removal. Once cured, casting materials would need to be removed and reused for another measure or hauled off and disposed of.
- **Cofferdams** are an enclosure that allows water to be pumped out to establish a dry working environment. A cofferdam would be constructed from steel sheet piles with interior bracing. Sheet piles would be driven into the sediment in the bay through hydraulic or pneumatic tools, braced internally with waler beams and compression struts to keep the wall from collapsing. Braces would be installed using heavy machinery from work barges in the bay. Inside of the cofferdam would be un-watered and dewatered with a combination of surface pumps/sumps and deep wells as necessary to create a dry and stable work environment. Once construction completes, the cofferdam would be disassembled and removed. For simplicity, it was assumed cofferdams would be installed across 50 linear ft at a time.

Proposed Measures by Reach

Reach 1

Reach 1 focuses on nonstructural measures that move people and assets away from the flood risk. Nonstructural measures reduce consequences of flooding and allow water to disperse naturally rather than constructing traditional structural solutions. In Fisherman's Wharf, the Recommended Plan relies on floodproofing buildings and infrastructure and installing curb walls to floodproof the piers (Figure 4).



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Figure 4. Proposed Action Reach 1.

Reach 2

Along the Embarcadero, the Recommended Plan elevates the shoreline in place by raising and reconstructing the bulkhead seawalls and pile-supported wharves north of the Bay Bridge to a finish elevation of 15.5 feet NAVD88, while gradually transitioning down from the new shoreline elevation back to the existing city grade to retain visual and physical access to the waterfront (Figure 5). The plan includes reconstruction of the full Embarcadero roadway right-of-way – surface design of the Embarcadero roadway and promenade would be determined in future project phases. The Ferry Building and bulkhead buildings are raised in place following construction of new pile supported foundations (wharves). Piers are floodproofed with concrete curbs around the perimeter to reduce flood risk. Engineering with Nature® (EWN®) features

have been incorporated into some of the designs to support the long-term resiliency of the structural measures proposed while providing natural features to enhance the aquatic habitats.

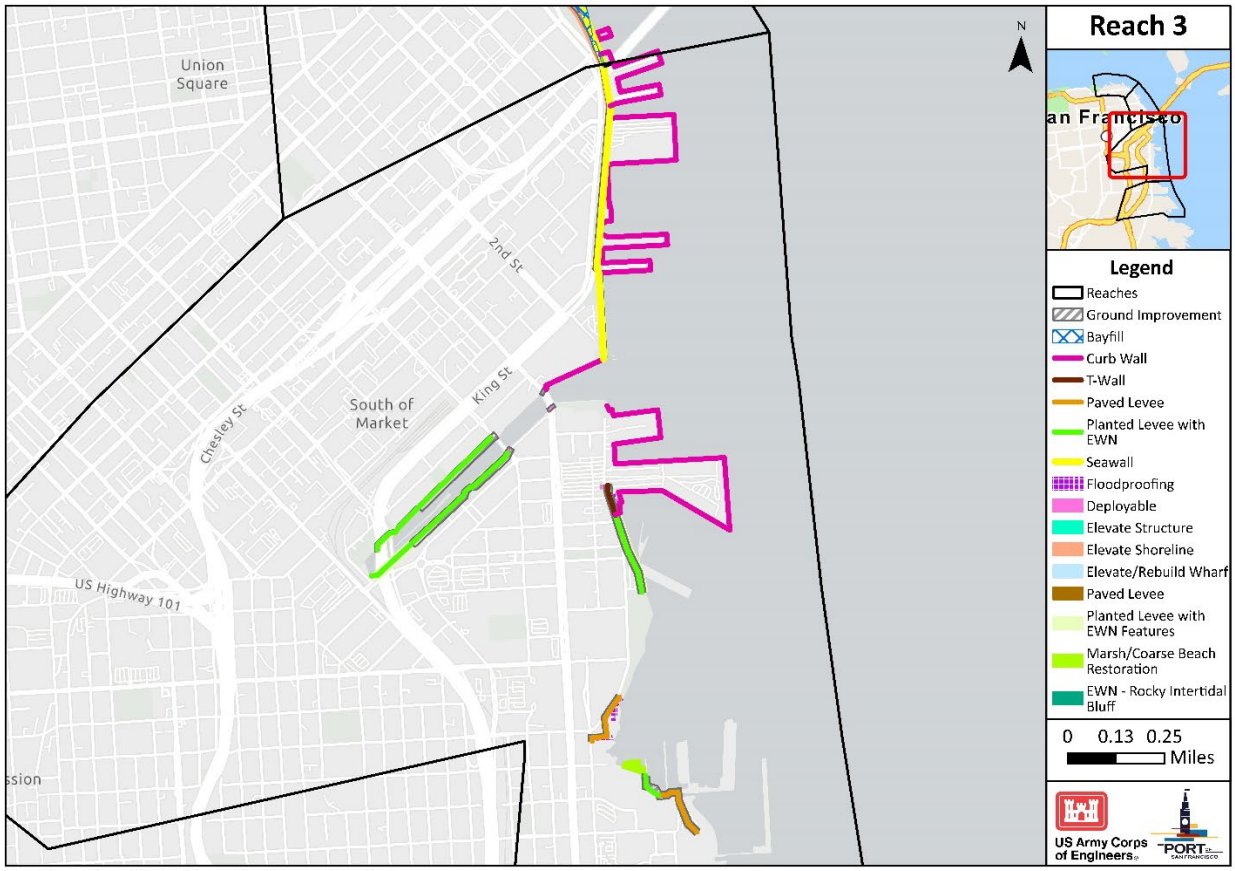


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Figure 5. Proposed Action Reach 2.

Reach 3

In the Mission Creek / Mission Bay geography, the Recommended Plan defends existing city and community assets in place by elevating the creek and Bay shorelines to a finished elevation of 13.5 feet NAVD88 with raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls, natural and nature-based features, and closure structures (Figure 6). The coastal defense will tie into existing and planned high ground at Bayfront, Agua Vista, and Crane Cove Parks, and at the Mission Rock and Pier 70 development areas. The plan also includes partial reconstruction of the Embarcadero roadway south of the Bay Bridge to manage elevation change in this constrained urban area.

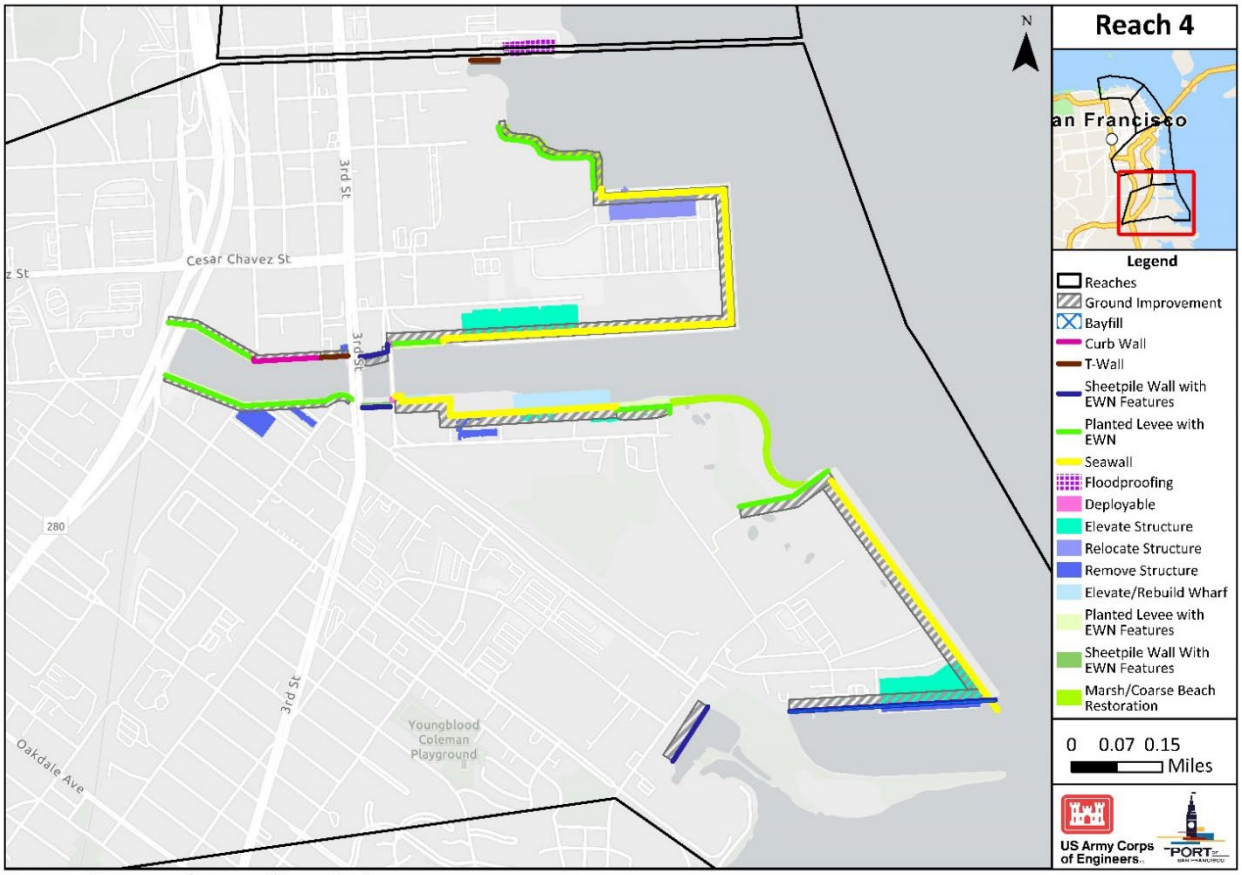


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Figure 6. Proposed Action Reach 3.

Reach 4

In the Islais Creek / Bayview geography, the Recommended Plan defends the existing shoreline to retain residential and commercial land uses in place, including Port land uses and maritime facilities. The flood defenses consist of raising the shoreline using bulkhead seawalls, levees, natural and nature-based features, floodwalls, closure structures, and tying into existing or planned high ground, near Potrero Power Station and behind the Pier 94 Wetlands (Port backlands). This area of the waterfront contains large parcels independent of the combined sewer system, such that the elevated shoreline will require modification to handle stormwater in a safe and effective manner (Figure 7).



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Figure 7. Proposed Action Reach 4

Measure Descriptions

Floodproofing

There are two types of floodproofing – wet and dry floodproofing. As the name implies, wet floodproofing allows floodwaters to enter the structure, while, in contrast, dry floodproofing prevents the entry of floodwaters. Dry floodproofing is proposed for industrial and commercial properties and critical infrastructures and wet floodproofing is proposed for residential structures.

Wet floodproofing measures involve permanent or temporary measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure. Generally, this includes properly anchoring the structure, using flood resistant materials below the Base Flood Elevation, relocating and/or protecting mechanical and utility equipment, and use of openings or breakaway walls to avoid structural damage due to hydrostatic pressure and to allow flows to enter and exit the structure. Wet floodproofing is practical only for portions of a structure that are not used for living spaces, such as basements, elevated structures, crawlspaces, or attached garages.

Floodproofing activities would be completed in phases based on flooding frequency over a given period. Those with imminent risk would be completed first and properties where the risk rises as

sea levels rise would be floodproofed when appropriate. They type of floodproofing would be structure dependent. Each structure would be evaluated independently of the others for what would be the most appropriate and least invasive method of flood protection possible that would still retain the integrity of the structure.

Many of the properties in the study area are considered historic and are eligible or listed on National Register of Historic Places under the National Historic Preservation Act. For these historic structures, the National Park Service's "Guidelines on Flood Adaptation" will be used to aid in identification of appropriate measures to increase flood resiliency while meeting the Secretary of the Interior's Standards for Rehabilitation and preserving the property's historic features, spaces, materials, site, and setting.

Deployable

Deployable gates would be used to close the openings at bridges and where additional tie into high ground is needed during high water events, while allowing continued vehicular, pedestrian, and rail access at all other times. A range of potential deployables may be used depending on the location, type of access needed, frequency of use, anticipated flooding conditions, operation and maintenance needs, etc. and may include swing gates, roller gates, flip up barriers, or other removable deployables (Figure 8).

Permanent deployables are designed for temporary deployment during storm events or king tides. Typically, they are constructed of structural steel elements with a steel plate skin and tied into the adjacent flood protection measures (i.e., levee or vertical wall). Swing gates are attached to a reinforced column of a flood wall with hinges on one side, while rolling gates rest and roll on a ground wheel carrier or track along the gate sill.

When closed, compressible seals along the bottom and sides of the gate seal against the wall and sill to resist water infiltration. Depending on the height and width, additional bracing can be placed on the dry side of the gate to help it withstand the pressure of the water. Gates can have the option for a manual cranking system to close depending on size, but many times a motorized opening/closing device is required. Traffic control measures would be added to the bridges to warn of gate deployment when activated.



Figure 8. Example of permanent deployable flood gates.

Elevated Structures

Structure elevation involves raising each structure to a higher elevation to reduce the risk of flooding during high-water events. To do this, the structure is separated from its foundation and temporarily raised in place with hydraulic jacks. The new foundation system, such as fill, columns, posts, piers, or raised foundation walls, would be constructed and then the structure lowered into place on the new foundation system. The goal is to ensure the lowest habitable

floor is at or above the base of flood elevation or higher. Selection of proper elevation method depends on flood characteristics such as flood depth or velocity.

Relocate/Remove Structures

Structures may be removed from the existing location to eliminate the potential flood risk or to make room for the proposed flood protection system. Structures identified for relocation will be physically relocated or rebuilt in another location off-site to be determined during the preconstruction, engineering, and design phase (PED). Structures identified for removal will be permanently removed and not rebuilt in place or elsewhere.

For structures being relocated, the structure may be transported in whole or disassembled and then reassembled at the new location. For whole structure transport, the structure is typically done by attaching a temporary steel framework under the structure to support it, then lifted off the foundation using a network of hydraulic jacks placed under the framework and controlled by a unified jacking system. Once the structure is at a sufficient height, hydraulic dollies or a flatbed trailer(s) are placed under the supporting framework. These are used to move the structure to the new location. After the move, the steps are reversed, and the structure is lowered.

In some instances, buildings being relocated would require modifications to allow for moving, and to make structural improvements to meet current building codes and standards once re-established on their new foundation. This is most likely to apply to historic bulkhead and shed building structures that are part of the Embarcadero Historic District.

For structures being permanently removed, the material would need to be removed and disposed of. This will require heavy machinery such as wrecking balls, excavators, and bulldozers. Additionally, the building debris will need to be hauled off using large trucks or barges to an appropriate disposal facility.

Curb Wall

A curb wall is a short wall, approximately two feet tall and no more than one-foot wide, made of reinforced concrete that will be connected to existing gray infrastructure (e.g., wharfs, piers, seawalls) to minimize floodwater entry into adjacent structures (Figure 9). The curb wall will be fixed to a concrete deck or capping beam along the perimeter of the main structure. For the feasibility study, the curb wall was assumed to be constructed of either cast-in-place concrete or precast concrete elements which are attached mechanically, both of which would include some type of water stop integrated to ensure an acceptable seal against seepage. During the PED phase, other elements such as glass or clear polymer panel that would provide similar functionality may be considered to minimize visual impacts from the land or Bay.

If cast-in-place concrete is used it would be constructed by pouring concrete into removable forms (or castings) erected on site and cured in the structure’s finished position. Temporary forms or castings would be constructed on site and would be reinforced with steel. Most formwork would be composed of steel, aluminum, and wood. Ready mixed concrete would be delivered via large cement trucks and poured into the castings with a truck chute, bucket, or pump. The concrete is left to cure in the castings before removal. Once cured, casting materials would be removed and reused for another location or measure or hauled off for disposal.

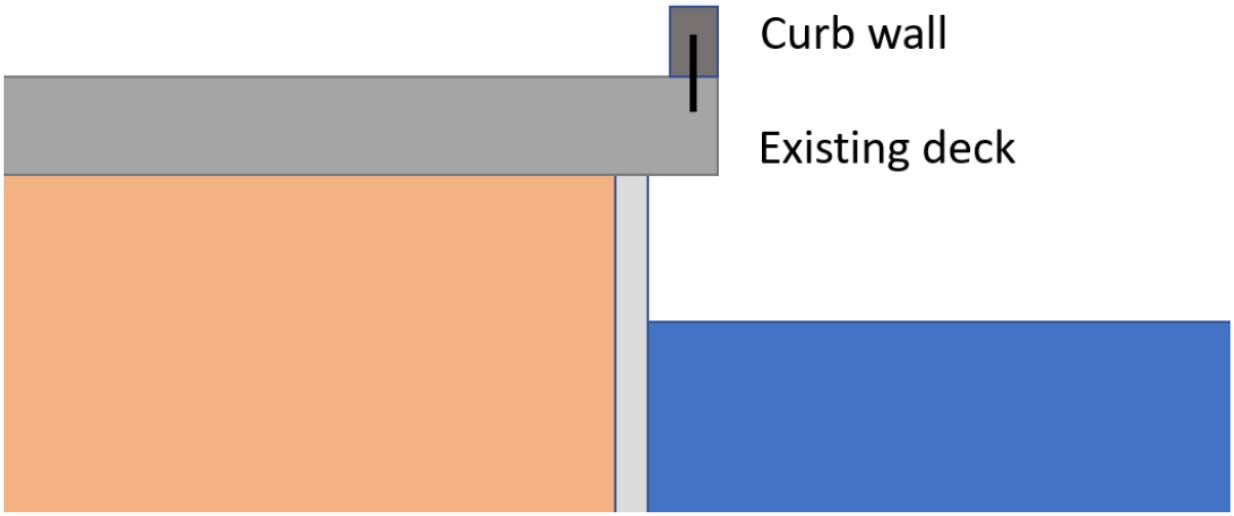


Figure 9. Example Curb Wall

Bulkhead Seawall

A seawall, synonymous with bulkhead wall, is a retaining wall structure that supports earthen fill on one side and protects against erosion caused by a waterbody on the other side. The seawall is the defined line of defense for the protection system. The design height of each seawall is the basis for how high the wharf or shoreline must be raised.

Seawalls are subdivided into two categories, 1) seawalls less than 30ft in vertical height from the seafloor, and 2) seawalls greater than 30ft in vertical height from the seafloor. The two different height groups roughly correspond to the anticipated maritime use along the wall, but also require different means of construction due to their scale and access for construction along the shoreline. Seawalls greater than 30 feet in height generally will require shoreline raises and/or wharf reconstruction and elevation if they are present, while seawalls less than 30 feet in height will typically only need the seawall itself to function as designed and not impeded the existing land uses (Figure 10 and Figure 11). Shoreline elevation and wharf elevation and rebuilding is described in further detail in subsequent sections.

In general, it was assumed that all seawalls are constructed of concrete. The seawall is either constructed of precast concrete piles driven along the wall alignment at close spacing, then subsequently followed by driven square piles to fit within the interstitial space to fill the voids and create space for a grout pocket or forms would be constructed and filled with concrete. Voids would be grouted to create a low permeability wall that would retain soils and resist erosion of the shoreline. The need for additional anchorage or tiebacks at the top of the wall using steel rods or soil anchors may be needed; however, the best technique for installation will be determined during PED.

Construction of the seawall is assumed to be completed from land by using secant pile or diaphragm wall designs. However, if other measures at the location require construction of a cofferdam and dewatering or construction in the “wet”, then the seawall may also employ similar techniques to avoid multiple moves of equipment or additional disruptions.

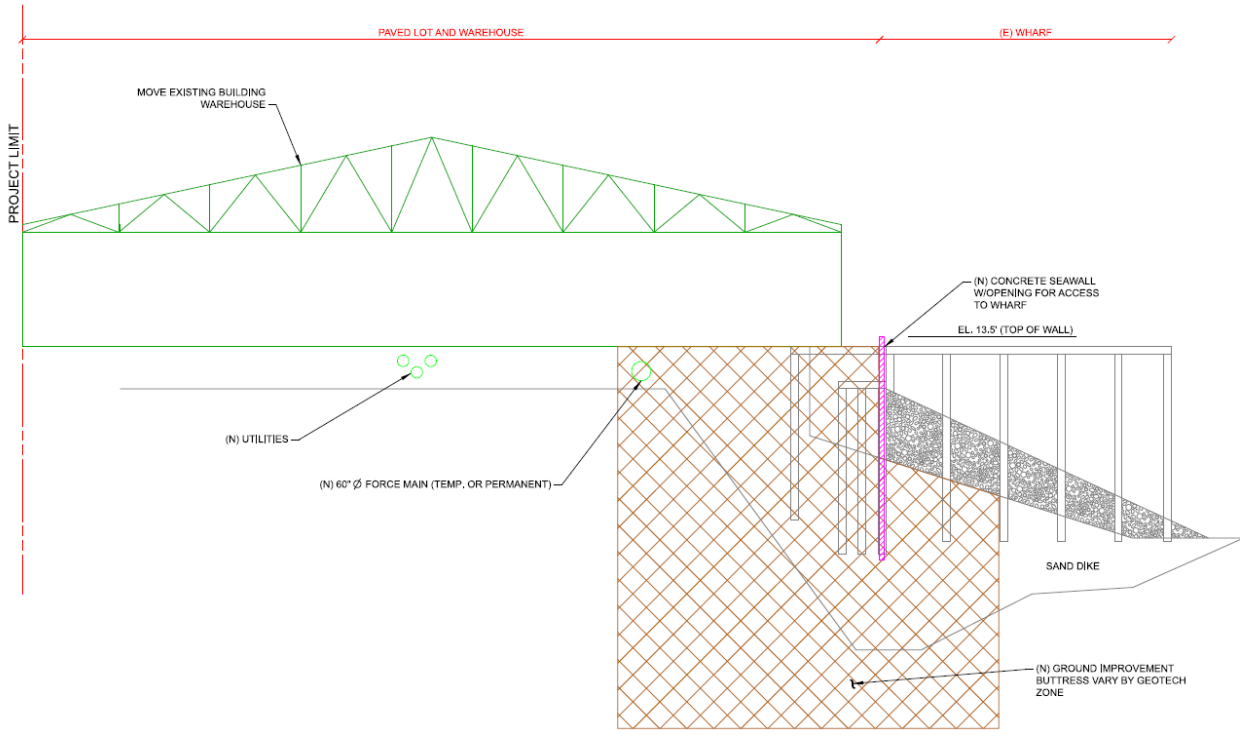


Figure 10. Example Cross-Section of a Seawall <30 Feet Tall Where no Wharf or Shoreline Elevation is Needed (e.g., Pier 80).

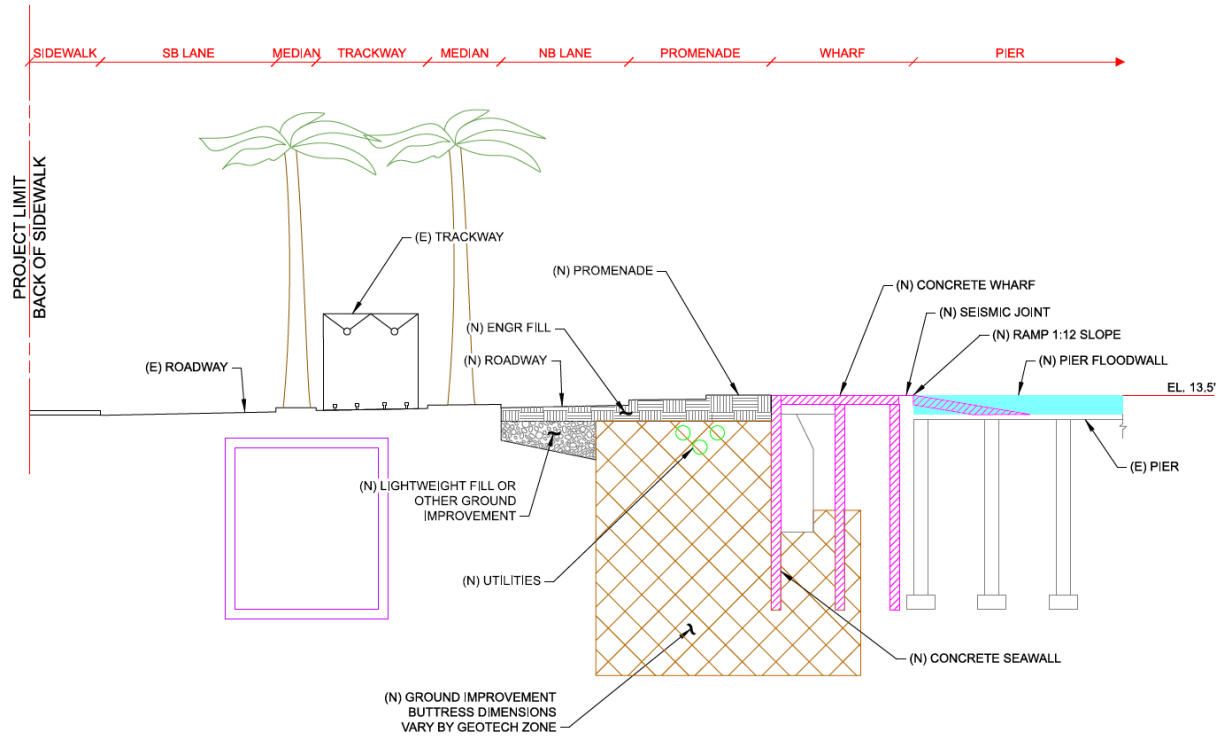


Figure 11. Example Cross-Section of a Seawall >30 feet Tall where Wharf and Shoreline Elevation are Needed (e.g., Pier 28)

Ferry Building Seawall

At the Ferry Building, the complicated foundation condition and confluence of buried infrastructure warrant a bayward line of defense. A new seawall would be constructed to follow the perimeter of the Ferry Building Structure (Figure 12). This will require approximately 4.6 acres of bay fill to back fill voids between the new and existing seawall. Fill materials would be imported material.

To construct the new seawalls, a cofferdam around the work area would be constructed and the area landward would be dewatered. Cofferdams are an enclosure that allows water to be pumped out to establish a dry working environment. A cofferdam would be constructed from steel sheet piles with interior bracing. Sheet piles would be driven into the sediment in the bay through hydraulic or pneumatic tools, braced internally with waler beams and compression struts to keep the wall from collapsing. Braces would be installed using heavy machinery from work barges in the bay. The area inside the cofferdam would be dewatered with a combination of surface pumps/sumps and deep wells as necessary to create a dry and stable work environment. Once construction completes, the cofferdam would be disassembled and removed.

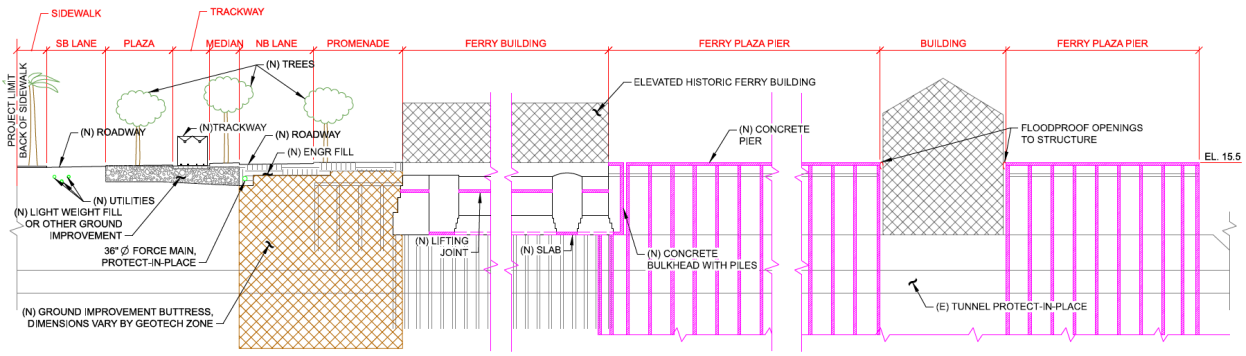


Figure 12. Proposed Cross-Section of the Seawall, Shoreline Elevation, and Wharf Raise at the Ferry Building.

Rincon Park Seawall

At Rincon Park, a new seawall needs to be constructed approximately 60 feet into the bay to mitigate disruption to below grade transit infrastructure and the surface transit corridor in this area (Figure 13). The Rincon Park seawall will require approximately 4.0 acres of bay fill to fill the void between the new and existing seawall. Construction at this location would be similar to what is described for the Ferry Building and require cofferdam construction.

Additional EWN® features have been added in front of the seawall to provide a natural solution to protecting the new seawall from high tidal energies at this location. The rocky intertidal bluff feature is described further below.

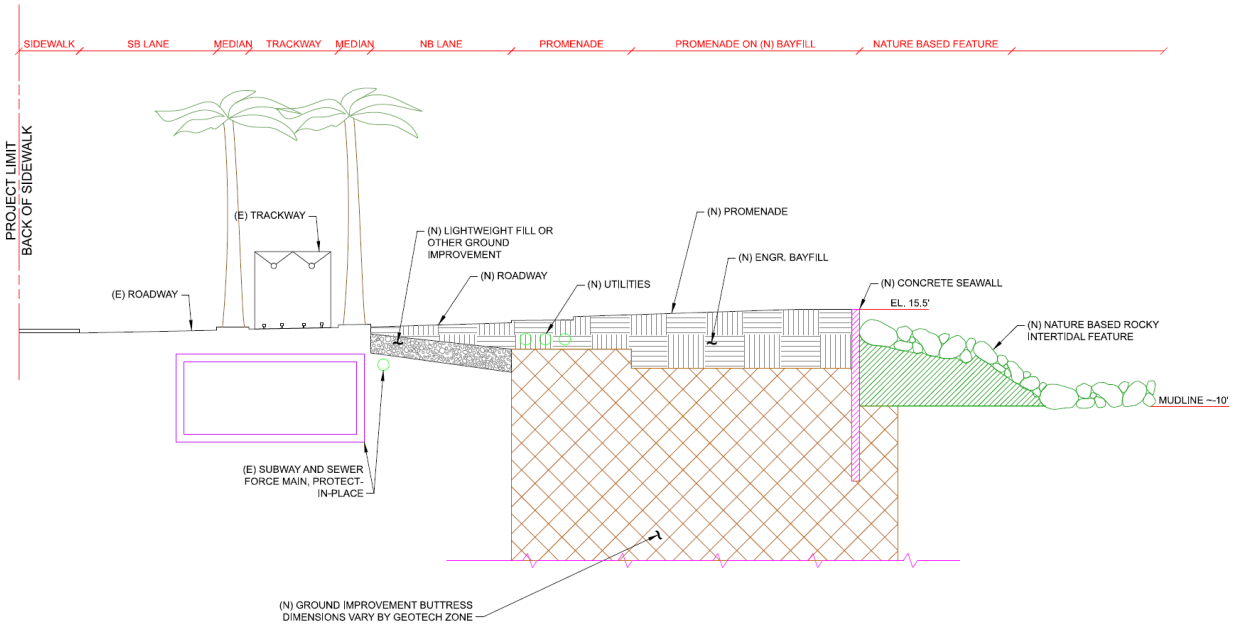


Figure 13. Proposed Cross-Section for the Seawall and Shoreline Elevation at Rincon Park.

T-wall

A T-wall has a cross-section of an inverted “T”, and as designed for this project, is configured with a horizontal base (Figure 14) and is also the basis for the line of defense where this measure is employed. In some areas, a new pile-supported T-wall would be constructed landside of the existing or integral to a new seawall. At this design level, the T-walls are assumed to be founded on deep foundations consisting of either steel H-piles or pipe piles which could be driven either vertically or battered depending on the design loads and underground site constraints. A steel sheet pile cutoff, extending 20-30 feet vertically beneath the wall base, will be installed to reduce under seepage and uplift pressures on the structure. The pile foundations are assumed to consist of two rows of piles which are 50 feet in length and placed on 5-foot centers along the wall length. The panel height of each t-wall is dependent upon the existing elevation. The base of each t-wall is constructed wider than typical for the designed panel height to accommodate anticipated adaptability for future height increase. These design estimates will be refined in the PED phase.

After the T-Wall is complete, the area landward of the t-wall would be regraded using imported fill material. After grading, the fill material would be paved to create sidewalks and landscaping added.

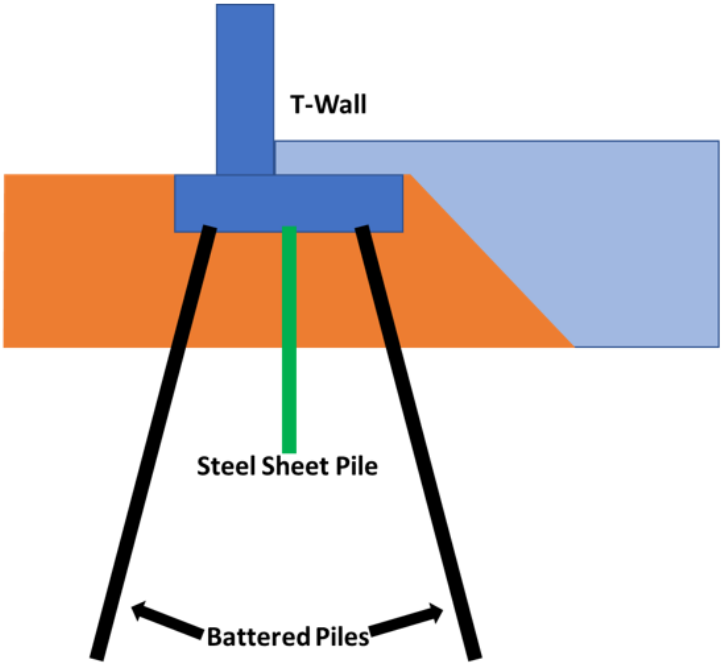


Figure 14. Typical T-Wall Cross-Section

Elevated Shoreline

Where the existing shoreline elevation is lower than the top of design elevation of the new seawall or T-wall, the shoreline may need to be elevated or raised 3.5 to 7.5 feet to defend against 3.5 feet of sea level rise (13.5 or 15.5 feet NAVD88 top design elevation) (Figure 15). To raise the shoreline, the area landward of the seawall would be filled with imported material, compacted down, and regraded over sufficient space to facilitate grade transitions, transit, vehicular and multi-modal access along the urban waterfront edge. Roadway, trackway, and promenade configurations are assumed to be generally the same as existing configuration; however, the exact surface configuration will be determined during PED.

Shoreline elevation would be constructed using standard earth moving equipment such as graders, bulldozers, dump trucks, etc. after all ground improvement measures have been completed. Any utilities that would be affected would also be relocated or modified to function with the new shoreline design.

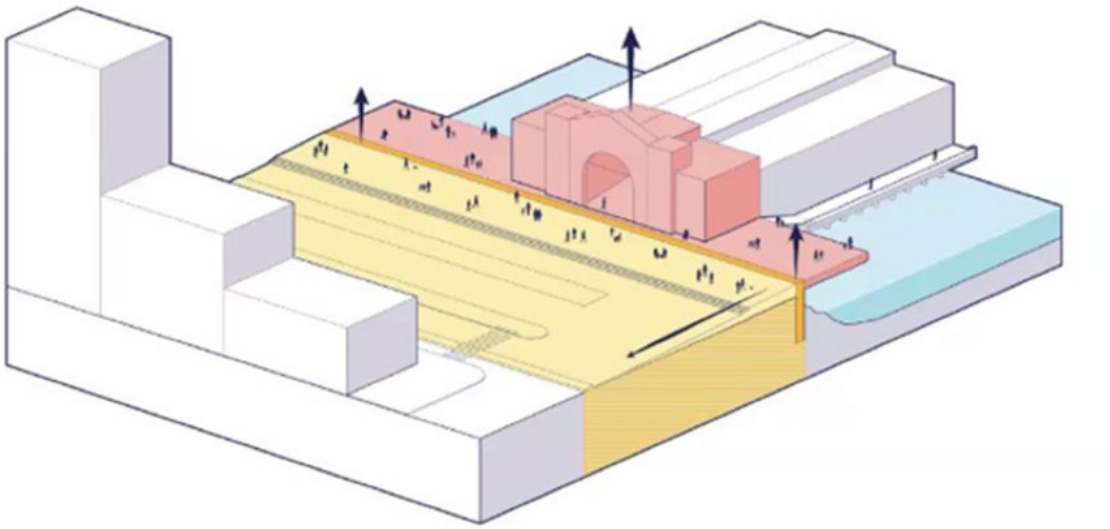


Figure 15. Example of Shoreline Elevation (yellow), Seawall Construction (orange), and Wharf Elevation (red).

Elevate/Rebuild Wharf

In places where the shoreline is being elevated, the existing bulkhead wharf, typically 50 feet wide running parallel to the shoreline, would also be elevated (Figure 16). The bulkhead wharf would be replaced with a new elevated reinforced concrete wharf structure with the top of the deck at specified flood defense design elevation.

To construct the new wharf, the existing wharf would be demolished, material removed, hauled away, and disposed of at an appropriate and approved facility. This would entail pulling out old pilings and existing concrete deck and surfacing (concrete or asphalt). The new wharf would then be constructed in the place of the old wharf. First, the 24-inch octagonal reinforced concrete or steel piles, approximately 100 feet long spaced on a 15-foot by 15-foot grid, would be driven through the rock dike down to competent soils using marine equipment and impact or vibratory pile driving techniques. Then, an approximately 12-inch-thick reinforced concrete deck (flat slab) made of pre-case elements or using cast-in-place construction, extending approximately 50 ft over the bay in all locations, except at the Ferry Plaza, would be constructed on top of the newly placed piles. At the Ferry Plaza, the reconstructed, reinforced concrete deck extends approximately 650’ into the bay to provide emergency egress and vehicular access for the Bay Area Rapid Transit system (Figure 12). During PED the design is likely to be refined (e.g., spacing and thickness may vary depending on load bearing, materials used, increase in height, etc.) and additional features may be incorporated such as glass blocks in the decking to allow for light penetration to the water below.

Reinforced concrete ramps would be constructed to allow pedestrian and vehicular access from the elevated wharf to the finger piers, since the finger piers that stretch out into the bay would remain at the existing elevation, unless otherwise noted.

With the new wharf design, less bay fill from pile material is anticipated when compared to the existing bay fill from existing piles; however, the change cannot be quantified at this time due to uncertainty in the number and size of existing piles at each wharf.

Wharf raising may be constructed in the wet using marine or land-based equipment if the wharf raise is not being completed in conjunction with a measure that would require a temporary cofferdam. If a cofferdam is intended to construct other measures at the location, it is anticipated that the cofferdam would not be breached until after all construction is complete including the wharf elevation and rebuild.

For wharves that supports structures, each would be removed, relocated and/or replaced (see description for relocating/removing structures above). For buildings requiring relocation and replacement back on the wharf, it is assumed that these buildings would be either braced and moved to a temporary location (on land or to floating barge) or carefully dismantled and stored until the new wharf is constructed. Once the new wharf is constructed the structure(s) would be moved back or reassembled.

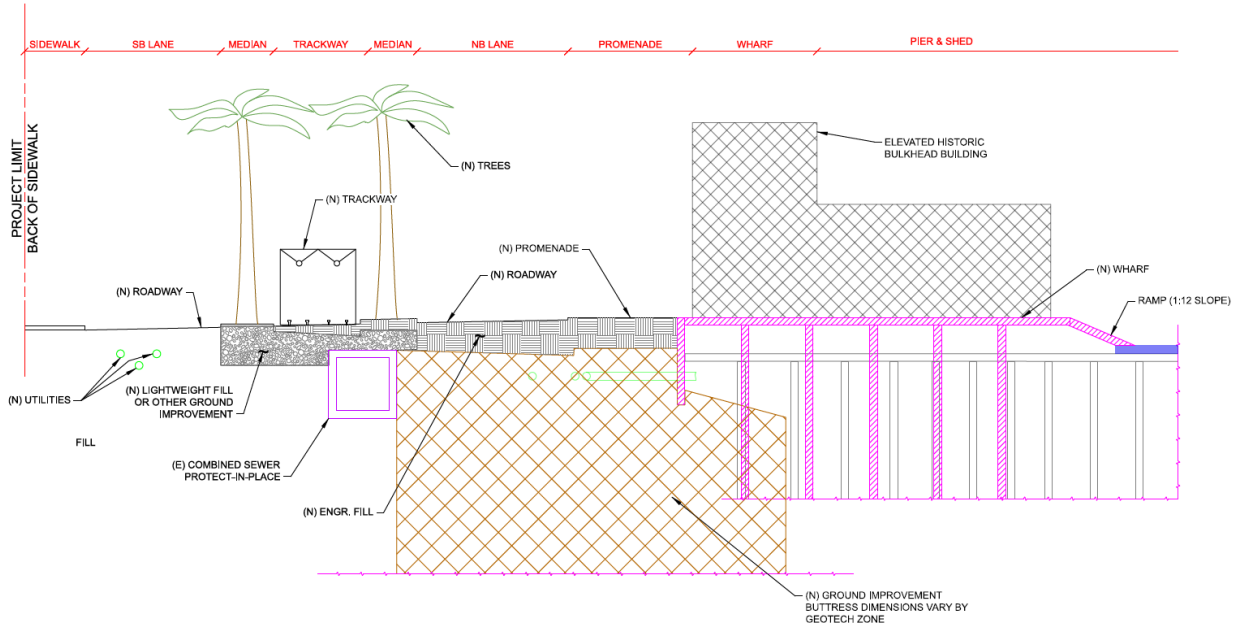


Figure 16. Example Cross-Section with an Elevated Shoreline, Elevated and Rebuilt Wharf, Elevated Structures, and a Ramp Down to the Existing Finger Pier (e.g., Pier 3)

Paved Levee

The levees would be designed as a raised earthen bank with a trapezoidal cross-section with a wider base that slopes up to a narrower crest to fortify against flooding risks (Figure 17). For this phase of the study, the side slopes were assumed to be no steeper than 3H:1V. It is likely that in locations where vehicle passage is necessary the slopes may range from 5H–10H:1V and on piers the slopes may be 12H:1V to accommodate Americans with Disabilities Act (ADA) accessibility requirements. The required levee height and width is dependent on local existing elevations and the final flood side design side slope and configuration. The height of the levee

could range from one to 10 feet to achieve the target design elevation of 13.5 feet in reach 2. The crest width of the levee may range from 10 to 20 feet.

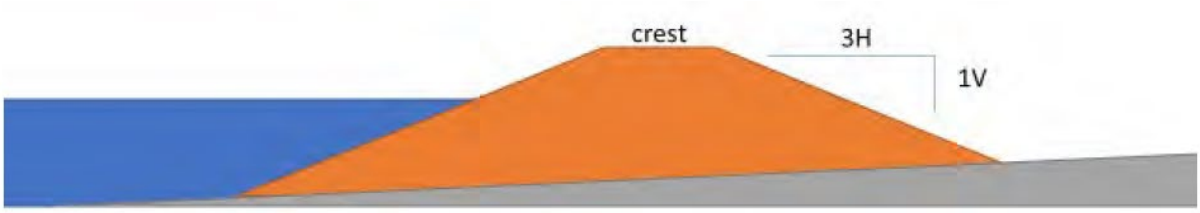


Figure 17. Typical Cross Section of a Levee

To construct the levees, first any existing vegetation, structures, roadways or parking lots along the proposed alignment would be removed and all material disposed of offsite. If utilities are within the alignment, they would need to be relocated prior to construction beginning. The project site would then be prepared for the levee foundation, which may include but is not limited to grading/stripping earthwork, adding or removing subgrade materials, drainage improvements, ground improvements, etc. The levees would be constructed of imported impervious earthen fill material, assumed to be procured from a commercial source near San Francisco and delivered to each site via dump truck. Fill would be placed in layers and compacted to reach the desired strength, width and height. For levees with a crest height ≥ 4 ft, a 20-foot-deep continuous vinyl sheet pile seepage barrier would be installed along the centerline of the structure using a vibratory or impact hammer to prevent undermining of the levee. Once complete, the levee would be dressed in a combination of commercially sourced bedding stones, rip rap/armoring stones, concrete, and/or pavement depending on the location of the structure and long-term use (Figure 18). Any existing bike lanes, bay trails, or roadways disrupted by the new structure would be relocated or built into the overall design of the structure (e.g. crest may be converted to a paved bike path or walking trail), which will be determined during PED (Figure 19).

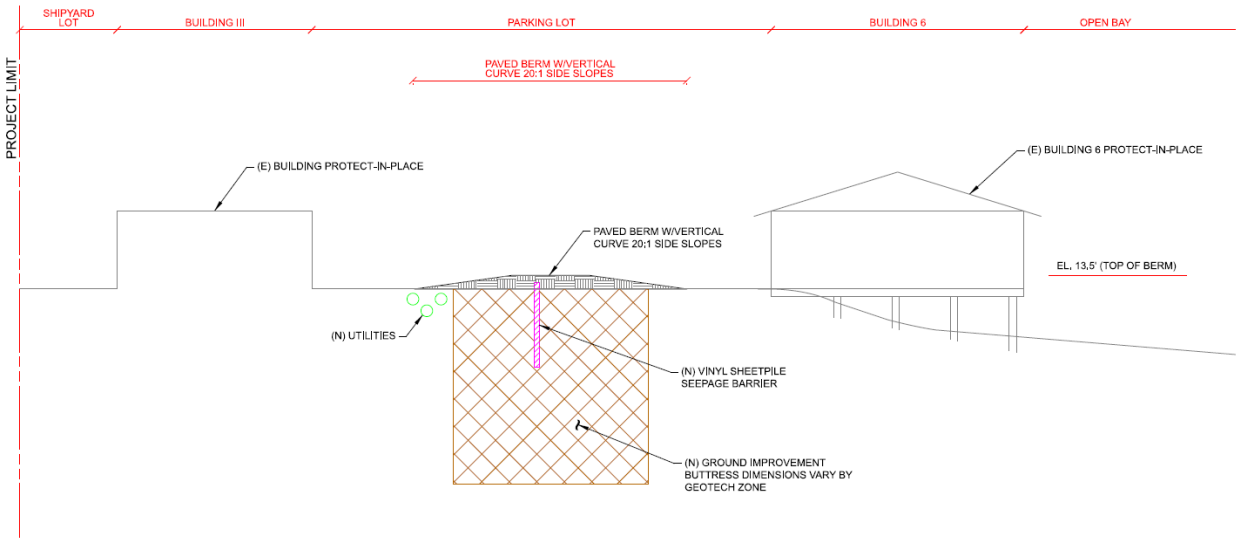


Figure 18. Example Cross-Section of a ≥ 4 ft Levee with a Paved Surface (e.g., Shipyard)

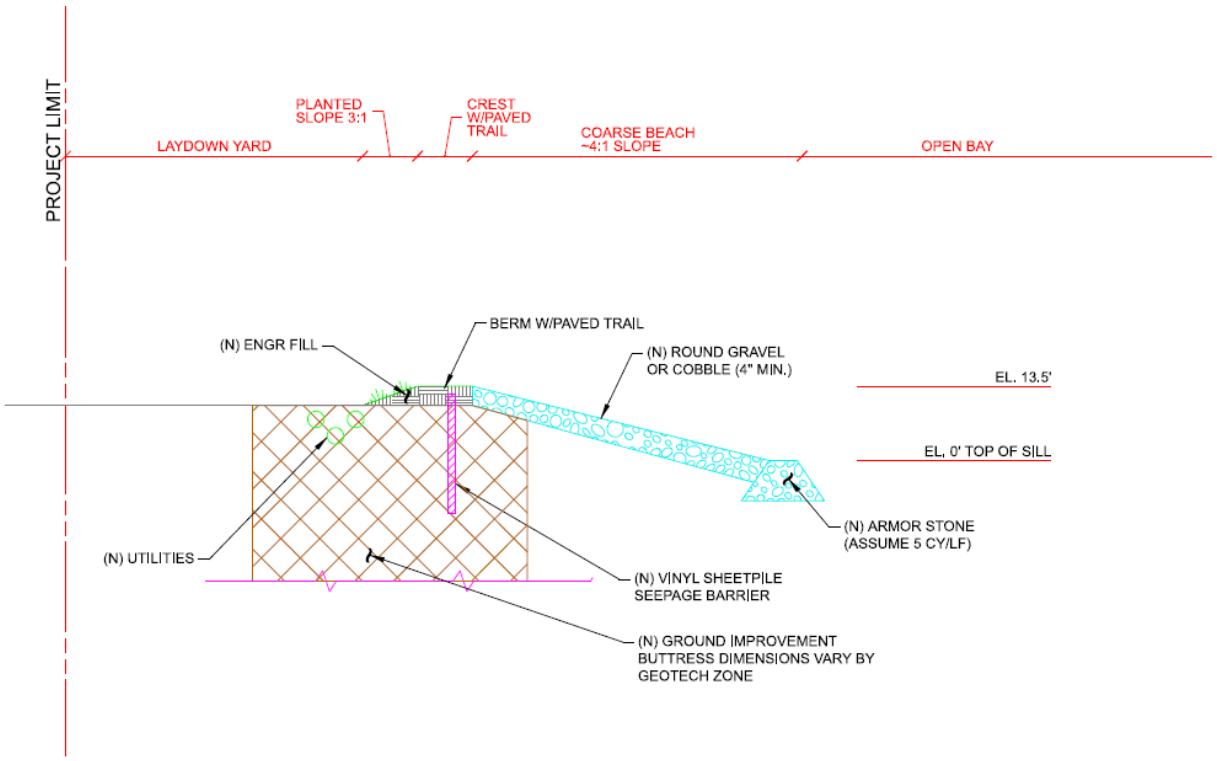


Figure 19. Example Cross-Section of a ≥ 4 ft Levee with a Paved Trail on the Crest and Armoring Stones on the Bayward Slope (e.g., Warm Water Cove)

Planted Levees with EWN® Features

The planted levees would be constructed in the same manner as the Paved Levees measure except that the levee surface would be dressed in more native materials and pervious type surfaces and the side slopes may have gentler slopes to incorporate EWN® features. This style levee typically connects the levee to terrestrial or aquatic habitat and can provide high quality transition zone habitat when vegetated with native plants. The slopes of these structures will typically vary between 10H:1V in space constrained areas to 30H:1V in isolated areas where real estate is not restrictive.

Each levee would be constructed of commercially sourced imported impervious earthen fill material same as the paved levee, but the topsoil would need to be specified based on the vegetation type anticipated to cover the slope. The final design of the planted levee and the type of EWN® incorporated at each location will be dependent on site-specific conditions including real estate constraints, adjacent habitat types that can be connected, desired species composition and recruitment, and long-term use of the area. Each of the design would provide erosion control and stabilization of slopes using biological, mechanical and ecological concepts while providing floodable area in storms and extreme tides. The additional EWN features may be constructed of many different materials and textures to create a layered approach that can be refined to suit site and design needs. Additionally, each designs considered avoids introducing material into open water areas to avoid bay fill, but over the long-term would increase available aquatic habitats as RSLC occurs.

For space constrained locations, such as areas along the lower creek banks of Islais and Mission Creeks, creek enhancements can fit within the footprint of traditional levees and may include features such as habitat shelves or terraces, planted edges, live crib walls, and other measures that increase surface complexity (Figure 20).

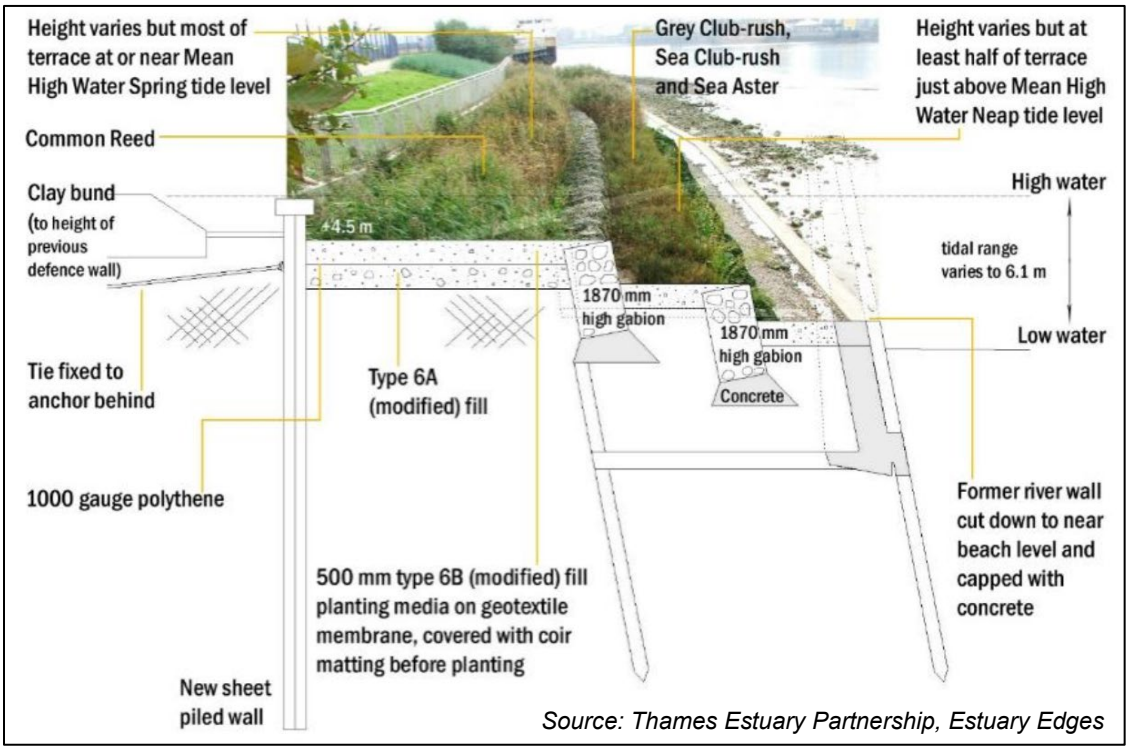


Figure 20. Example Creek Enhancements on the Thames Estuary.

Where space is available, a gentle slope may be graded to support multiple transition zones and may feature a levee with side slopes greater than 10H:1V. At the crest upland habitat would be created and transition to riparian, marsh and/or beach habitat to open water on the bayward side slope (Figure 21 and Figure 22). For levee with a steeper grade slope, vegetated riprap may be incorporated while gentler slopes may rely entirely on native materials.

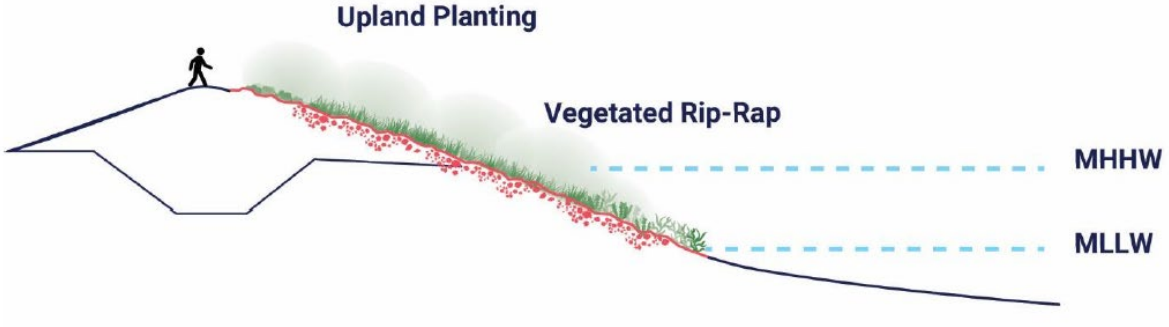


Figure 21. Example Cross-Section of a Planted Levee Where a Moderate Amount of Space is Available (~10H:1V slope).

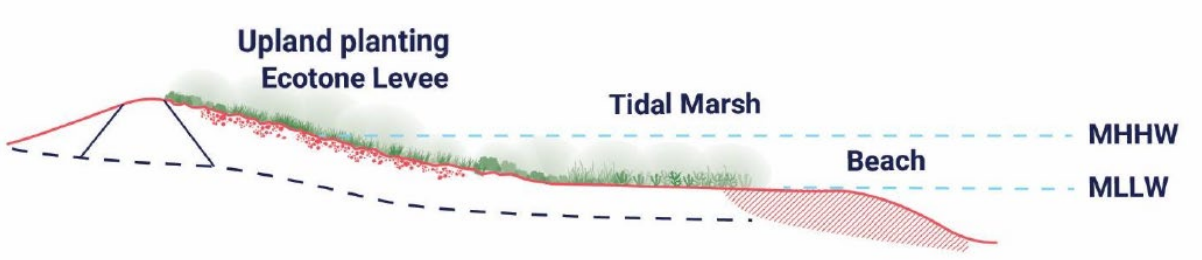


Figure 22. Example Cross-Section of a Planted Levee Where Considerable Space Available (~ 30H:1V slope).

Vegetated riprap, or ecological armoring, is armoring a direct replacement for traditional riprap that aims to replicate the natural processes and functions of rocky, intertidal habitat. Interlocking layered armored protection units or differently shaped riprap, sometimes with integrated tide pools, are designed to mimic natural intertidal conditions and create microhabitats, including vegetation establishment (Figure 23). Units can be stone (riprap), concrete, or other precast materials. In suitable environments, the units may be vegetated by filling in voids with soil and planted with upland, riparian or intertidal species.



Figure 23. Example of Ecologically Engineered Articulated Concrete Block Mattress Used as Ecological Armoring (Source: Courtesy of ECOncrete Tech, Ltd.)

Sheet Pile Wall with EWN® Features

At locations identified for Sheet Pile Wall with EWN® Features, a standalone sheet pile wall would be constructed as a floodwall, unlike in other measures where a sheet pile wall would be constructed in combination with another feature (e.g., levee or seawall). A sheet pile wall is a construction feature involving driving interlocking sheets of material into the ground to act as a barrier to contain water, for bank stabilization, and to prevent water from overflowing into vulnerable areas. The measure may be constructed using steel and/or cast-in place concrete

materials using the same techniques described previously. The sheet pile wall would be constructed using land-based equipment.

As part of this measure, EWN® features that would be used in space constrained locations would be incorporated into the overall design to provide additional protection to the floodwall (Figure 24). The EWN® features would be constructed as described in the Planted Levees description.

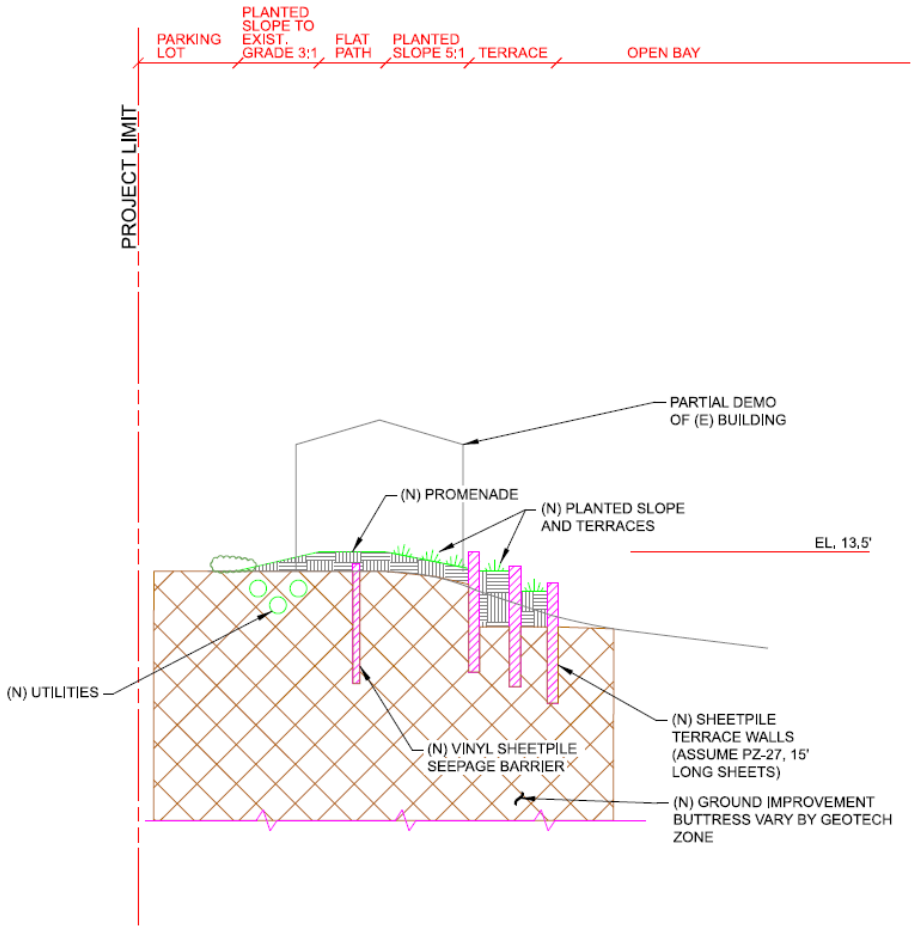


Figure 24. Example Cross-Section Using Sheet Pile Walls and EWN® Features (e.g., Mission Creek North)

EWN® -- Marsh/Coarse Beach Restoration

Marsh and coarse beach restoration involves the restoration of degraded existing coastal wetlands (e.g., salt, brackish, and tidal freshwater marshes), mudflats, and/or coarse beach found in the proposed measure location. To restore the target habitat type at each location, sediment and other natural materials (cobble, gravel, larger rock size) would be introduced to the site to reach a target design elevation that will support the long-term viability of the desired habitat (Figure 25).

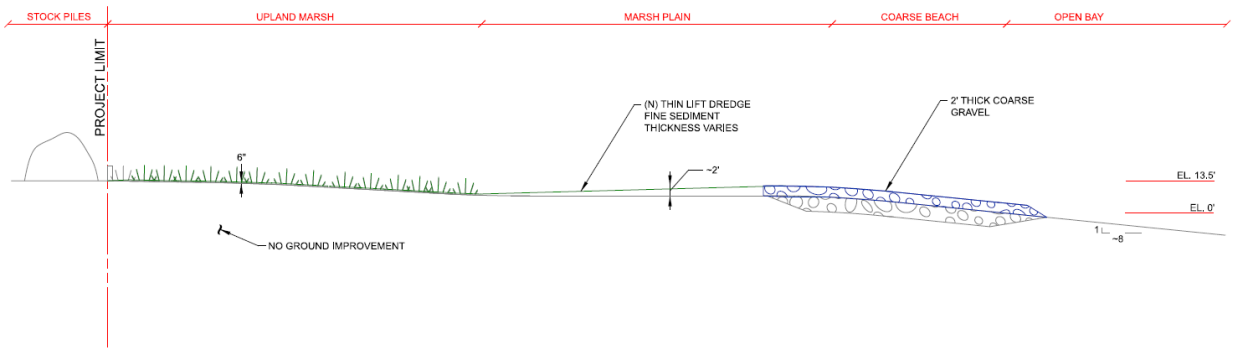


Figure 25. Example Cross-Section of Marsh and Coarse Beach Restoration Proposed at Pier 94 Wetlands

It is assumed material used to augment or nourish the marsh or beach would come from a commercially sourced material or from dredged material removed during normal operations and maintenance cycles (i.e. no new dredging would be pursued to implement this measure). The source of material would be determined during PED, but in any case, material placed at the site must have similar properties to the existing marsh or beach or meet the conditions of the target habitat type, if being created rather than restored.

To construct the marsh or beach, the material would be dumped in place (commercially sourced material) or pumped through a series of pipelines (dredged material) into the site until the surface profile is built up to the target elevations, which will be determined during PED and based on the target species, salinity and flooding regime and site conditions. Heavy machinery would be used to move sediment and facilitate construction which could include bulldozers, front-end loaders, track-hoes, marsh buggy, and backhoes. As necessary, temporary containment dikes would be constructed from in-situ material around the nourished areas to minimize material movement and to delineate work areas. The dikes would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages deemed appropriate for the site.

It is assumed that work would begin in an individual cell and continue until that cell is completed, with attempts made to not place material in more than one cell at a time to minimize the disturbance to existing marsh processes. Figure 24 shows an example of marsh restored at Heron's Head and Figure 25 shows an example of coarse beach restored in San Francisco that both would be suitable reference sites for restoration targets.

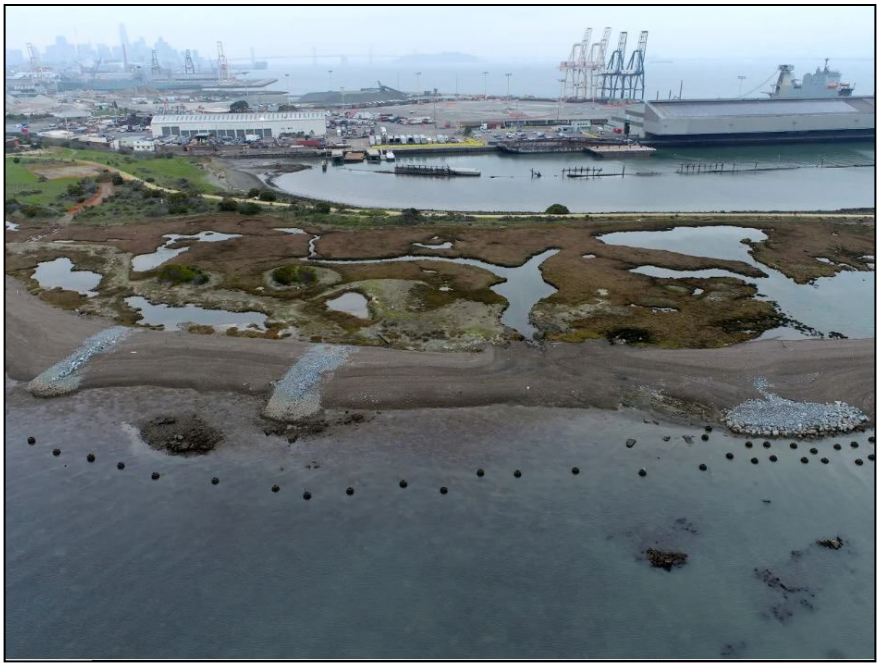


Figure 26. Tidal Marsh at Heron's Head in San Francisco, CA. Source: Port of San Francisco.



Photo Credit: SFEI

Figure 27. Example Coarse Beach Restoration in San Francisco

EWN® -- Rocky Intertidal Bluffs

Rocky Intertidal Bluffs would only be constructed at Rincon Park just south of the Ferry Building. This particular EWN® feature integrates an engineered rocky tidal habitat into the shoreline elevation and bulkhead seawall design as a way to minimize wave runup and promote greater biodiversity along a steep shoreline rather than relying on traditional riprap or other engineered armoring to protect the new bulkhead seawall (Figure 28). Approximately 2.0 acres of new intertidal and subtidal habitat would be constructed bayward of the new seawall.

To construct the rocky intertidal bluff, a foundation of compacted sediment would be placed along the mudline/bay bottom and built up to achieve a target profile that slopes from the new

seawall to the mudline. On top of this foundation, a combination of sand, gravel, rock, and/or pre-cast material like ecological armoring of varying sizes would be placed using cranes and heavy machinery to create tidepools and bluff areas to increase surface complexity (grooves, crevices, nooks, etc.). After construction is complete, the cofferdam would be removed, and the area would be subject to inundation. Minor refinements and adjustments to material in the rocky intertidal bluff post-construction, such as moving, replacing or adding more stone or other materials, is anticipated to be needed to meet the design goals.

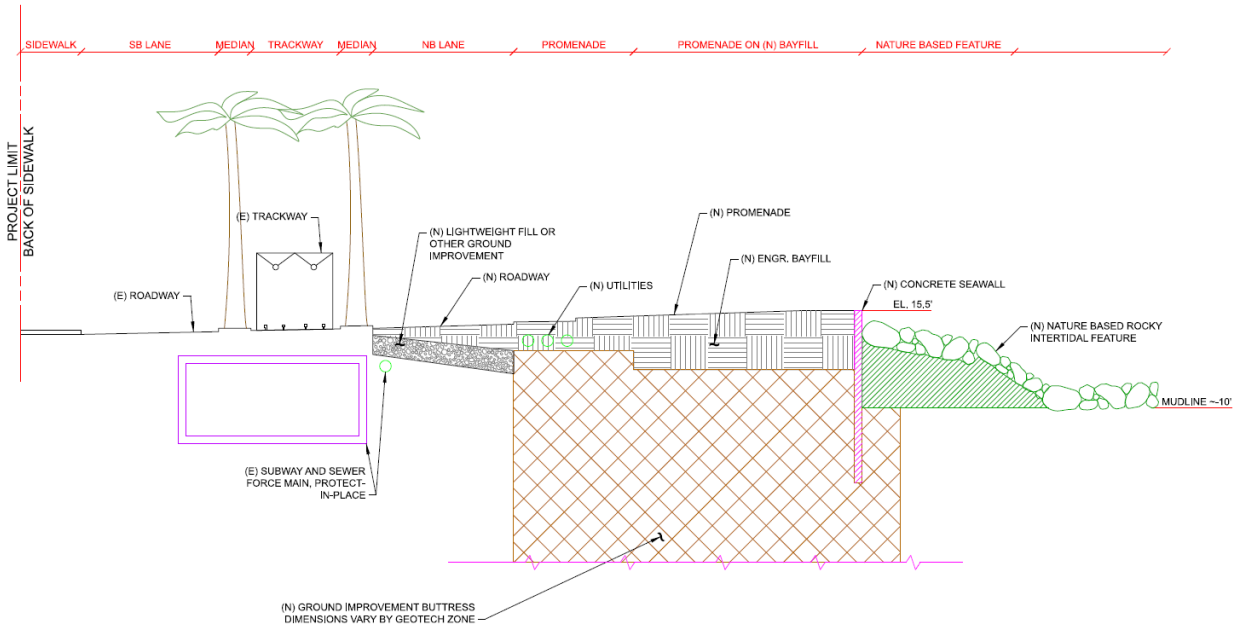


Figure 28. Cross Section of Intertidal Rocky Bluff at Rincon Park

EWN ® -- Living Seawalls

Living seawalls consist of structural elements combined with traditional seawalls that create varied micro-habitat conditions through surface relief and material composition (Figure 29). The introduction of surface complexity (e.g., surface texture, grooves, crevices, and nooks) to traditionally smooth surfaces promote vegetation growth, provides foraging habitat, and creates shelter from predation.

Living seawalls would be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design would incorporate textures to increase surface complexity). These elements would be incorporated as part of the pre-cast or cast-in-place forms used to construct the walls or piles. No additional specialized equipment or methodology is necessary to incorporate this added EWN feature and should not increase the construction duration.

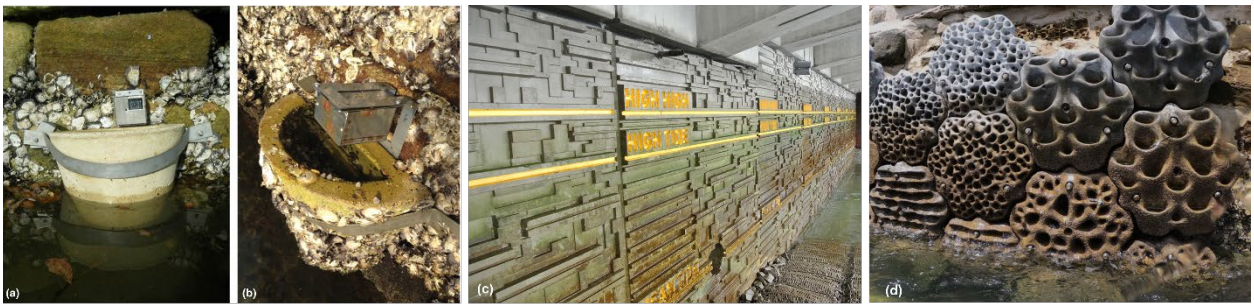


Figure 29. Examples of living seawall/vertical enhancements that could be installed on vertical shorelines. These could consist of pre-cast pots as shown in (a), (b), or (d) and pre-cast panels (c). Source: Morris et al. 2017; Waterfront Seattle; van Remortel 2022.

Ground Improvements

Ground improvements are proposed to be incorporated into several of the structural measures to address both static and seismic loading conditions because of poor soil conditions and the increased weight of the new construction. A deep soil mixed (DSM) stabilization buttress with a 1:1 height to depth ratio (50 feet by 50 feet for Zone 1 and 100 feet by 100 feet for Zone 2) is currently assumed to be sufficient to stabilize the foundation and shoreline soil but will be further refined during PED when site-specific conditions are known. The DSM process forms columns of cemented material in the ground by mechanically mixing the in-situ soil with an introduced binder agent such as cement or lime. The binder can be introduced either by injection of a wet slurry or dry binder systems through the mechanical mixing tool. A grid of individual or overlapping soil mixed columns will make up the buttress.

The installation of DSM columns involves the introduction of a rotating auger into the subsoil which disrupts the existing soil structure and mixes it with the injected binder. Typically, one to six augers are mounted to a drilling rig and each auger consists of a drilling rod and cross bars. The soil mixing process is aided by injecting the cement binder through nozzles located at the end of the drilling rod. The column formation stage starts after reaching the target depth, which is usually divided into several stages where the auger is lifted and lowered to ensure adequate mixing of the soil with the binder and to form a homogeneous column. The width of the column is unknown at this time but could range from 2 to 9 feet wide.

Best Management Practices

This section outlines best management practices (BMPs) proposed by USACE in order to avoid and minimize potential project effects during construction on federally listed species and their habitat within the Action Area.

These are typical BMPs for construction activities to minimize potential short-term impacts. During PED, site specific BMPs would be developed, as appropriate. BMPs would be used to manage sediment and erosion during the construction of any of the alternatives. Construction period preparedness and weather condition BMPs control erosion and sediment through management and monitoring that includes:

- Ensuring the contractor has the appropriate equipment and materials available at the start of construction to complete the project within the planned time frame.
- All disturbed areas are treated with erosion control measures.

- Coordination between vegetative planting and grading is in place prior to construction.
- Daily weather monitoring for possible precipitation events and a plan in case of significant rainfall.
- Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control erosion, storm water runoff, sedimentation, and other construction-related pollutants during all phases of construction, until the construction is complete and all disturbed areas are permanently stabilized throughout the project area.

The short-term increase in sediment would be reduced by implementing the following erosion control measures during construction:

- All soils would be stabilized within 14 days of completed work.
- Construction equipment would be limited to the actual area being disturbed and vehicles may not travel in areas outside of designated staging areas or access routes.
- Short-term staging of soil material (less than 1 week) would be surrounded by a silt fence, fiber rolls, or other perimeter.
- Long-term staging of soil material (longer than 1 week) would be placed away from surface waters, vegetated, and surrounded by a berm perimeter to control runoff and erosion.
- Excavation would be limited to the extent practicable. All excavated material that is not relocated to another portion of the project area will be completely removed to a disposal site located outside the study area.
- Existing vegetation would be left in place to the maximum extent possible.
- Bare ground would be monitored for dryness and watered, if necessary, to reduce wind and water erosion.
- The contractor would be required to conduct water quality tests specifically for increases in turbidity and sedimentation caused by in-water construction activities. Water samples for determining background levels would be collected in San Francisco Bay in the vicinity of the construction site. Testing to establish background levels would be performed at least once per day when construction activity is in progress. The contractor would monitor turbidity and settleable solids at least daily and turbidity at least hourly when a turbidity plume is visible. If turbidity limits are exceeded, the contractor would slow the rate of earthwork or use other means to comply with the requirements, including stopping construction activities until the plume has cleared.
- Sediment barriers would be installed on graded or other disturbed slopes, as needed, to prevent sediment from leaving the project sites and entering nearby surface waters.
- The contractor would have a designated vehicle and equipment maintenance staging area that is self-contained to protect groundwater, surface water, and soils from contamination.
- Construction traffic would be restricted to predetermined routes.
- Traffic during wet weather or within the wet zone would be minimized.
- Pivoting excavators would be used within the wet zone to prevent rutting and excess erosion.
- A spill prevention and containment countermeasure plan that addresses all potential mechanisms of contamination would be developed. Suitable containment materials would be on site in the event of a spill. All discarded material and any accidental spills would be removed and disposed of at approved sites.

- Equipment and vehicles operated within the floodway would be checked and maintained daily to leaks of fuels, lubricants, and other fluids to surface waters. Hardened armoring would be used in areas susceptible to high erosion rates as identified by hydrologic and sedimentation modeling.

In order to avoid and/or minimize potential impacts to waters of the U.S. and state, water quality, and biological resources, the following minimum construction BMPs would be implemented as part of the proposed project. These minimum measures would be subject to modification and additions based upon regulatory and resource agency review.

- Unless otherwise specified in the project biological opinion from the National Marine Fisheries Service, in-water construction activities shall be restricted to the National Oceanic and Atmospheric Administration (NOAA) approved environmental work window (June 1 to November 30).
- No debris, trash, creosote-treated wood, soil, silt, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products shall be placed in a location where it would be subject to erosion by rain, wind, or waves and allowed to enter jurisdictional waters, including as a result of fueling activities and storage of hazardous materials.
- No fresh concrete or concrete washings shall enter into jurisdictional waters. Fresh concrete will be isolated until it no longer poses a threat to water quality using appropriate measures, including exclusion of poured concrete from jurisdictional waters, such as open San Francisco Bay waters. Contractor(s) shall use only designated concrete transit vehicle cleanout stations for cleanout.
- Protective measures shall be utilized to prevent accidental discharges to waters during fueling, cleaning, and maintenance.
- Floating booms shall be used to contain debris discharged into waters and any debris shall be removed as soon as possible, no later than the end of each workday.
- Machinery or construction materials not essential for project improvements shall not be allowed at any time in the intertidal zone. The construction contractor shall be responsible for checking daily tide and current reports.
- Well-maintained equipment shall be used.
- A spill prevention contingency plan for hazardous waste spills into San Francisco Bay shall be prepared for review and approval. The plan shall include, at a minimum, floating booms, and absorbent materials to recover hazardous wastes.
- Contractors shall prepare an anchoring plan that applies to all ships, barges, and other open water vessels and describes procedures for deploying, using, and recovering anchorages.

BMPs for construction water-handling procedures and requirements for dewatering discharges in the study area include:

- Dischargers shall not violate any discharge prohibitions contained in applicable Basin Plans or statewide water quality control panels.
- The discharge does not cause or contribute to a violation of any water quality standard.
- The discharge is not prohibited by the applicable Basin Plan.

- The discharger has included and implemented specific BMPs required by their permit to prevent or reduce the contact of the non-stormwater discharge with construction materials or equipment.
- The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants.
- The discharge is monitored and meets the applicable numeric action levels.

Best practices to minimize construction noise include the following:

- Limiting heavy equipment use to daytime hours not regulated by San Francisco, between 7:00 a.m. and 8:00 p.m.
- Limiting pile driving to times of day that would be least disruptive to residences, hotels, motels, hospitals, or convalescent homes.
- Locating stationary equipment (e.g., generators, pumps, cement mixers, idling trucks) as far as possible from noise-sensitive land uses.
- Requiring that all construction equipment powered by gasoline or diesel engines have sound-control devices, such as exhaust mufflers, that are at least as effective as those originally provided by the manufacturer and that all equipment be operated and maintained to minimize noise generation.
- Using equipment powered by electric motors instead of gasoline- or diesel-powered engines.
- Preventing excessive noise by shutting down idle vehicles or equipment.
- Using noise-reducing enclosures around noise-generating equipment.
- Using noise-reducing shrouds for impact pile drivers, where feasible.
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (e.g., terrain, structures) to block sound transmission to noise-sensitive land uses. The barriers should be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment.

The following list of BMPs recommended by the Bay Area Air Quality Management District to reduce construction-generated criteria pollutant emissions:

- All exposed surfaces (e.g., unpaved parking and staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day, except during rainy days.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph).
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
- All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.
- All trucks and equipment, including their tires, shall be washed off prior to leaving the active site.

- Unpaved roads providing access to sites located 100 feet or more from a paved road shall be treated with a 6- to 12-inch layer of compacted wood chips, mulch, or gravel.
- Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The air district's general air pollution complaints number shall also be visible to ensure compliance with applicable regulations.
- Limit the simultaneous occurrence of excavation, grading, and ground-disturbing construction activities.
- Install wind breaks (e.g., trees, fences) on the windward side(s) of actively disturbed areas of construction. Wind breaks should have a maximum of 50 percent air porosity.
- Plant vegetative ground cover (e.g., fast-germinating native grass seed) in disturbed areas as soon as possible and water appropriately until the vegetation is established.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than 1 percent.
- Minimize the amount of excavated material or waste materials stored at the site.
- Hydroseed or apply non-toxic soil stabilizers to construction areas, including previously graded areas, that are inactive for at least 10 calendar days.

SPECIES AND HABITAT DESCRIPTIONS

Consultation History

Coordination with the USFWS, National Marine Fisheries Service, San Francisco Bay Regional Water Quality Control Board, and San Francisco Bay Conservation and Development Commission has occurred since the study began with USACE. Coordination has included: identifying mitigation and avoidance and minimization measures for consideration; discussing analyses; describing future without-project-conditions; identifying measure-specific concerns; and describing alternatives being considered. The following list documents coordination with USFWS regarding ESA and general resource agency coordination:

- September 6, 2022 – An initial list of threatened and endangered species was acquired from the IPaC database (Consultation Code: 2022-0082557).
- September 22, 2022 – resource agency working group meeting
- October 5, 2022: a formal letter was sent by USACE to USFWS inviting them to be a cooperating agency on the feasibility study
- January 24, 2024 – resource agency working group meeting
- June 16, 2025 – call with FWS to confirm initiation of informal consultation, as well as agreement on effects determination for ESA species potentially occurring in the Action Area
- June 18, 2025 – updated list of threatened and endangered species was acquired from the IPaC database

Listed Species and Critical Habitat in Action Area

Twenty-three threatened, endangered, proposed for listing, or candidate species are listed on the official species list using the USFWS IPaC tool (Appendix A); of those 23 species, six species could potentially occur in the Action Area (Table 3).

To assess the status of species in the Action Area and potential impacts of the action on ESA-listed species and their designated critical habitat, several sources were consulted including literature review of scientific data; interview of recognized experts on listed species including local and regional authorities and Federal (USFWS) and State (California Department of Fish and Wildlife [CDFW]) wildlife personnel; and digital data sources (e.g., habitat databases, record occurrences, aerial imagery). Significant literature sources consulted include the USFWS species specific webpages, Federal status reports and recovery plans, CDFW species occurrence and monitoring reports, peer-reviewed journals, and other standard references. Critical habitat has been designated for the marbled murrelet; however no designated critical habitat occurs in the Action Area.

Table 3. USFWS ESA-listed species identified as potentially occurring in the Action Area.

Common Name	Species Name	Status
BIRDS		
California ridgeway's rail[1]	*Rallus obsoletus obsoletus*	Endangered
California least tern	*Sterna antillarum browni*	Endangered
Marbled murrelet	*Brachyrampuhus marmoratus*	Threatened
FISH		
Longfin smelt San Francisco Bay-Delt Distinct Population Segment (DPS)	*Spirinchus thaleichthys*	Endangered
MAMMALS		
Salt marsh harvest mouse	*Reithrodontomys raviventris*	Endangered
PLANTS		
California seablite	*Suaeda californica*	Endangered

Species Eliminated from the Analysis

During the review, it was found that seventeen federally listed species would not be affected by the proposed action and, thus, were eliminated from further consideration because no suitable habitat exists, or the Action Area is outside of their known range(s). Because each of these species have no potential to occur in the Action Area, only a brief description of the species range and habitat was provided to document consideration (Table 4). Applicable recovery plans and 5-year review reports were relied upon for range and habitat descriptions.

[1] Previous name was California Clapper Rail (Rallus longirostris obsoletus), corrected in July 31, 2023, 88 FR 49310 49355

Table 4. Description of species eliminated from the analysis for a no effects or no jeopardy determination.

Species Common Name *Scientific Name*	Federal Status	Habitat Association	Effect Determination	Summary of Effects
BIRDS				
Western snowy plover *Charadrius nivosus nivosus*	Threatened	Winters along the California coast resting and foraging on sand spits and dune-backed beaches, in urban areas they are found in bluff-backed beaches; nests along shores, peninsulas, offshore islands, bays, estuaries, and rivers of the U.S. Pacific Coast	*No effect*	Unlikely; lacks suitable habitat
REPTILES[2]				
Alameda whipsnake *Masticophis lateralis euryxanthus*	Threatened	Prefer coastal sage scrub and northern coastal scrub, but can also inhabit grasslands, oak savanna, oak-bay, and open woodlands; rock outcrops and talus; use small burrows, rock, and soil crevices, brush, and debris for refuge	*No effect*	Outside known range; lacks suitable habitat
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	Endangered	Prefer densely vegetated ponds near open hillsides; hunt in shallow water 2 inches deep or less; aquatic habitats with shallow water edges are essential habitat; require adjacent upland habitat for basking, and burrows or thick grass mats for shelter and hibernacula	*No effect*	Lacks suitable habitat
Northwestern Pond Turtle *Actinemys marmorata*	Proposed	Semi-aquatic requiring upland terrestrial habitat and aquatic habitats within proximity (approximately less than 500m). Habitat generalists, occurring in a broad range of permanent and ephemeral aquatic waterbodies	*No jeopardy*	Lacks suitable habitat with extensive habitat fragmentation due to urbanized setting.

[2] Sea turtles jurisdiction is shared jointly by USFWS (inland waters and nesting beaches) and National Marine Fisheries Service (offshore marine environment). Only shore-based effects to sea turtles are captured in this analysis.

Species Common Name *Scientific Name*	Federal Status	Habitat Association	Effect Determination	Summary of Effects
		including ponds, marshes, wetlands, estuaries, rivers, lakes, etc. Despite their ability to be generalists, suitable aquatic habitat is relatively rare across their range.		
Green sea turtle *Chelonia mydas*	Threatened	Shallow habitats such as lagoons, bays inlets, shoals, estuaries, and other areas with abundant marine algae and seagrass; high-energy beaches with deep sand for nesting, usually coarse to fine grain sizes, with little organic content	*No effect*	Lacks suitable nesting and foraging habitat
AMPHIBIANS				
California red-legged frog *Rana draytonii*	Threatened	Requires aquatic breeding habitat – low-gradient freshwater bodies (ponds, marshes, lagoons) that hold water for at least 20 weeks; non-breeding aquatic habitat – provides shelter, forage, refuge, and dispersal for juveniles and adults (springs, plunge pools); upland habitat – located within 300 feet of aquatic/riparian habitat, comprised of grasslands, woodlands, and/or vegetation that provides shelter, forage, and refuge; and dispersal habitat – accessible upland or riparian haitats between occupied locations allowing for movement between sites	*No effect*	Lacks suitable habitat
FISH				
Tidewater goby *Eucyclogobius newberryi*	Endangered	Brackish water lagoons, estuaries, and marshes along the California coast; shallow, still water	*No effect*	Outside of known range
INSECTS				
Monarch butterfly *Danaus plexippus*	Proposed	Require milkweed and flowering plants for foraging during breeding	*No jeopardy*	Lacks suitable habitat

Species Common Name *Scientific Name*	Federal Status	Habitat Association	Effect Determination	Summary of Effects
		and migration. Lay eggs on milkweed plants		
PLANTS				
Franciscan manzanita *Arctostaphylos franciscana*	Endangered	Bluffs and hills surrounding San Francisco Bay, northern coastal scrub	*No effect*	Lacks suitable habitat
Marin dwarf-flax *Hesperolinon congestum*	Threatened	Endemic to California; serpentine soils in Marin, San Francisco, and San Mateo counties	*No effect*	Outside known range
Presidio clarkia *Clarkia franciscana*	Endangered	Serpentine bluffs and serpentine grasslands	*No effect*	Outside known range
Presidio manzanita *Arctostaphylos hookeri var. ravenii*	Endangered	Serpentine outcrop of the San Francisco Presidio in maritime chaparral-coastal prairie plant communities	*No effect*	Outside known range
Robust spineflower *Chorizanthe robusta var. robusta*	Endangered	Endemic to California; grows in dunes, coastal areas, and meadows	*No effect*	Observations are restricted to Santa Cruz County, CA. All nearby historic documented occurrences are presumed to have been extirpated.
San Francisco lessignia *Lessingia germanorum*	Endangered	Restricted to vegetation gaps on remnant sand dunes and related sandy soils	*No effect*	Outside known range
Showy Indian clover *Trifolium amoenum*	Endangered	Endemic to California; occurs typically in wetlands or grassland areas	*No effect*	Outside known range
Sonoma sunshine *Blennosperma bakeri*	Endangered	Occurs in Sonoma County in vernal pools and wet grasslands	*No effect*	Low – not observed in San Francisco County.
White-rayed pentachaeta *Pentachaeta bellidiflora*	Endangered	Found only in San Mateo County in grasslands with serpentine soil	*No effect*	Outside known range; lacks suitable habitat

Species Accounts

Information about the description, status, habitat, and range for the following ESA-listed species is summarized in Table 5 and is incorporated by reference using the information found on USFWS' Environmental Conservation Online System (https://ecos.fws.gov/ecp/).

Table 5. Summary of ESA-listed species' description, status, habitat, and range.

Species **Common Name** **Description**	**Federal Status**	**Habitat and Range**
BIRDS		
California ridgeway's rail Characterized by its hen-like appearance, a long, slightly downward-curving bill, olive-brown upper parts, a cinnamon-buff colored breast, dark flanks crossed by white bars and white undertail coverts which are often exposed when the bird is agitated. Measuring 13-19 inches from bill to tail.	Endangered	Occur almost exclusively in tidal and brackish marsh with unrestricted daily tidal flows, adequate invertebrate food supply, well-developed tidal channel networks, and suitable nesting and escape cover to provide habitat during extreme tides. Range is known to or believed to occur along California coast
California least tern Long, narrow wings and a broad, forked tail, black-capped head and black-tipped, pale gray wings, white body white blaze across its forehead, dark forewings, black-tipped yellow bill, and yellowish feet. Less the 25 cm when full grown and has 75 cm wingspan.	Endangered	Breeds along the immediate coast of California on unfrequented sandy beaches or abandoned salt flats close to estuaries and coastal embayment's; feeding occurs nearshore in open water. Range is known to or believed to occur along California coast and areas within Arizona
Marbled murrelet A small, chubby seabird that has a very short neck. During the breeding season it	Threatened	Spends most time on the ocean, resting and foraging in near-shore marine waters; nest in old-growth forests with large trees, multiple canopy layers and moderate to high canopy closure.

Species Common Name Description	Federal Status	Habitat and Range
has dark brown to blackish upperparts and a white belly and throat that are greatly mottled. During the winter the upperparts become grey, dark marks form on the sides of the breast and a white ring develops around the eye. Males and females are similar in appearance and size. Juveniles are similar to the adult winter plumage, but with dusky mottling on the underparts		Range is known to or is believed to occur along the California, Oregon, and Washington coasts
MAMMALS		
Salt marsh harvest mouse Dark brown above; pinkish cinnamon or tawny below. Tail similarly bicolored. Upper incisors grooved.	Endangered	Generally restricted to saline or subsaline marshes, particularly dense stands of pickleweed, adjacent to upland, salt-tolerant vegetation. Range is known to or is believed to occur in California.
PLANTS		
California seablite A succulent-leaved perennial shrub of the goosefoot family (Chenopodiaceae) endemic to the coastal zone of California.	Endangered	Margins of coastal salt marshes on Morro Bay in upper intertidal zones, the narrow high tidal marsh zone; however reintroduced attempt has occurred at Heron's Head and Pier 94 saltmarshes.

ENVIRONMENTAL BASELINE

Environmental baseline is defined in 50 CFR 402.02 as “the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.”

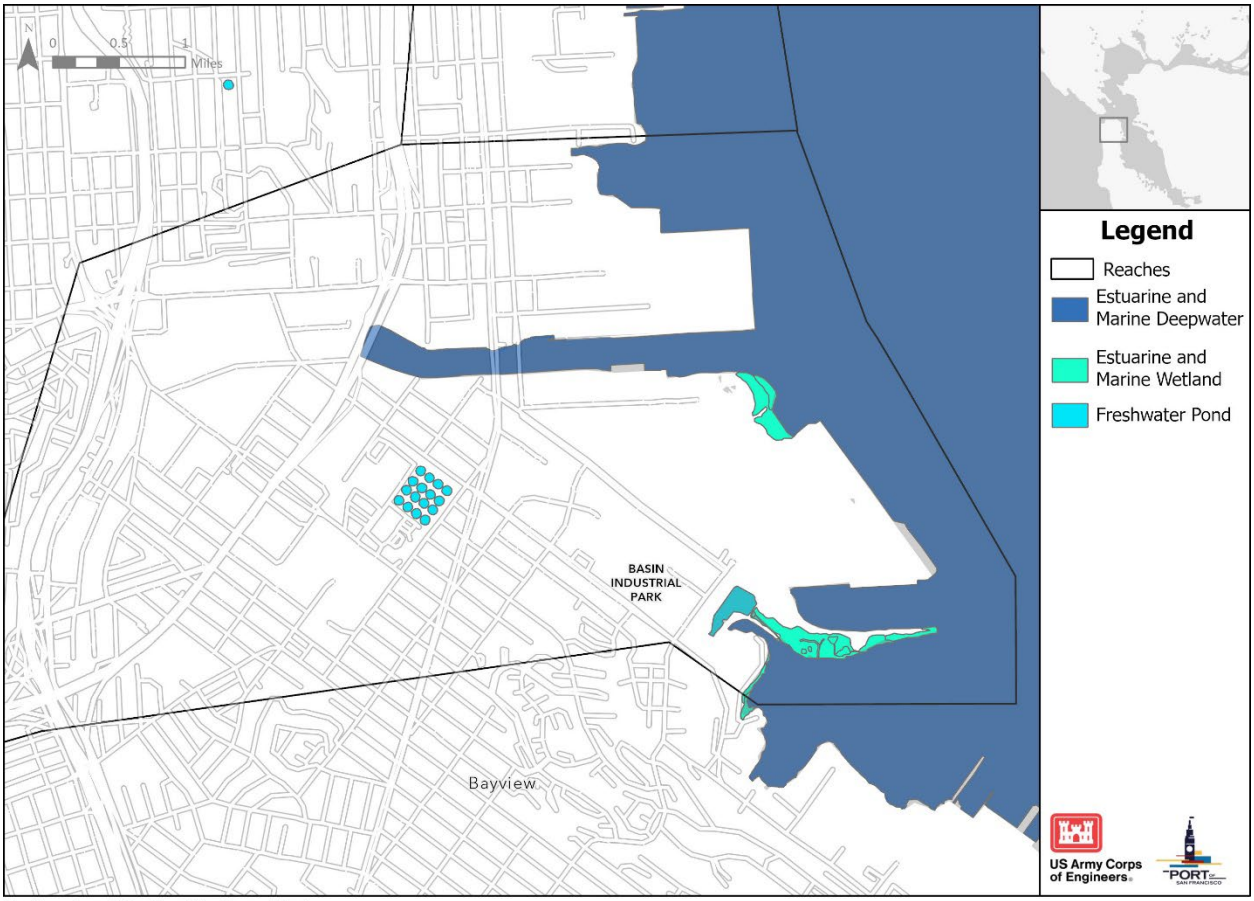
For this BA, the environmental baseline is synonymous with the future without project and existing conditions descriptions from the Integrated Feasibility Report and Environmental Impact Statement. For purposes of this consultation, construction is anticipated to be a phased effort with the goal to be completed by 2040, though this is highly dependent on Congressional funding and authorization.

Under the baseline conditions, the Proposed Action would not be constructed. However, local and private projects such as commercial building and ferry improvement, housing development, smaller-scale climate change resiliency, and restoration projects would be implemented within the Action Area.

The Action Area is largely composed of developed urban land that includes buildings, paved streets, sidewalks, parking lots, docks, and piers. These areas provide limited habitat opportunities for wildlife and do not include natural vegetation communities. However, there is some limited habitat within the study area that wildlife can utilize. Landscape vegetation is present in the study area adjacent to buildings and within public parks including, but not limited to, Levi’s Plaza, Mission Creek Garden, Mission Bay Commons Park, Warm Water Cove Park, Islais Creek Park, and India Basin Shoreline Park. Mature ornamental landscape trees and shrubs in the study area can provide cover, foraging, and nesting habitat for a variety of bird species, as well as reptiles and small mammals, especially those that are tolerant of disturbance and human presence. California annual grassland is present at Heron’s Head Park and Pier 94 where it is interspersed with scattered shrubs such as coyote brush (*Baccharis pilularis*). Coastal scrub is present only at the easternmost portion of the study area, within India Basin Open Space. Coastal scrub commonly includes buckwheat (*Eriogonum* spp.), sage (*Salvia* spp.), bush monkeyflower (*Mimulus aurantiacus*) and poison oak (*Toxicodendron diversilobum*).

In addition, coastal saltmarsh is present in the Southern Waterfront subarea, including at the Pier 94 wetlands and Heron’s Head Park. Coastal saltmarsh is a wetland type flood and drained by saltwater between high and low tides, and is composed of a variety of terrestrial and aquatic species (Figure 30, NOAA 2022). However, coastal saltmarshes in the Central and South Bay are remnants of their former extent. Coastal saltmarshes can be fully tidal, or brackish if they occur near the mouth of a freshwater source. Vegetation associated with this habitat include pickleweed (*Salicornia pacifica*), marsh jaumea (*Jaumea carnosa*), alkali heath (*Frankenia salina*), cordgrass (*Spartina* sp.), salt grass (*Distichlis spicata*), alkali bulrush (*Bolboschoenus maritimus*), and cattail (*Typha* sp.). They are considered significant in the study area,

particularly Heron's Head, due to the rare nature in the otherwise urban environment. The saltmarsh at Heron's Head is interspersed with areas of unvegetated salt panne (water retaining depressions). Salt panne's are often seasonally inundated, and because of this, can inhibit the establishment of vegetation, leavening a barren area. This saltmarsh may provide suitable habitat for the California Ridgway's rail and salt marsh harvest mouse. However, the saltmarshes within the study are small, narrow, and scattered, providing marginal habitat for these species.



San Francisco Waterfront Resiliency Study
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Figure 30. Wetland habitat expected in the study area. Source: National Wetlands Inventory

Additionally, the study area includes limited areas of sandy beaches (e.g., Aquatic Park) and mudflats (e.g., Heron's Head), which are mainly composed of sandy substrates and other soft-bottom material (SFPUC 2014). These habitats support benthic fauna including amphipods, polychaetes, and flies of the intertidal zone, providing food for shorebirds. Other common invertebrates within the intertidal environment included balanoid barnacles (Balanidae) in the high and middle intertidal zones; limpets (Patellidae, Fissurellidae), saltwater mussels (*Mytilus* spp.), and native Olympia oysters (*Ostrea lurida*) in the lower middle and low intertidal zones. Shorebirds that frequent intertidal habitats during migration or overwinter within the terrestrial study area include sanderling (*Calidris alba*), willet (*Tringa semipalmata*), marbled godwit (*Limosa fedoa*), and whimbrel (*Numenius phaeopus;* GFNMS and FMSA 2006). Spotted sandpiper (*Actitis macularius*) and black oystercatcher (*Haematopus bachmani*) may forage along the rocky shoreline during low tide within the intertidal zones of the study area.

EFFECTS ON SPECIES AND HABITAT

The following section provides the findings of USACE and the effect determinations for each species and their critical habitat, if applicable. Effect determinations were made following the definitions in the ESA:

- ***No effect*** – the proposed action will not affect a federally-listed species or critical habitat.
- ***May affect, but not likely to adversely affect*** – the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial; or
- ***Likely to adversely affect*** – adverse effects to listed species and/or critical habitat may occur as a direct result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or completely beneficial.

The analysis describes the consequences to listed species that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. As defined in 50 CFR Part 402, as amended in 2019, a consequence "is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur." As such, the effects analysis describes those impacts that are reasonably certain to occur as a result of the proposed action.

Planned measures to reduce the potential for adverse effects to protected species are provided in the Best Management Practices section. The effects on a protected species and the habitat used by the species, as described above, were considered when determining the extent of impacts from proposed construction activities.

Common Effects to All ESA-Listed Species

Operations and maintenance (O&M) activities are expected to have no effect to any of the five ESA-listed species, given the unlikelihood of presence in the area. O&M would consist of inspections, construction to repair damaged features, and application of corrosion resistant coating for some in-water structures (e.g., sheetpile wall). No loss or take of any ESA-listed species would be expected with O&M.

Sea level change could potentially affect the ESA-listed species that may utilize or are present in the saltmarsh habitat within the study area. As the sea level rises in the San Francisco Bay, saltmarshes are anticipated to convert to a tidal habitat, thus losing saltmarsh habitat. The proposed action would not exacerbate sea level rise at these marsh locations. Therefore, no loss or take of the ESA-listed species would be expected to occur from the proposed action in combination with sea leave change.

California Ridgeway's Rail

Occurrence in the Action Area

As mentioned the Environmental Baseline, the saltmarshes at both Heron's Head and Pier 94 provide suitable habitat for the California ridgeway's rail, though this habitat is small, narrow, and scattered, providing marginal habitat. In south and central San Francisco Bay, and along the perimeter of San Pablo Bay, rails typically inhabit tidal marshes dominated by *Sarcocornia pacifica* and *Spartina foliosa*, especially where significant high tide refugia exist (USFWS 2013).

No *Sarcocornia* vegetation is expected to be removed or degraded during construction activities. Construction of the proposed action would occur adjacent to Heron's Head Park and Pier 94. Short-term construction-related impacts associated with habitat disturbance, lighting, and noise are expected during construction of proposed action from activities such as earthwork, use of heavy machinery, pile driving, demolition, placement of fill, installation of stone and concrete, and ground improvements. The rail is not expected to be present in the adjacent saltmarshes. No nesting habitat is present and therefore is not expected to be directly impacted or removed during construction.

Effects Determination – Not Likely to Adversely Affect

As mentioned above, short-term construction-related impacts would occur adjacent to Heron's Head Park and Pier 94 which may temporarily impact the rail, if present. Temporary impacts would be minimized with implementation of construction BMPs as described in the Best Management Practices section. The site-specific BMPs would be determined during PED. Direct impacts to the saltmarsh would be avoided and therefore no permanent impacts to saltmarsh habitat would occur. Due to implementation of BMPs, lack of high-quality habitat, and direct avoidance of the saltmarsh habitat, the Proposed Action would *not likely to adversely affect* the California ridgeway's rail.

California Least Tern

Occurrence in the Action Area

Typically, California least terns nest on sandy beaches with no to minimal human disturbance (Grinnell and Miller 1944; Garrett and Dunn 1981 as cited in USFWS 2020). As mentioned above there is small sandy beach at Aquatic Park within the project area. The approximately 0.25 mile long beach at Aquatic Park is a popular tourist destination and would not be suitable nesting habitat for the terns. In addition, no existing nesting colonies occur within the project area; the closest nesting area is Alameda Point, Alameda, CA, approximately 3 miles away across the San Francisco Bay (USFWS 2020). Due to lack of suitable habitat occurring within project area, no to negligible effects to nesting habitat are expected. Furthermore, no features of the proposed action would be constructed on the sandy beach at Aquatic Park.

According to USFWS' 2020 5-year Review, California least terns feed primarily on small fishes such as juvenile or larval anchovies, captured in estuaries, bays, and shallow, nearshore waters. California least terns typically forage within 2 miles of their nest area, although they have been documented occasionally foraging within 5 miles from nest sites (Atwood and Minsky 1983, as cited in USFWS 2020). California least terns at Alameda Point have been known to forage within 4 miles of their nesting area (TetraTech 2006, as cited in ERDC 2016) which is within the project area. Short-term, indirect impacts to foraging terns could occur during construction-related noise, air emission, fugitive dust, or turbidity generating activities by temporarily disturbing the terns while they are foraging.

Effects Determination – Not Likely to Adversely Affect

As mentioned above, short-term, indirect, construction-related impacts would occur which may temporarily impact foraging for the California least tern, if present. Temporary impacts would be minimized with implementation of construction BMPs as described in Best Management Practices. The site-specific BMPs would be determined during PED. Direct impacts to the sandy beach habitat at Aquatic Park would be avoided and therefore no permanent impacts would

occur. Due to implementation of BMPs, lack of suitable habitat, and direct avoidance of the habitat, the Proposed Action would *not likely to adversely affect* the California least tern.

Marbled Murrelet

Occurrence in the Action Area

No marbled murrelet nesting habitat is within the study area which is highly urbanized. Marbled murrelet nest in old-growth forest, preferably large unfragmented stands. In addition, the closest known breeding area for marbled murrelets is south of San Francisco Bay in forested areas of the Santa Cruz Mountains (Felis et al 2022). No short- or long-term impacts would occur to marble murrelet nesting since there is no suitable nesting habitat within the study area. Marbled murrelets, primarily, forage in marine waters, usually within 1.2 to 3 miles of shore, typically in waters less than 100 feet deep (USFWS 2023a). There has been unconfirmed sighting of marbled murrelets off the ocean side of the City of San Francisco, according to e-Birds website: https://ebird.org/region/US-CA-075. If foraging marbled murrelets are present, though unlikely, then short-term indirect negligible to minor impacts could occur during construction-related noise, air emission, fugitive dust, or turbidity generating activities by temporarily disturbing the terns while they are foraging.

Effects Determination – Not Likely to Adversely Affect

As mentioned above, short-term, indirect, construction-related impacts would occur which may temporarily impact foraging for the marbled murrelets, if present though unlikely. Temporary impacts would be minimized with implementation of construction BMPs. The site-specific BMPs would be determined during PED. No direct impacts are expected since no suitable habitat is found within the study area. Due to implementation of BMPs, lack of suitable habitat, and direct avoidance of the habitat, the Proposed Action would *not likely to adversely affect* the marbled murrelet.

Salt Marsh Harvest Mouse

Occurrence in the Action Area

As mentioned above the Environmental Baseline, the saltmarshes at both Heron's Head and Pier 94 provide suitable habitat for the salt marsh harvest mouse. Salt marsh harvest mouse are generally restricted to brackish and saline marshes but can frequently use terrestrial grassland habitats adjacent to marsh and grass-*Sarcocornia* ecotones (Johnson and Shellhammer 1988; Shellhammer et al. 1988). Construction activities would be avoided in saltmarshes where the mouse would likely be most present. In addition, no *Sarcocornia* vegetation is expected to be removed or degraded during construction activities, which is the preferred habitat for the mouse species.

Effects Determination – Not Likely to Adversely Affect

As mentioned above, short-term construction-related impacts would occur adjacent to Heron's Head Park and Pier 94 where coastal saltmarsh habitat occurs which may indirectly impact the salt marsh harvest mouse, if present. Temporary impacts would be managed through implementation of construction BMPs, minimizing possible short-term impacts. Direct impacts to the saltmarsh would be avoided and therefore no permanent impacts to saltmarsh habitat would occur. Due to implementation of BMPs and direct avoidance of the saltmarsh habitat, the Proposed Action would *not likely to adversely affect* the salt marsh harvest mouse.

Longfin Smelt

Occurrence in the Action Area

The San-Francisco Bay-Delta DPS range is scattered through bays, estuaries, and streams to include the Central San Francisco Bay in the study area. Longfin smelt are pelagic forage fish that exhibit facultative anadromous life history (Moyle 2002), adapted to cold- and cool-water habitats; thus, their presences in the San Francisco Estuary are influenced by variation in seasonal water temperatures. Young fish transition seaward during summer months as water temperatures warm and are speculated to return to estuarine habitats in the fall to early winter. Spawning in the San Francisco Estuary typically occurs December through April, with peaks in January and February, though this would occur outside of the study area in fresh or low-saline waters north of Central Bay (USFWS 2022). Longfin smelt are most likely to occur in the study area in transition to the Pacific Ocean or for a few months in the fall to early winter prior to spawning.

Effects Determination – Not Likely to Adversely Affect

Localized, temporary, minor impacts would occur to the longfin smelt if present in the study area during time of construction. In-water construction (e.g., pilings, bay fill) could create noise pollution, increase turbidity, and minimally change hydrologic conditions locally while construction is persisting. However, these impacts would cease upon construction completion. As a mobile species, longfin smelt are likely to avoid construction areas and have a wide enough range that the impact to overall habitat is negligible. Assuming 7.5 miles of in-water construction occurred across the study area, the overall habitat available to the smelt is 477 square miles. As the species is likely to only transit or spend few months out of the year in the estuary, the likelihood of occurrence in the study area during construction is low. Additionally, construction would happen in stages across the waterfront; thus, the distribution of impacts would be minimized spatially and temporarily through the life of the project. With the implementation of BMPs, phased construction, and the smelt's limited presence in the study area, the Proposed Action is *not likely to adversely affect* the longfin smelt.

California Seablite

Occurrence in the Action Area

This plant grows in a restricted area within the intertidal zone of salt marshes, which are present at Heron's Head Park and Pier 94. At both Heron's Head Park and Pier 94, reintroduction efforts occurred in 1999 and 2006, respectively. According to USFWS' 5-year review, the occurrence at Heron's Head Park is likely extirpated while at Pier 94, reproductive plants were present in 2020 and are presumed extant (2023b). Construction activities are avoided in saltmarshes where California seablite would likely be most present.

Effects Determination – Not Likely to Adversely Affect

As mentioned above, localized, temporary, and negligible or minor impacts at Heron's Head Park and Pier 94, respectively, would occur to the California seablite, if present. These temporary indirect impacts would be minimized with implementation of construction BMPs, minimizing short-term impacts. Direct impacts to the saltmarsh would be avoided and therefore no permanent direct impacts to California seablite would occur, especially to the known

occurrence at Pier 94. Due to implementation of BMPs and direct avoidance of the saltmarsh, the Proposed Action would *not likely to adversely affect* the California seablite.

CONCLUSION AND EFFECTS DETERMINATION

With the implementation of the BMPs, lack of quality habitat, and no construction within beach and saltmarsh habitats, USACE has made an effect determination of not likely to adversely affect (NLAA) for all five ESA-listed species potentially occurring in the action area (Table 6). Submittal of this BA by the USACE, Tulsa District to the USFWS will initiate the Section 7 review process under the ESA.

Table 6. Effects determination for ESA-species identified as occurring or potentially occurring in the Action Area.

Common Name	Species Name	Effect Determination
BIRDS		
California ridgeway's rail[3]	*Rallus obsoletus obsoletus*	NLAA
California least tern	*Sterna antillarum browni*	NLAA
Marbled murrelet	*Brachyrampuhus marmoratus*	NLAA
MAMMALS		
Salt marsh harvest mouse	*Reithrodontomys raviventris*	NLAA
FISH		
Longfin smelt, San Francisco Bay-Delta DPS	*Spirinchus thaleichthys*	NLAA
PLANTS		
California seablite	*Suaeda californica*	NLAA

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[3] Previous name was California Clapper Rail (Rallus longirostris obsoletus), corrected in July 31, 2023, 88 FR 49310 49355

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Appendix A – IPaC

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: 06/18/2025 20:49:18 UTC
Project Code: 2025-0111456
Project Name: San Francisco Waterfront Flood Study

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)

(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Note: IPaC has provided all available attachments because this project is in multiple field office jurisdictions.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

This project's location is within the jurisdiction of multiple offices. However, only one species list document will be provided for all offices. The species and critical habitats in this document reflect the aggregation of those that fall in each of the affiliated office's jurisdiction. Other offices affiliated with the project:

San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

PROJECT SUMMARY

Project Code: 2025-0111456
Project Name: San Francisco Waterfront Flood Study
Project Type: Flooding
Project Description: This study is authorized to investigate the feasibility of managing tidal and fluvial flooding and sea level rise along 7.5 miles of the San Francisco Waterfront, from Aquatic Park to Herons Head Park, in the City of San Francisco, San Francisco County, California.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@37.771217899999996,-122.39119053391713,14z



Counties: San Francisco County, California

ENDANGERED SPECIES ACT SPECIES

There is a total of 23 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Salt Marsh Harvest Mouse *Reithrodontomys raviventris* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/613	Endangered

BIRDS

NAME	STATUS
California Least Tern *Sternula antillarum browni* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8104	Endangered
California Ridgway's Rail *Rallus obsoletus obsoletus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4240	Endangered
Marbled Murrelet *Brachyramphus marmoratus* Population: U.S.A. (CA, OR, WA) There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/4467	Threatened
Western Snowy Plover *Charadrius nivosus nivosus* Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened

REPTILES

NAME	STATUS
Alameda Whipsnake (=striped Racer) *Masticophis lateralis euryxanthus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5524	Threatened
Green Sea Turtle *Chelonia mydas* Population: East Pacific DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6199	Threatened
Northwestern Pond Turtle *Actinemys marmorata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1111	Proposed Threatened
San Francisco Garter Snake *Thamnophis sirtalis tetrataenia* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5956	Endangered

AMPHIBIANS

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

FISHES

NAME	STATUS
Longfin Smelt *Spirinchus thaleichthys* Population: San Francisco Bay-Delta DPS There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9011	Endangered
Tidewater Goby *Eucyclogobius newberryi* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/57	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

FLOWERING PLANTS

NAME	STATUS
California Seablite *Suaeda californica* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6310	Endangered
Franciscan Manzanita *Arctostaphylos franciscana* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5350	Endangered
Marin Dwarf-flax *Hesperolinon congestum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5363	Threatened
Presidio Clarkia *Clarkia franciscana* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3890	Endangered
Presidio Manzanita *Arctostaphylos hookeri var. ravenii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7216	Endangered
Robust Spineflower *Chorizanthe robusta var. robusta*	Endangered

NAME	STATUS
There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9287	
San Francisco Lessingia *Lessingia germanorum (=L.g. var. germanorum)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8174	Endangered
Showy Indian Clover *Trifolium amoenum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6459	Endangered
Sonoma Sunshine *Blennosperma bakeri* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1260	Endangered
White-rayed Pentachaeta *Pentachaeta bellidiflora* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7782	Endangered

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

BALD & GOLDEN EAGLES

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

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1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are Bald Eagles and/or Golden Eagles in your project area.

Measures for Proactively Minimizing Eagle Impacts
For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the National Bald Eagle Management Guidelines. You may employ the timing and activity-specific distance recommendations in this document when designing your project/ activity to avoid and minimize eagle impacts. For bald eagle information specific to Alaska, please refer to Bald Eagle Nesting and Sensitivity to Human Activity.

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

If disturbance or take of eagles cannot be avoided, an incidental take permit may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the Do I Need A Permit Tool. For assistance making this determination for golden eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

Ensure Your Eagle List is Accurate and Complete
If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Jan 1 to Aug 31
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project

activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

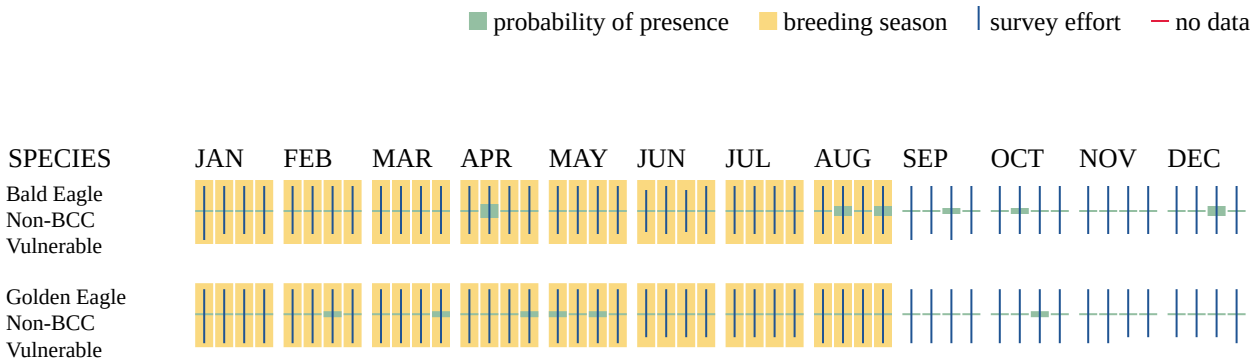
Probability of Presence (▪)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (▪)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MIGRATORY BIRDS

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird *Selasphorus sasin* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow *Passerculus sandwichensis beldingi* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher *Haematopus bachmani* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Scoter *Melanitta nigra* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10413	Breeds elsewhere
Black Skimmer *Rynchops niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15

NAME	BREEDING SEASON
Black Storm-petrel *Hydrobates melania* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10558	Breeds May 15 to Nov 15
Black Tern *Chlidonias niger surinamenisis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20
Black Turnstone *Arenaria melanocephala* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10557	Breeds elsewhere
Black-footed Albatross *Phoebastria nigripes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8033	Breeds elsewhere
Brandt's Cormorant *Urile penicillatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/11903	Breeds Apr 15 to Sep 15
Brown Pelican *Pelecanus occidentalis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/6034	Breeds Jan 15 to Sep 30
Buller's Shearwater *Ardenna bulleri* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/11939	Breeds elsewhere
Bullock's Oriole *Icterus bullockii* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9458	Breeds Mar 21 to Jul 25
California Gull *Larus californicus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10955	Breeds Mar 1 to Jul 31
California Thrasher *Toxostoma redivivum* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9436	Breeds Jan 1 to Jul 31

NAME	BREEDING SEASON
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10575	Breeds Jun 1 to Aug 31
Common Loon *gavia immer* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/4464	Breeds Apr 15 to Oct 31
Common Murre *Uria aalge* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10453	Breeds Apr 15 to Aug 15
Common Yellowthroat *Geothlypis trichas sinuosa* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Double-crested Cormorant *phalacrocorax auritus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/3478	Breeds Apr 20 to Aug 31
Elegant Tern *Thalasseus elegans* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8561	Breeds Apr 5 to Aug 5
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Heermann's Gull *Larus heermanni* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/11955	Breeds Mar 15 to Aug 31
Lawrence's Goldfinch *Spinus lawrencei* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9464	Breeds Mar 20 to Sep 20

NAME	BREEDING SEASON
Long-eared Owl *asio otus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15
Long-tailed Duck *Clangula hyemalis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/7238	Breeds elsewhere
Marbled Godwit *Limosa fedoa* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Northern Harrier *Circus hudsonius* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8350	Breeds Apr 1 to Sep 15
Nuttall's Woodpecker *Dryobates nuttallii* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9410	Breeds Apr 1 to Jul 20
Oak Titmouse *Baeolophus inornatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9656	Breeds Mar 15 to Jul 15
Olive-sided Flycatcher *Contopus cooperi* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31
Pink-footed Shearwater *Ardenna creatopus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9598	Breeds elsewhere
Red Knot *Calidris canutus roselaari* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8880	Breeds elsewhere
Red Phalarope *Phalaropus fulicarius* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10469	Breeds elsewhere

NAME	BREEDING SEASON
Red-breasted Merganser *Mergus serrator* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10693	Breeds elsewhere
Red-necked Phalarope *Phalaropus lobatus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10467	Breeds elsewhere
Red-throated Loon *Gavia stellata* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/9589	Breeds elsewhere
Ring-billed Gull *Larus delawarensis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10468	Breeds elsewhere
Santa Barbara Song Sparrow *Melospiza melodia graminea* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/5513	Breeds Mar 1 to Sep 5
Short-billed Dowitcher *Limnodromus griseus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
Sooty Shearwater *Ardenna grisea* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10417	Breeds elsewhere
Surf Scoter *Melanitta perspicillata* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10463	Breeds elsewhere
Tricolored Blackbird *Agelaius tricolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3910	Breeds Mar 15 to Aug 10

NAME	BREEDING SEASON
Tufted Puffin *Fratercula cirrhata* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/430	Breeds elsewhere
Western Grebe *aechmophorus occidentalis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31
Western Gull *Larus occidentalis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/11969	Breeds Apr 21 to Aug 25
White-winged Scoter *Melanitta fusca* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10462	Breeds elsewhere
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10669	Breeds elsewhere
Wrentit *Chamaea fasciata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10668	Breeds Mar 15 to Aug 10

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

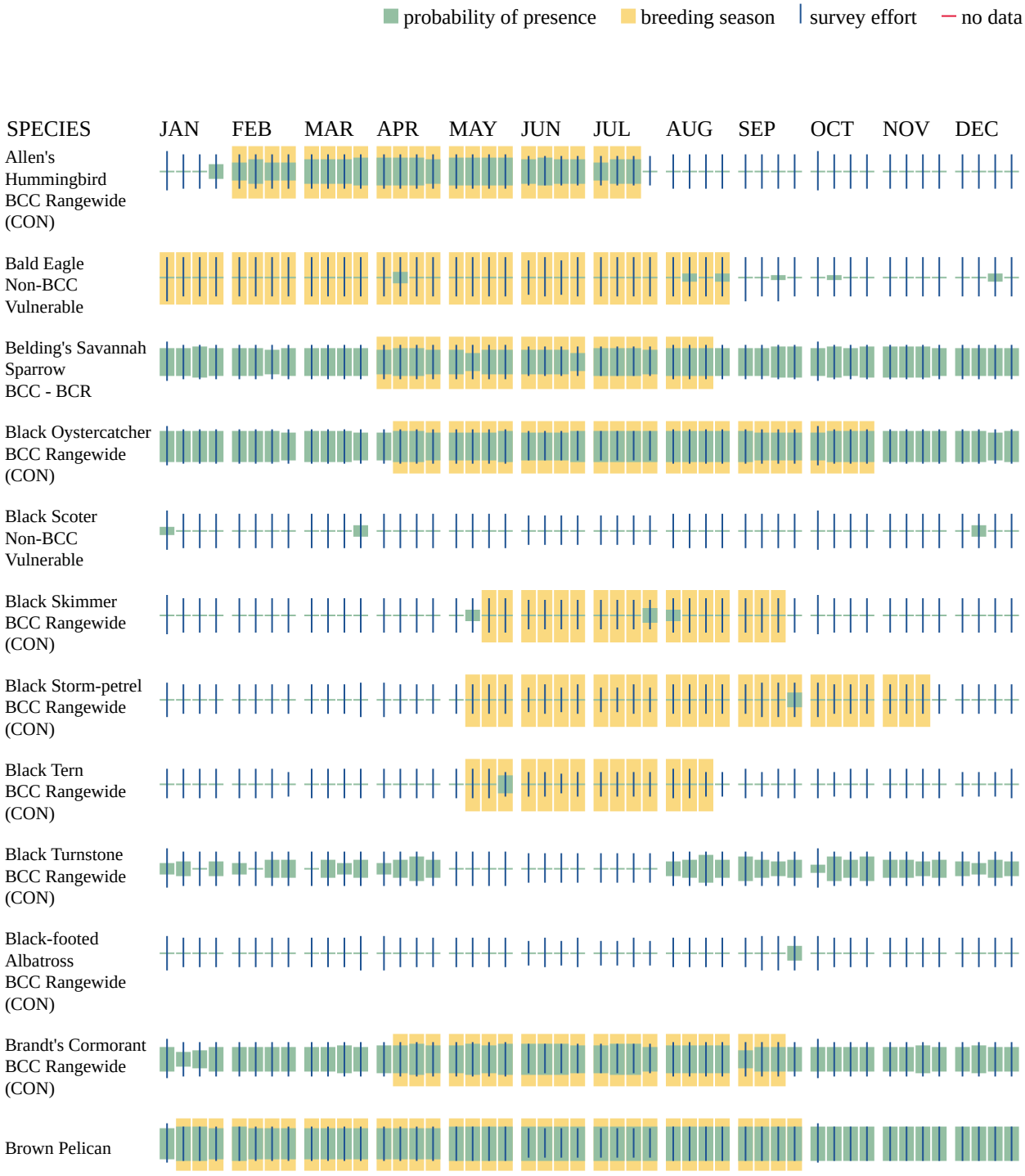
Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

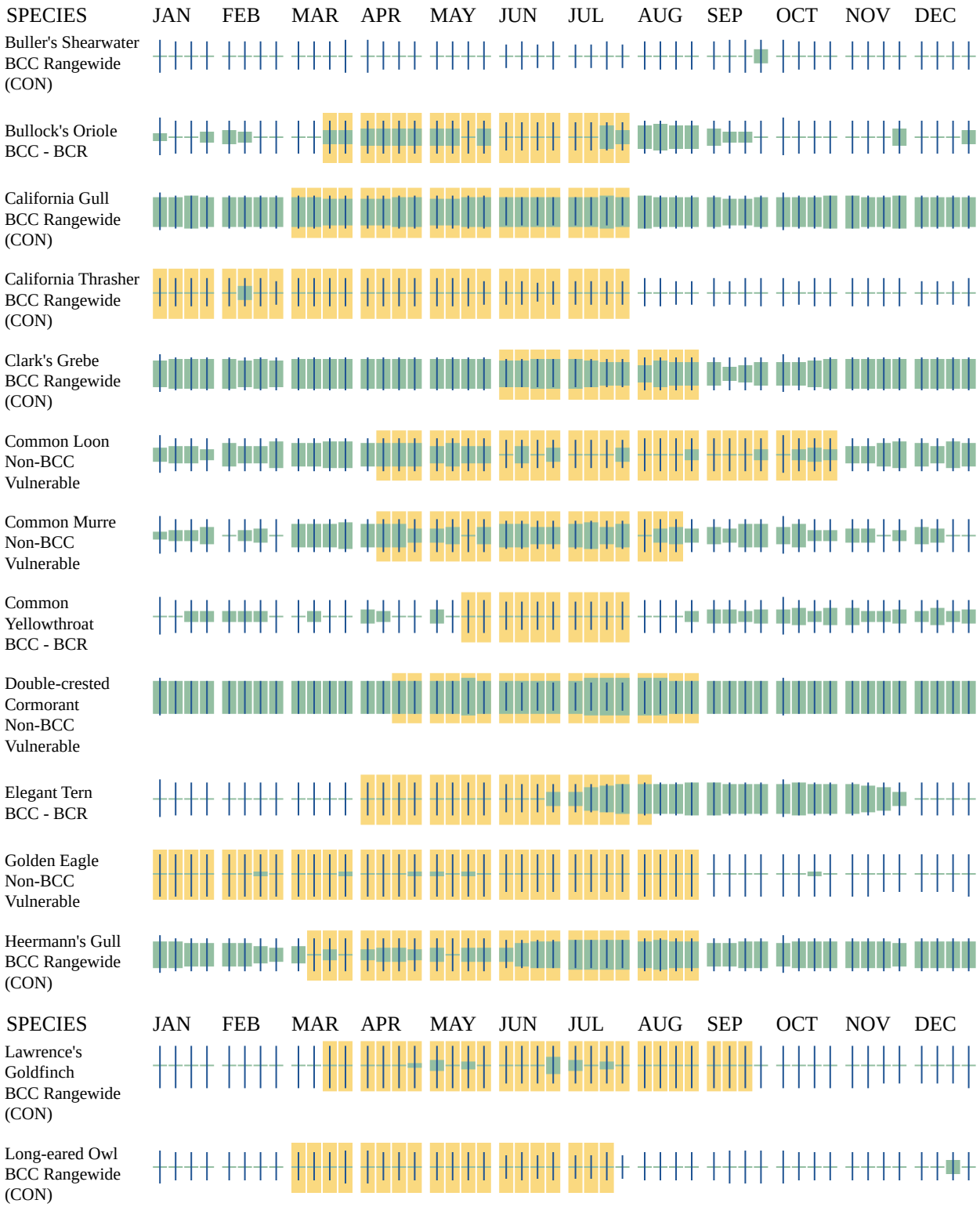
Survey Effort (|)

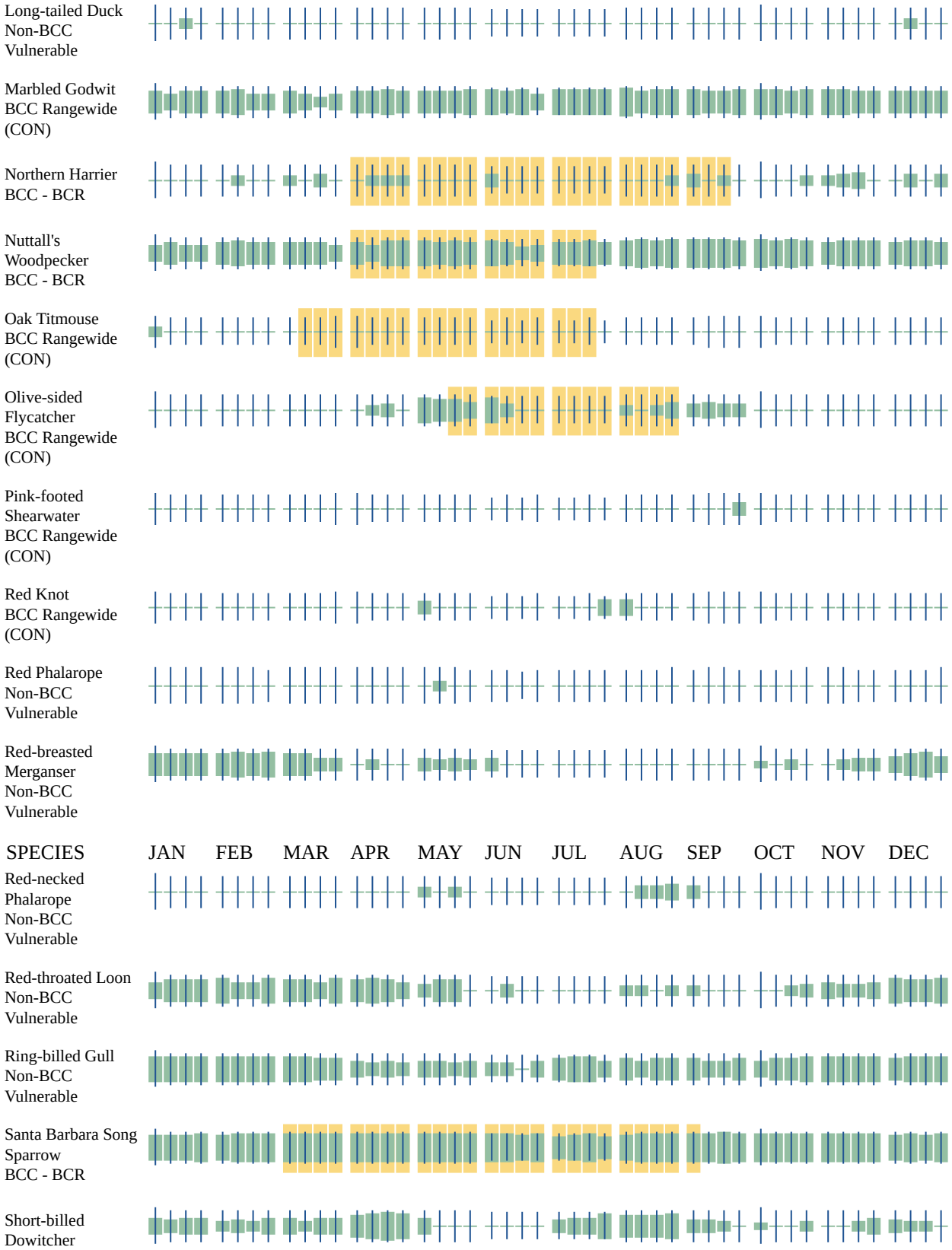
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Non-BCC
Vulnerable




Long-tailed Duck
Non-BCC
Vulnerable
Marbled Godwit
BCC Rangewide
(CON)
Northern Harrier
BCC - BCR
Nuttall's
Woodpecker
BCC - BCR
Oak Titmouse
BCC Rangewide
(CON)
Olive-sided
Flycatcher
BCC Rangewide
(CON)
Pink-footed
Shearwater
BCC Rangewide
(CON)
Red Knot
BCC Rangewide
(CON)
Red Phalarope
Non-BCC
Vulnerable
Red-breasted
Merganser
Non-BCC
Vulnerable
SPECIES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Red-necked
Phalarope
Non-BCC
Vulnerable
Red-throated Loon
Non-BCC
Vulnerable
Ring-billed Gull
Non-BCC
Vulnerable
Santa Barbara Song
Sparrow
BCC - BCR
Short-billed
Dowitcher



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER POND

- PUBHx
- PUBHh3

ESTUARINE AND MARINE WETLAND

- E2SBNx
- E2USM
- E2EM1N
- E2SBN
- E2USN

ESTUARINE AND MARINE DEEPWATER

- E1UBL
- E1UBLh

IPAC USER CONTACT INFORMATION

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State:	TX
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Email	elizabeth.j.knapp@usace.army.mil
Phone:	8179466055

You have indicated that your project falls under or receives funding through the following special project authorities:

- BIPARTISAN INFRASTRUCTURE LAW (BIL) (OTHER)

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.6.2
NATIONAL MARINE FISHERIES SERVICE BIOLOGICAL ASSESSMENT & ESSENTIAL FISH HABITAT ASSESSMENT

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
2488 E 81ST ST
TULSA, OKLAHOMA 74137

December 29, 2025

CESWF-PEE

Ms. Jennifer Quan
Regional Administrator
National Marine Fisheries Service, West Coast Region
c/o Justin Ly
North Coast and San Francisco Bay Branch Supervisor
1655 Heindon Road
Arcata, CA 95521

Dear Ms. Quan:

The U.S. Army Corps of Engineers Tulsa District (USACE), in partnership with the Port of San Francisco, is conducting the San Francisco Waterfront Coastal Flood Study (SFWCFS) as authorized under Section 110 of the Rivers and Harbors Act of 1950, Section 142 of the Water Resources Development Act (WRDA) of 1976, Pub. L. 94-587, 90 stat. 2917, 2930, as amended by Section 705 of WRDA 1986, Pub. L. 99-662, 100 stat. 4082, 4158, Section 203 of WRDA 2020, and Section 8325 of WRDA 2022. The study's purpose is to recommend an alternative to reduce flooding risks along the waterfront by considering coastal storms, extreme high tides, and relative sea level change scenarios.

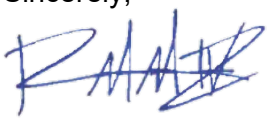
A Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR/EIS) was prepared to present the findings and recommendations and disclose the potential impacts on the human and natural environment if the Tentatively Selected Plan (TSP) were implemented. The DIFR/EIS was released for public and agency review from January 26 through March 29, 2024. Since publication of the draft, the USACE has been preparing the Final Integrated Feasibility Report and Environmental Impact Statement (FIFR/EIS). The Recommended Plan (i.e., TSP in the DIFR/EIS), also referred to as the Total Net Benefits Plan, is a hybridization of alignments that maximized cost effectiveness and benefits across the study area. The Recommended Plan manages coastal flood risk through a suite of structural (e.g., wharfs, seawalls, floodwalls, levees) and non-structural (e.g., floodproofing, retreat, building demolition) measures that function as a system and are implemented over time, based on the risk of rising sea levels.

A Biological Assessment (BA) and Essential Fish Habitat (EFH) Assessment was prepared to analyze the impacts of implementing the project on the surrounding action area (Enclosure). The USACE requests to initiate formal consultation under Section 7(a)(2) of the Endangered Species Act and EFH under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for the SFWCFS. Based on the enclosed analysis, the USACE has determined the action is ***likely to adversely affect*** green sturgeon (*Acipenser medirostris*), central valley Sacramento spring-run chinook salmon (*Oncorhynchus tshawytscha*), and Sacramento winter-run chinook salmon (*O. tshawytscha*). Additionally, the USACE determined the proposed action ***may affect, but is not likely to adversely affect*** central California coast Distinct Population Segment

(DPS) steelhead (*O. mykiss*) or California central valley steelhead (*O. mykiss*). Finally, the USACE determined the proposed action is ***not likely to adversely modify*** designated critical habitat for green sturgeon and chinook salmon.

If you have any questions or need additional information to conduct your review, please contact Dr. Raven Blakeway, Biologist, Environmental Branch, Regional Planning and Environmental Center, at 409-790-9058 or Raven.Blakeway@usace.army.mil.

Sincerely,



Robert M Morrow, PMP
Chief, Environmental Branch
Southwest Regional Planning and
Environmental Center

Enclosure

San Francisco Waterfront Coastal Flood Study

Section 110 of the Rivers and Harbors Act 1950, Section 142 of the Water Resources Development Act (WRDA) of 1976, Section 705 of WRDA 1986, Section 203 of WRDA 2020

Endangered Species Act Biological Assessment and Essential Fish Habitat Assessment

San Francisco

San Francisco County, California

December 2025

Prepared by:

United States Army Corps of Engineers

Southwestern Regional Planning and Environmental Center

US Army Corps of Engineers

PORT OF SAN FRANCISCO

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Executive Summary

This project investigates the feasibility of managing tidal and fluvial flooding and relative sea level change (RSLC) along 7.5-miles of the San Francisco Waterfront, from Aquatic Park to Heron's Head Park, in the City of San Francisco, San Francisco County, California. The San Francisco Waterfront Coastal Flood Study (SFWCFS) was originally authorized under Section 110 of the Rivers and Harbors Act of 1950, Public Law (Pub. L.) 515, 64 stat. 163. The project was subsequently authorized under Section 142 of the Water Resources Development Act (WRDA) of 1976, Pub. L. 94-587, 90 stat. 2917, 2930, as amended by Section 705 of WRDA 1986, Pub. L. 99-662, 100 stat. 4082, 4158 and Section 203 of WRDA 2020. An array of alternatives was formulated that would reduce flooding risks along the waterfront by considering the three U.S. Army Corps of Engineers (USACE) RSLC curve scenarios (low, intermediate, high), alignment of the line of defense relative to the existing shoreline, and adaptability of the design to address higher sea levels if certain thresholds are triggered after construction.

The Recommended Plan is the Total Net Benefits Plan (TNBP), a hybridization of alignments that maximized cost effectiveness and benefits across the project area. The TNBP manages coastal flood risk through a suite of structural and non-structural measures that function as a system and are implemented over time, based on the risk of rising sea levels. The system is divided into four reaches based on hydrology and risk. Reach 1 relies primarily on non-structural measures such as floodproofing and building demolition, while reaches 2, 3, and 4 each prioritize protection of the existing shoreline with several structural measures including raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. Additionally, the system would be designed to comply with seismic standards and includes ground improvements for all structural measures.

This Biological Assessment (BA) has been prepared to initiate formal consultation with the National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act (ESA), and for Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), for the Recommended Plan of the SFWCFS study. This BA discusses the presence and status of ESA-listed and MSA-protected species in the Action Area, evaluates the impacts expected to these species through project actions, and makes a final determination on the effects anticipated for those species.

1.0 Introduction

This Biological Assessment (BA) has been prepared to initiate formal consultation with the National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act (ESA), and for Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), to fulfill requirements of the U.S. Army Corps of Engineers, Tulsa District (USACE) to evaluate impacts of Federal actions of ESA and EFH species and critical habitats. This document has been prepared to solicit a Biological Opinion (BO) from the NMFS for the Recommended Plan.

The Recommended Plan requiring this assessment is the result of a USACE feasibility study that is investigating the viability of alternatives and recommending proposed activities for the purposes of managing tidal and fluvial flooding and relative sea level change (RSLC) along 7.5-miles of the San Francisco Waterfront, from Aquatic Park to Heron's Head Park, in the City of San Francisco, San Francisco County, California. The purpose of this BA is to review the USACE's Recommended Plan in sufficient detail to determine to what extent the proposed activities may affect aquatic species listed as threatened, endangered, or candidate along with any designated or proposed critical habitat in the action area. This BA presents technical information about the proposed project actions and identifies and assesses potential effects from those actions to ESA-listed species and critical habitat, and MSA-managed species and EFH.

The study is authorized under Section 110 of the Rivers and Harbors Act of 1950, Section 142 of the Water Resources Development Act (WRDA) of 1976, as amended by Section 705 WRDA 1986, and Section 203 of WRDA 2020.

This BA is prepared in accordance with legal requirements set forth under regulations implementing Section 7 of the ESA (50 CFR Part 402; 16 U.S.C. 1536 (c)) and Section 305(b) of the MSA.

1.1 Project Location

The project extends approximately 7.5 miles from Aquatic Park in the northeast to just past Heron's Head Park in the south in San Francisco, CA. The project area is divided into four reaches as shown in Figure 1. These reaches were chosen based on hydrologic separability, identifiable geographic references, specific wave action within each reach, and major differences in physical structure inventory. These reaches also provide a neighborhood-scale approach to communicate risks, impacts, and alternatives. Reach delineations include:

- **Reach 1:** Covers Aquatic Park, Fisherman's Wharf, Pier 31 to Pier 35, and the North Beach neighborhood.

- **Reach 2:** Includes the Northeast Waterfront and Financial District. This area comprises a significant portion of the Embarcadero Historic District and includes popular sites such as the Exploratorium, Embarcadero Promenade, and the San Francisco Ferry Building.

- **Reach 3:** Contains South Beach, Mission Creek, Mission Rock, Mission Bay and Pier 70, and includes the South Beach, SoMa, and Mission Bay neighborhoods. This area is known for the Giants' baseball stadium, Chase Center, and access to Mission Creek and the Bay. It is one of the densest residential areas within the project area.

- **Reach 4:** Encompasses Pier 80, Islais Creek, Cargo Way, Pier 96, and Heron's Head Park. This area is comprised of industrial uses along the waterfront and provides critical industrial, maritime, and commercial Port functions.



Figure 1. San Francisco Waterfront project area with reach demarcation

1.2 Definition of the Action Area

The regulations governing consultations under the ESA define the "action area" as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (51 F.R. 19957). The action area for the proposed project includes the project area and an additional 1.5-mile buffer into San Francisco Bay, which is located within San Francisco County (Figure 2).

The action area contains artificial and natural intertidal habitats, subtidal and pelagic habitats, as well as two wetland areas at Pier 94 and Heron's Head Park. In addition to the aquatic regions, the action area is largely developed urban land areas including commercial, residential, and industrial infrastructure, with man-made parks and green spaces in distinct locations.

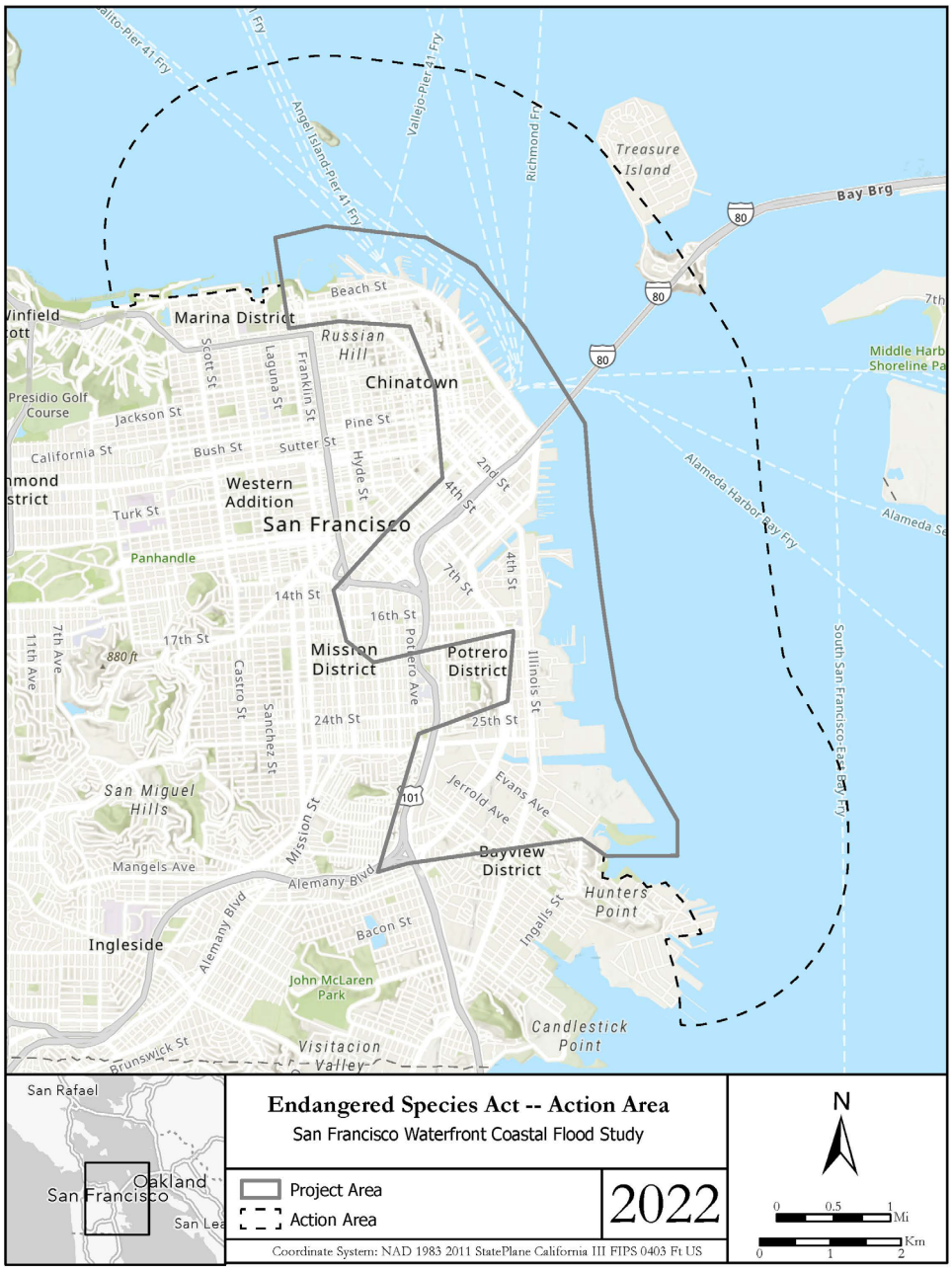


Figure 2. Action area for the proposed project. Project area is shown within the bold grey line while the entirety of the action area is displayed by the hashed black line.

1.3 Recommended Plan

The Recommended Plan includes a combination of measures including: non-structural methods (i.e., floodproofing, retreat, building demolition); raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. Table 1 provides a summary of the measures proposed within each reach of the Recommended Plan.

Table 1. Measures within each reach of the Recommended Plan

Measure	Reach 1	Reach 2	Reach 3	Reach 4
Floodproofing	•	•	•	
Deployable		•	•	•
Elevate Structures		•	•	•
Relocate Structures				•
Remove Structures				•
Curb Wall	•	•	•	
Elevate Shoreline		•	•	
Seawall		•	•	•
T-wall			•	•
Elevate/Rebuild Wharf		•	•	•
Paved Levee			•	
Planted Levee with EWN Features		•	•	•
Sheet Pile Wall with EWN Features				•
EWN – Marsh/Coarse Beach Restoration			•	•
EWN – Rocky Intertidal Bluff		•		
EWN – Living Seawalls		•	•	•
Bay Fill		•		
Ground Improvements		•	•	•

The project map provides an overview of where proposed features would occur along the San Francisco waterfront, simplified to polygons of the construction footprint (Figure 3). Detailed maps are provided in Section 1.4 Proposed Measures by Reach that define the measures occurring in each reach, with anticipated construction footprint, and include a description of how measures are assumed to be constructed.

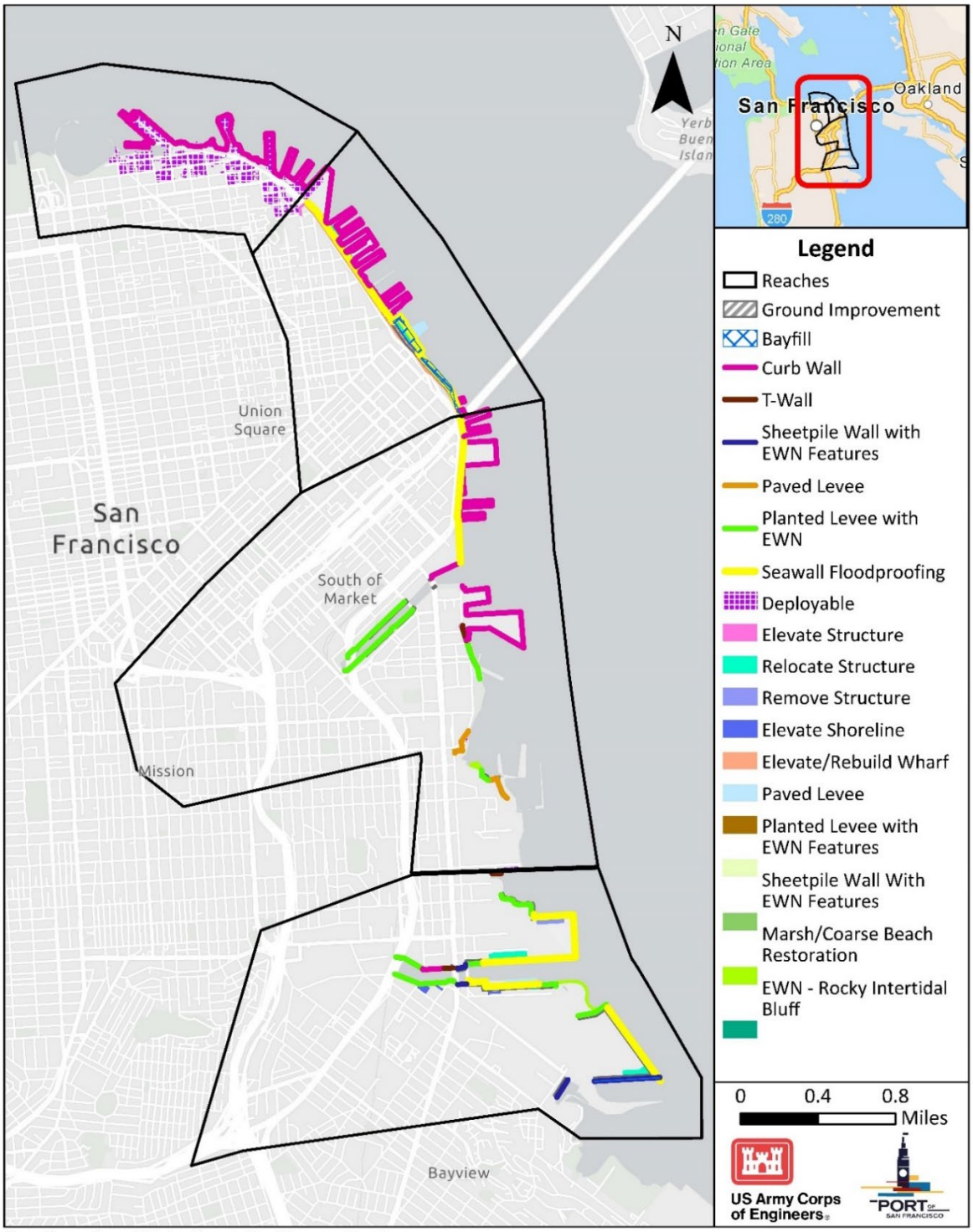


Figure 3. Overview of footprint for the Recommended Plan

A description of the construction activities for the Recommended Plan are provided in the following sections. Approximate spatial extent (e.g., linear feet, acres) for the construction footprint are provided in Table 2. A general description of the construction methods and equipment, as well as anticipated duration for construction, is provided below.

Table 2. Recommended Plan measure quantities.

Measure	Linear Feet (LF)	Square Feet (ft^2)	Acres
Floodproofing	--	2,835,000	65
Deployable	--	50,000	1
Elevate Structures	--	750,000	17
Relocate Structures	--	175,000	4
Remove Structures	--	195,000	4
Curb Wall	51,200	--	--
Elevate Shoreline	11,500	1,030,000	24
Seawall	21,000	--	--
T-wall	1,000	--	--
Elevate/Rebuild Wharf	10,900	660,000	15
Paved Levee	1,800	80,000	2
Planted Levee with EWN Features	11,800	865,000	20
Sheet Pile Wall with EWN Features	2,900	20,000	0
EWN – Marsh/Coarse Beach Restoration	--	225,000	5
EWN – Rocky Intertidal Bluff	--	85,000	2
Living Seawalls	TBD	--	--
Bay Fill	--	395,000	9
Ground Improvements	38,400	--	--

**Note: Linear feet (LF) are rounded to the nearest 100 feet, square feet (ft^2) are rounded to the nearest 5,000 ft^2, and acres are rounded to the nearest whole number. Values denoted as "—" indicate the measurement was not calculated or applicable. TBD = to be determined during PED.*

There are common construction techniques that would be applied across an array of measures, thus, are summarized here to avoid repetitive descriptions:

- **Cast-in-place concrete** is poured into removable forms (or castings) erected on site and cured in the concrete's finished position. Temporary forms or castings would be constructed on site and would be reinforced with steel. Most formwork would be composed of steel, aluminum, and wood. Ready mixed concrete would be delivered via large cement trucks and poured into the castings with a truck chute, bucket, or pump. The concrete is left to cure in the castings before removal. Once cured, casting materials would need to be removed and reused for another measure or hauled off and disposed of.

- **Cofferdams** are an enclosure that allows water to be pumped out to establish a dry working environment. A cofferdam would be constructed from steel sheet piles with interior bracing. Sheet piles would be driven into the sediment in the bay through hydraulic or pneumatic tools, braced internally with waler beams and compression struts to keep the wall from collapsing. Braces would be installed using heavy machinery from work barges in the bay. Inside of the cofferdam would be un-watered and dewatered with a combination of surface pumps/sumps and deep wells as necessary to create a dry and stable work environment. Once construction is completed, the cofferdam would be

disassembled and removed. For simplicity, it was assumed cofferdams would be installed across 50 linear ft at a time.

1.4 Proposed Measures by Reach

1.4.1 Reach 1

Reach 1 focuses on nonstructural measures that move people and assets away from the flood risk. Nonstructural measures reduce consequences of flooding and allow water to disperse naturally rather than constructing traditional structural solutions. In Fisherman's Wharf, the Recommended Plan relies on floodproofing buildings and infrastructure and installing curb walls to floodproof the piers (Figure 4).

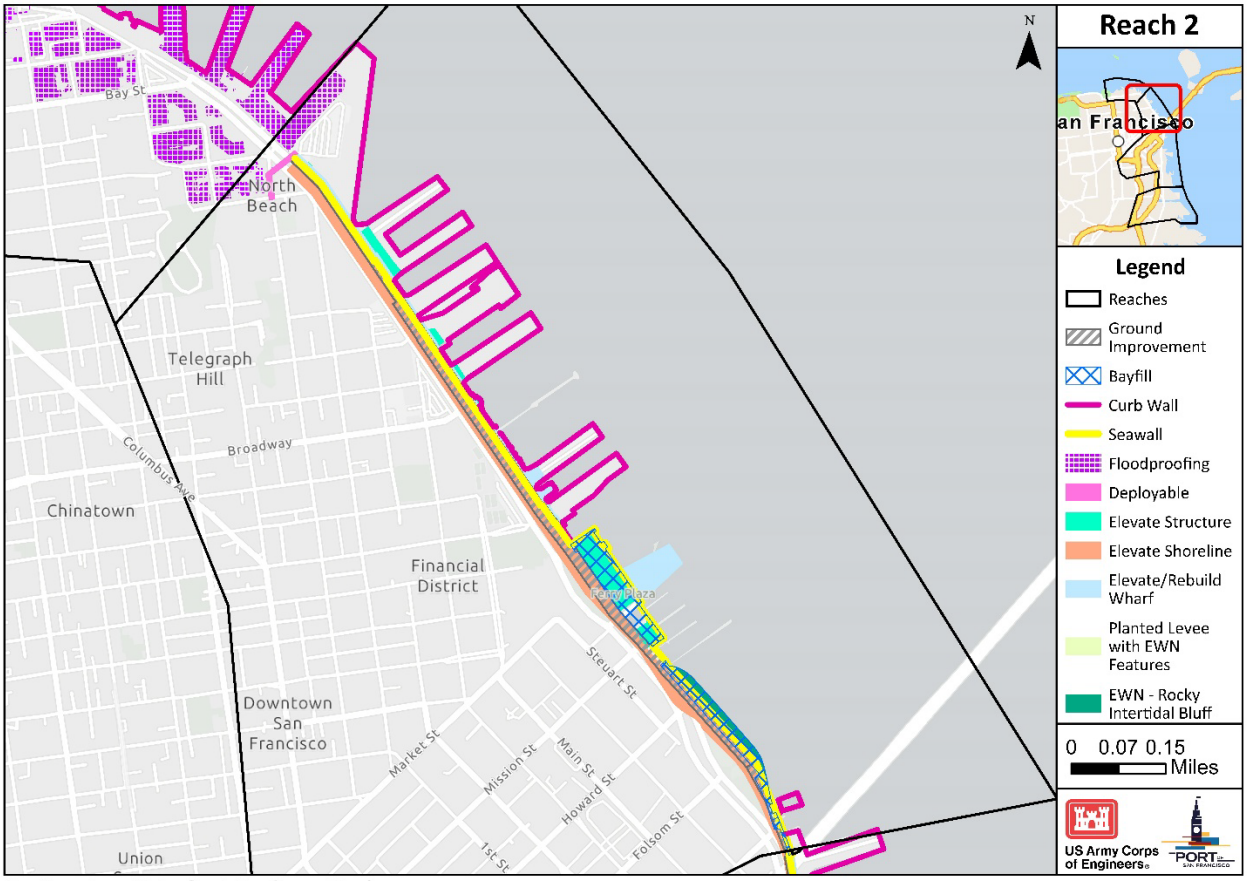


Figure 4. Recommended Plan Reach 1

1.4.2 Reach 2

Along the Embarcadero, the Recommended Plan elevates the shoreline in place by raising and reconstructing the bulkhead seawalls and pile-supported wharves north of the Bay Bridge to a finish elevation of 15.5 feet NAVD88, while gradually transitioning down from the new shoreline elevation back to the existing city grade to retain visual and physical access to the waterfront (Figure 5). The plan includes reconstruction of the full Embarcadero roadway right-of-way – surface design of the Embarcadero roadway and promenade would be determined in future

project phases. The Ferry Building and bulkhead buildings are raised in place following construction of new pile supported foundations (wharves). Piers are floodproofed with concrete curbs around the perimeter to reduce flood risk. Engineering with Nature® (EWN®) features have been incorporated into some of the designs to support the long-term resiliency of the structural measures proposed while providing natural features to enhance the aquatic habitats.

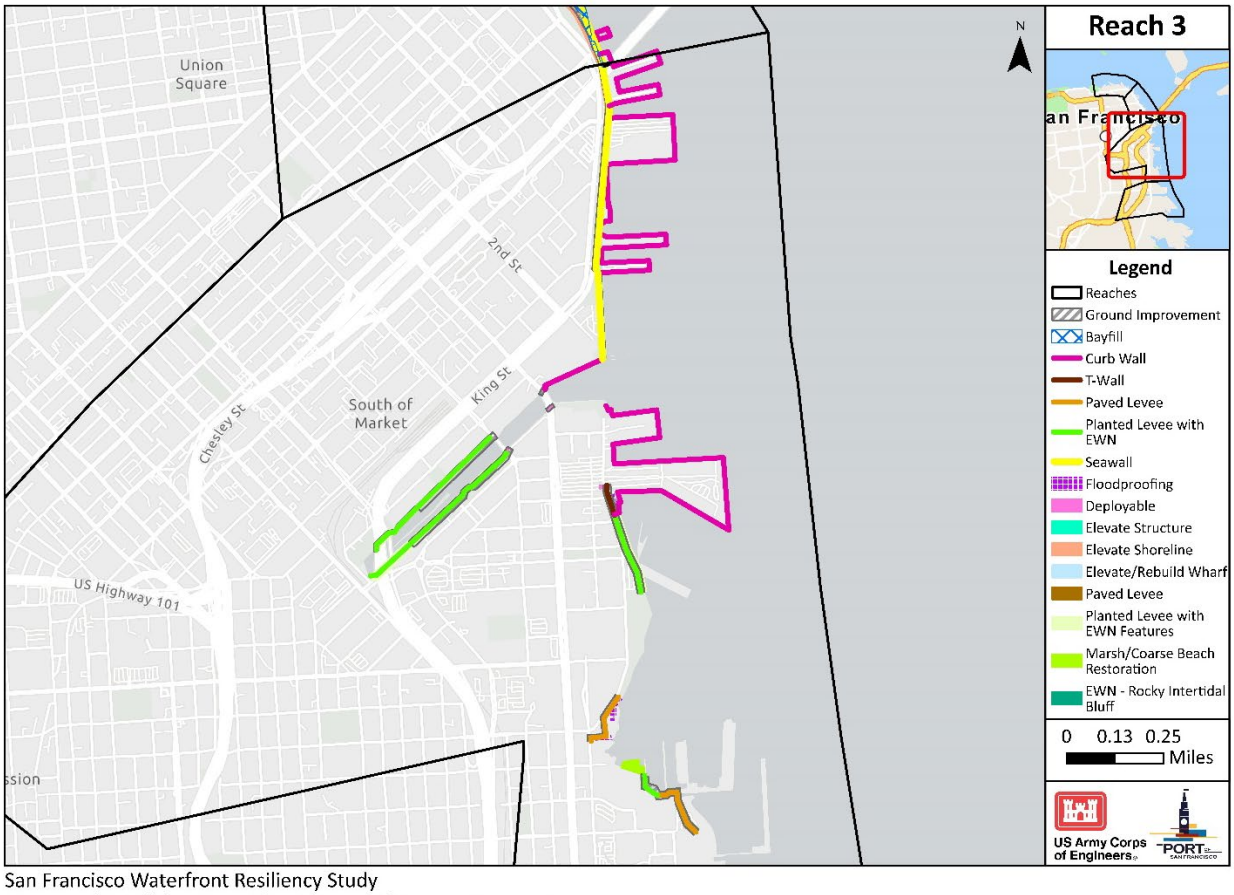


San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Figure 5. Recommended Plan Reach 2.

1.4.3 Reach 3

In the Mission Creek / Mission Bay geography, the Recommended Plan defends existing city and community assets in place by elevating the creek and Bay shorelines to a finished elevation of 13.5 feet NAVD88 with raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls, natural and nature-based features, and closure structures (Figure 6). The coastal defense would tie into existing and planned high ground at Bayfront, Agua Vista, and Crane Cove Parks, and at the Mission Rock and Pier 70 development areas. The plan also includes partial reconstruction of the Embarcadero roadway south of the Bay Bridge to manage elevation change in this constrained urban area.



San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Figure 6. Recommended Plan Reach 3.

1.4.4 Reach 4

In the Islais Creek / Bayview geography, the Recommended Plan defends the existing shoreline to retain residential and commercial land uses in place, including Port land uses and maritime facilities. The flood defenses consist of raising the shoreline using bulkhead seawalls, levees, natural and nature-based features, floodwalls, closure structures, and tying into existing or planned high ground, near Potrero Power Station and behind the Pier 94 Wetlands (Port backlands). This area of the waterfront contains large parcels independent of the combined sewer system, such that the elevated shoreline would require modification to handle stormwater in a safe and effective manner (Figure 7).

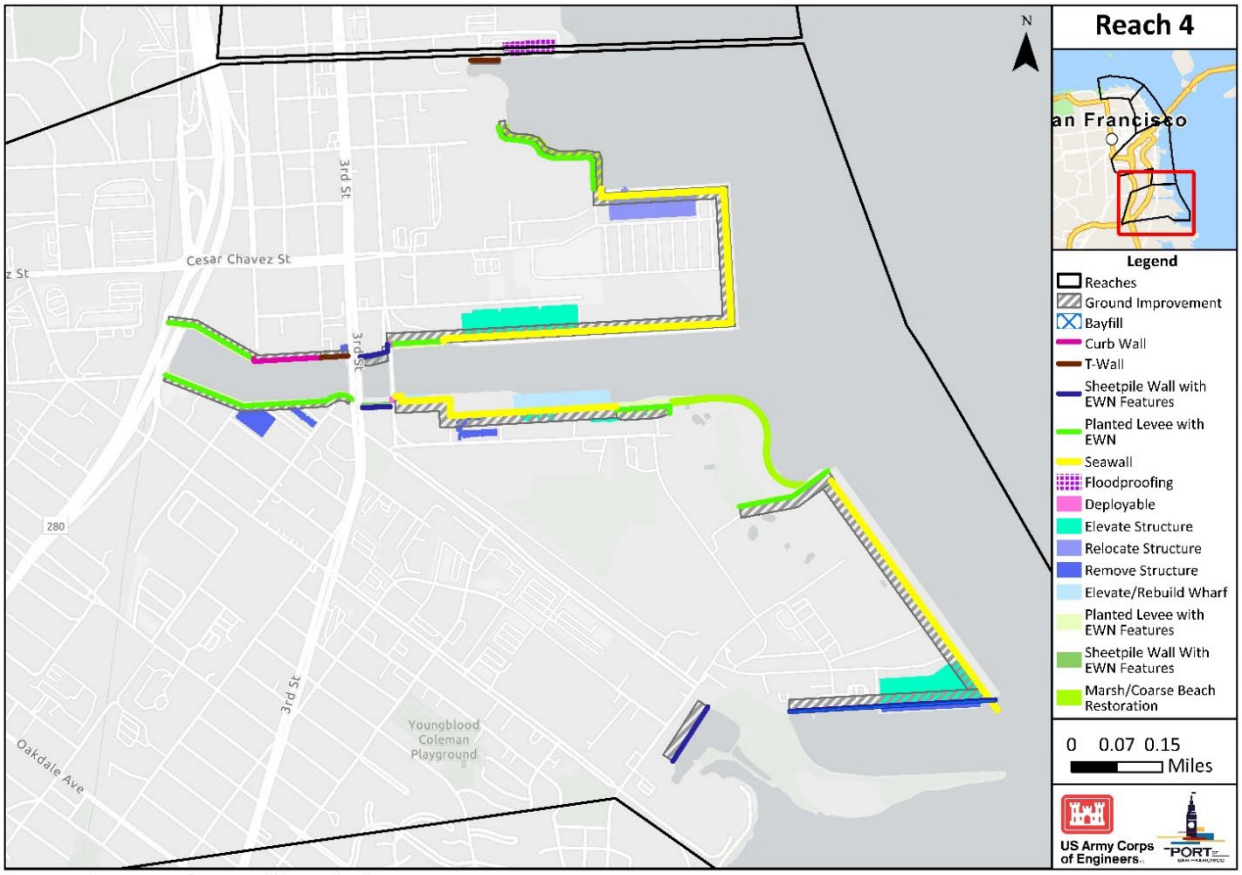


Figure 7. Recommended Plan Reach 4

1.5 Measure Descriptions

1.5.1 Floodproofing

There are two types of floodproofing – wet and dry floodproofing. As the name implies, wet floodproofing allows floodwaters to enter the structure, while, in contrast, dry floodproofing prevents the entry of floodwaters. Dry floodproofing is proposed for industrial and commercial properties and critical infrastructures and wet floodproofing is proposed for residential structures.

Wet floodproofing measures involve permanent or temporary measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure. Generally, this includes properly anchoring the structure, using flood resistant materials below the Base Flood Elevation, relocating and/or protecting mechanical and utility equipment, and use of openings or breakaway walls to avoid structural damage due to hydrostatic pressure and to allow flows to enter and exit the structure. Wet floodproofing is practical only for portions of a structure that are not used for living spaces, such as basements, elevated structures, crawlspaces, or attached garages.

Floodproofing activities would be completed in phases based on flooding frequency over a given period. Those with imminent risk would be completed first and properties where the risk rises as sea levels rise would be floodproofed when appropriate. The type of floodproofing would be structure dependent. Each structure would be evaluated independently of the others for what would be the most appropriate and least invasive method of flood protection possible that would still retain the integrity of the structure.

Many of the properties in the project area are considered historic and are eligible or listed on the National Register of Historic Places pursuant to the National Historic Preservation Act. For these historic structures, the National Park Service's "Guidelines on Flood Adaptation" would be used to aid in identification of appropriate measures to increase flood resiliency while meeting the Secretary of the Interior's Standards for Rehabilitation and preserving the property's historic features, spaces, materials, site, and setting.

1.5.2 Deployable

Deployable gates would be used to close the openings at bridges and where additional tie into high ground is needed during high water events, while allowing continued vehicular, pedestrian, and rail access at all other times. A range of potential deployables may be used depending on the location, type of access needed, frequency of use, anticipated flooding conditions, operation and maintenance needs, etc. and may include swing gates, roller gates, flip up barriers, or other removable deployables (Figure 8).

Permanent deployables are constructed to remain on-site and are designed for deployment temporarily during storm events or king tides. Typically, they are constructed of structural steel elements with a steel plate skin and tied into the adjacent flood protection measures (i.e., levee or vertical wall). Swing gates are attached to a reinforced column of a flood wall with hinges on one side, while rolling gates rest and roll on a ground wheel carrier or track along the gate sill.

When closed, compressible seals along the bottom and sides of the gate seal against the wall and sill to resist water infiltration. Depending on the height and width, additional bracing can be placed on the dry side of the gate to help it withstand the pressure of the water. Gates can have the option for a manual cranking system to close depending on size, but many times a motorized opening/closing device is required. Traffic control measures would be added to the bridges to warn of gate deployment when activated.



Figure 8. Example of permanent deployable flood gates.

1.5.3 Elevated Structures

Structure elevation involves raising each structure to a higher elevation to reduce the risk of flooding during high-water events. To do this, the structure is separated from its foundation and

temporarily raised in place with hydraulic jacks. The new foundation system, such as fill, columns, posts, piers, or raised foundation walls, would be constructed and then the structure lowered into place on the new foundation system. The goal is to ensure the lowest habitable floor is at or above the base of flood elevation or higher. Selection of proper elevation method depends on flood characteristics such as flood depth or velocity.

1.5.4 Relocate/Remove Structures

Structures may be removed from the existing location to eliminate the potential flood risk or to make room for the proposed flood protection system. This would require heavy machinery such as wrecking balls, excavators, and bulldozers. The building debris would need to be hauled off using large trucks or barges to an appropriate disposal facility. Structures identified for removal would be permanently removed and not rebuilt in place or elsewhere.

Structures identified for relocation would be physically relocated or rebuilt in another location off-site to be determined during the preconstruction, engineering, and design phase (PED). Relocated structures may be transported in whole or disassembled and then reassembled at the new location. For whole structure transport, a temporary steel framework is attached under the structure to support it, then lifted off the foundation using a network of hydraulic jacks placed under the framework and controlled by a unified jacking system. Once the structure is at a sufficient height, hydraulic dollies or a flatbed trailer(s) are placed under the supporting framework. These are used to move the structure to the new location. After the move, the steps are reversed, and the structure is lowered.

In some instances, buildings being relocated would require modifications to allow for moving, and to make structural improvements to meet current building codes and standards once re-established on their new foundation. This is most likely to apply to historic bulkhead and shed building structures that are part of the Embarcadero Historic District.

1.5.5 Curb Wall

A curb wall is a short wall, approximately two feet tall and no more than one-foot wide, made of reinforced concrete that would be connected to existing gray infrastructure (e.g., wharfs, piers, seawalls) to minimize floodwater entry into adjacent structures (Figure 9). The curb wall would be fixed to a concrete deck or capping beam along the perimeter of the main structure. For the feasibility study, the curb wall was assumed to be constructed of either cast-in-place concrete or precast concrete elements which are attached mechanically, both of which would include some type of water stop integrated to ensure an acceptable seal against seepage. During the PED phase, other elements such as glass or clear polymer panel that would provide similar functionality may be considered to minimize visual impacts from the land or Bay.

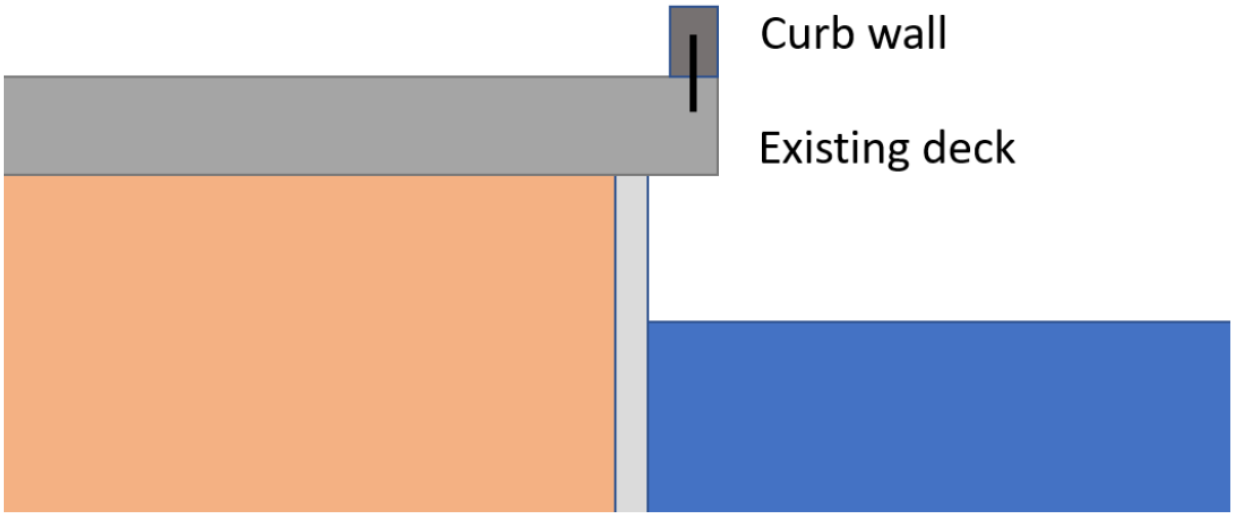


Figure 9. Example Curb Wall

1.5.6 Bulkhead Seawall

A seawall, synonymous with bulkhead wall, is a retaining wall structure that supports earthen fill on one side and protects against erosion caused by a waterbody on the other side. The seawall is the defined line of defense for the protection system. The design height of each seawall is the basis for how high the wharf or shoreline must be raised.

Seawalls are subdivided into two categories, 1) seawalls less than 30ft in vertical height from the seafloor, and 2) seawalls greater than 30ft in vertical height from the seafloor. The two different height groups roughly correspond to the anticipated maritime use along the wall, but also require different means of construction due to their scale and access for construction along the shoreline. Seawalls greater than 30 feet in height generally would require shoreline raises and/or wharf reconstruction and elevation if they are present, while seawalls less than 30 feet in height would typically only need the seawall itself to function as designed and not impede the existing land uses (Figure 10 and Figure 11). Shoreline elevation, wharf elevation, and rebuilding are described in further detail in subsequent sections.

In general, it was assumed that all seawalls are constructed of concrete. The seawall is either constructed of (i) precast concrete piles driven along the wall alignment at close spacing, followed by square piles driven to fit within the interstitial space to fill the voids and create space for a grout pocket, or (ii) forms would be constructed and filled with concrete. Voids would be grouted to create a low permeability wall that would retain soils and resist erosion of the shoreline. The need for additional anchorage or tiebacks at the top of the wall using steel rods or soil anchors may be needed; however, the best technique for installation would be determined during PED.

Construction of the seawall is assumed to be completed from land by using secant pile or diaphragm wall designs. However, if other measures at the location require construction of a cofferdam and dewatering or construction in the “wet”, then the seawall may also employ similar techniques to avoid multiple moves of equipment or additional disruptions.

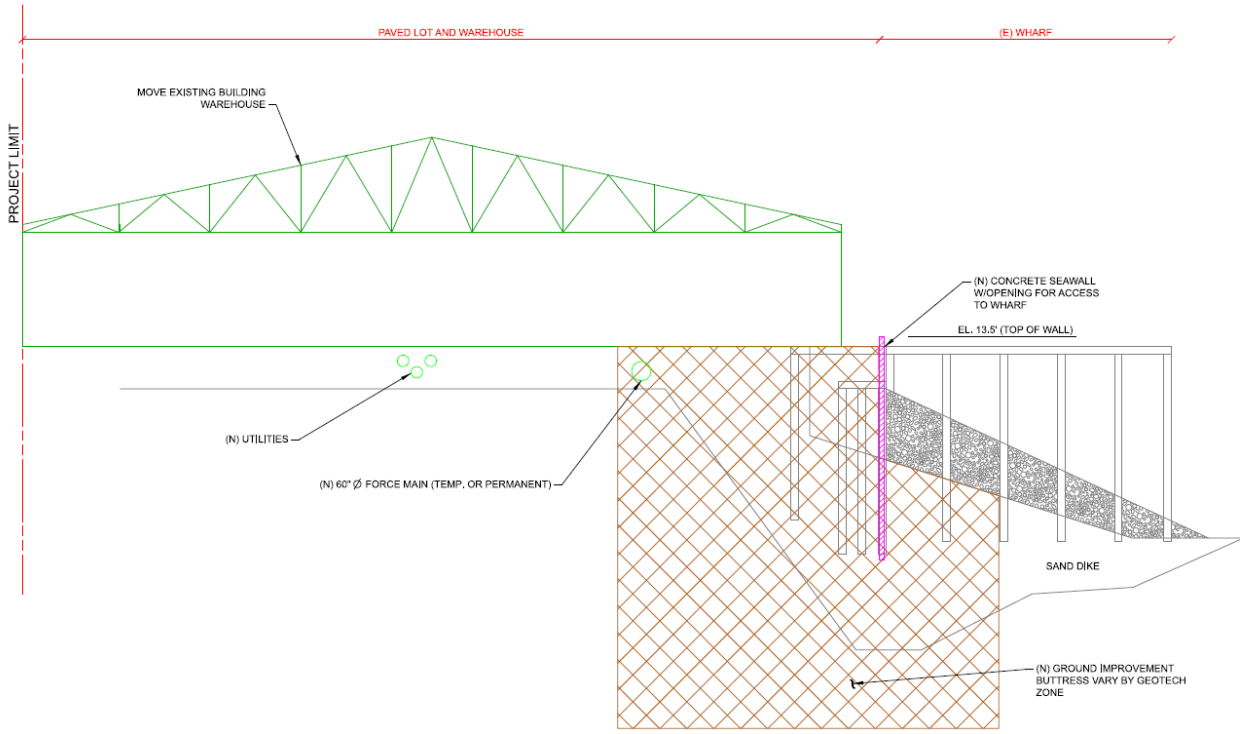


Figure 10. Example Cross-Section of a Seawall <30 Feet Tall Where no Wharf or Shoreline Elevation is Needed (e.g., Pier 80).

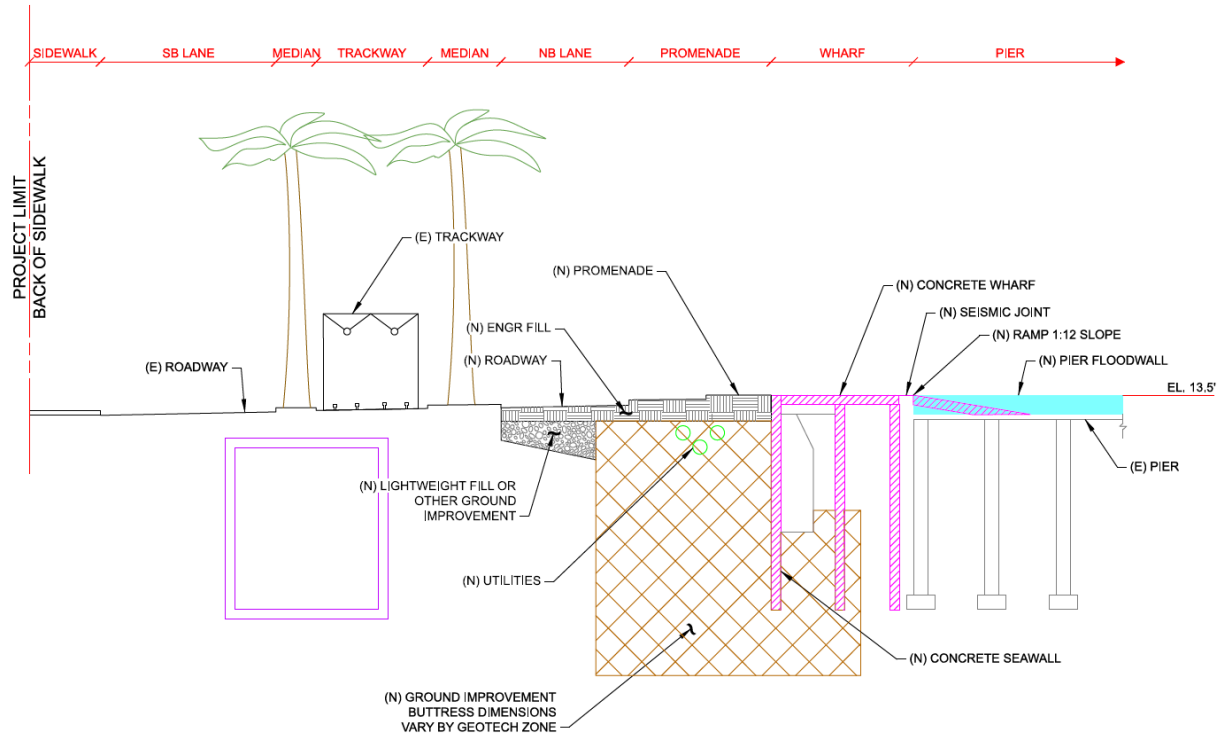


Figure 11. Example Cross-Section of a Seawall >30 feet Tall where Wharf and Shoreline Elevation are Needed (e.g., Pier 28)

1.5.7 Ferry Building Seawall

At the Ferry Building, the complicated foundation condition and confluence of buried infrastructure warrant a bayward line of defense. A new seawall would be constructed to follow the perimeter of the Ferry Building Structure (Figure 12). This would require approximately 4.6 acres of bay fill to back fill voids between the new and existing seawall. Fill materials would be imported material from commercial sources.

To construct the new seawalls, a cofferdam (described in Section 1.3) would be constructed around the work area and the area landward would be dewatered.

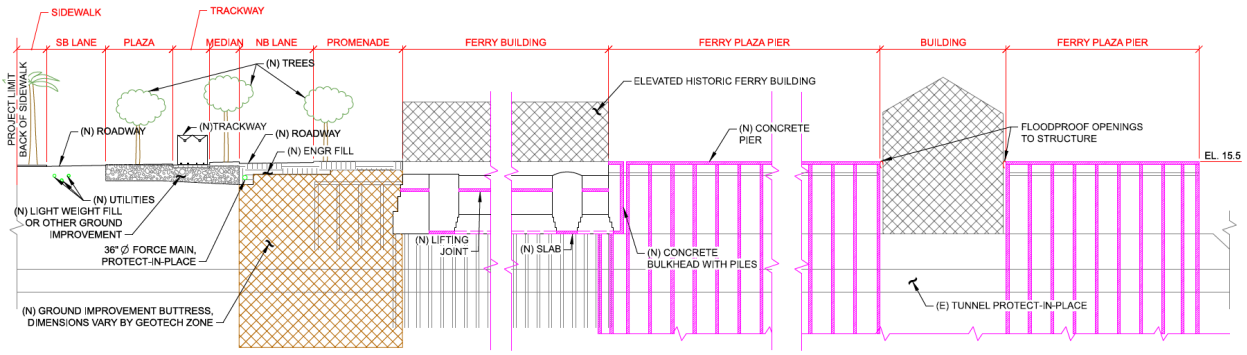


Figure 12. Proposed Cross-Section of the Seawall, Shoreline Elevation, and Wharf Raise at the Ferry Building.

1.5.8 Rincon Park Seawall

At Rincon Park, a new seawall needs to be constructed approximately 60 feet into the bay to mitigate disruption to below grade transit infrastructure and the surface transit corridor in this area (Figure 13). The Rincon Park seawall would require approximately 4.0 acres of bay fill to fill the void between the new and existing seawall. Construction at this location would be similar to what is described for the Ferry Building and require cofferdam construction.

Additional EWN® features have been added in front of the seawall to provide a natural solution to protecting the new seawall from high tidal energies at this location. The rocky intertidal bluff feature is described further below.

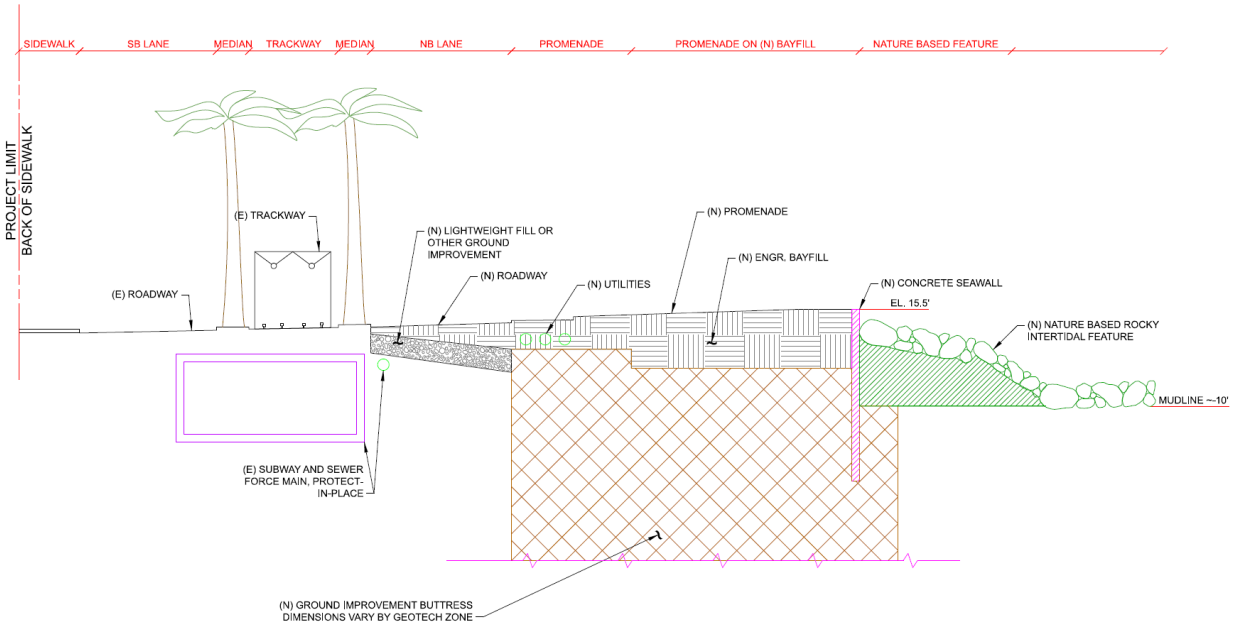


Figure 13. Proposed Cross-Section for the Seawall and Shoreline Elevation at Rincon Park.

1.5.9 T-wall

A T-wall has a cross-section of an inverted “T”, and as designed for this project, is configured with a horizontal base (Figure 14) and is also the basis for the line of defense where this measure is employed. In some areas, a new pile-supported T-wall would be constructed landside of the existing or integral to a new seawall. At this design level, the T-walls are assumed to be founded on deep foundations consisting of either steel H-piles or pipe piles which could be driven either vertically or battered depending on the design loads and underground site constraints. A steel sheet pile cutoff, extending 20-30 feet vertically beneath the wall base, would be installed to reduce under seepage and uplift pressures on the structure. The pile foundations are assumed to consist of two rows of piles which are 50 feet in length and placed on 5-foot centers along the wall length. The panel height of each t-wall is dependent upon the existing elevation. The base of each t-wall is constructed wider than typical for the designed panel height to accommodate anticipated adaptability for future height increase. These design estimates would be refined in the PED phase.

After the T-Wall is complete, the area landward of the t-wall would be regraded using imported fill material from commercial sources. After grading, the fill material would be paved to create sidewalks and landscaping added.

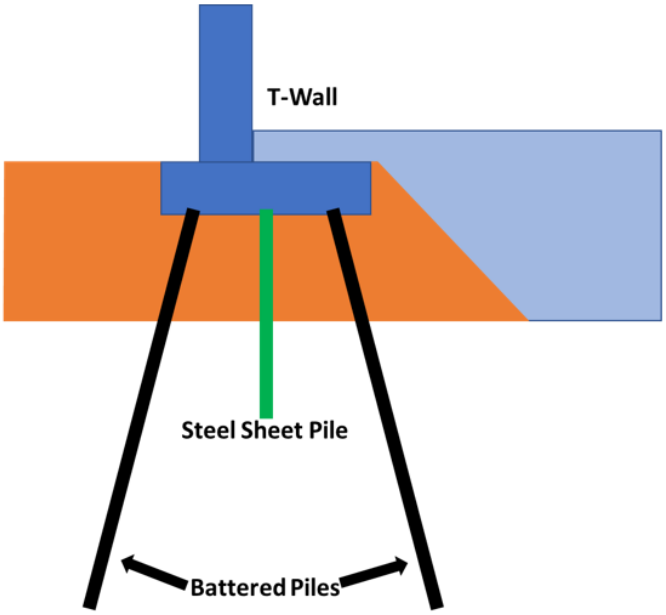


Figure 14. Typical T-Wall Cross-Section

1.5.10 Elevated Shoreline

Where the existing shoreline elevation is lower than the top of design elevation of the new seawall or T-wall, the shoreline may need to be elevated or raised 3.5 to 7.5 feet to defend against 3.5 feet of sea level rise (13.5 or 15.5 feet NAVD88 top design elevation) (Figure 15). To raise the shoreline, the area landward of the seawall would be filled with imported material from commercial sources, compacted down, and regraded over sufficient space to facilitate grade transitions, transit, vehicular and multi-modal access along the urban waterfront edge. Roadway, trackway, and promenade configurations are assumed to be generally the same as existing configuration; however, the exact surface configuration would be determined during PED.

Shoreline elevation would be constructed using standard earth moving equipment such as graders, bulldozers, dump trucks, etc. after all ground improvement measures have been completed. Any utilities that would be affected would also be relocated or modified to function with the new shoreline design.

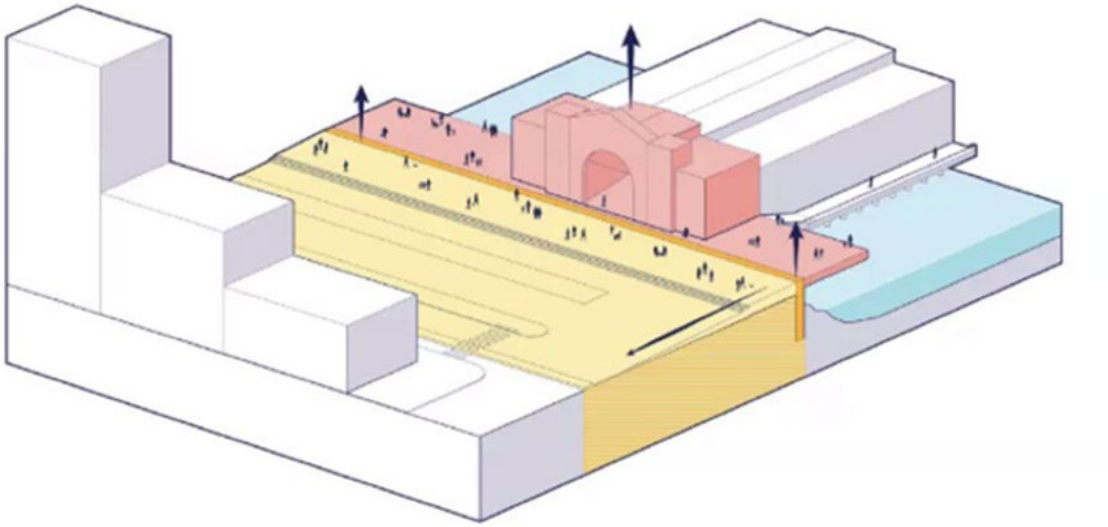


Figure 15. Example of Shoreline Elevation (yellow), Seawall Construction (orange), and Wharf Elevation (red).

1.5.11 Elevate/Rebuild Wharf

In places where the shoreline is being elevated, the existing bulkhead wharf, typically 50 feet wide running parallel to the shoreline, would also be elevated (Figure 16). The bulkhead wharf would be replaced with a new elevated reinforced concrete wharf structure with the top of the deck at specified flood defense design elevation.

To construct the new wharf, the existing wharf would be demolished, material removed, hauled away, and disposed of at an appropriate and approved facility. This would entail pulling out old pilings and existing concrete deck and surfacing (concrete or asphalt). The new wharf would then be constructed in the place of the old wharf. First, the 24-inch octagonal reinforced concrete or steel piles, approximately 100 feet long spaced on a 15-foot by 15-foot grid, would be driven through the rock dike down to competent soils using marine equipment and impact or vibratory pile driving techniques. Then, an approximately 12-inch-thick reinforced concrete deck (flat slab) made of pre-case elements or using cast-in-place construction, extending approximately 50 ft over the bay in all locations, except at the Ferry Plaza, would be constructed on top of the newly placed piles. At the Ferry Plaza, the reconstructed, reinforced concrete deck extends approximately 650’ into the bay to provide emergency egress and vehicular access for the Bay Area Rapid Transit system (Figure 12). During PED the design is likely to be refined (e.g., spacing and thickness may vary depending on load bearing, materials used, increase in height, etc.) and additional features may be incorporated such as glass blocks in the decking to allow for light penetration to the water below.

Reinforced concrete ramps would be constructed to allow pedestrian and vehicular access from the elevated wharf to the finger piers, since the finger piers that stretch out into the bay would remain at the existing elevation, unless otherwise noted.

With the new wharf design, less bay fill from pile material is anticipated when compared to the existing bay fill from existing piles; however, the change cannot be quantified at this time due to uncertainty in the number and size of existing piles at each wharf.

Wharf raising may be constructed in the wet using marine or land-based equipment if the wharf raise is not being completed in conjunction with a measure that would require a temporary cofferdam. If a cofferdam is intended to construct other measures at the location, it is anticipated that the cofferdam would not be breached until after all construction is complete including the wharf elevation and rebuild.

For wharves that supports structures, each would be removed, relocated and/or replaced (see description for relocating/removing structures above). For buildings requiring relocation and replacement back on the wharf, it is assumed that these buildings would be either braced and moved to a temporary location (on land or to floating barge) or carefully dismantled and stored until the new wharf is constructed. Once the new wharf is constructed the structure(s) would be moved back or reassembled.

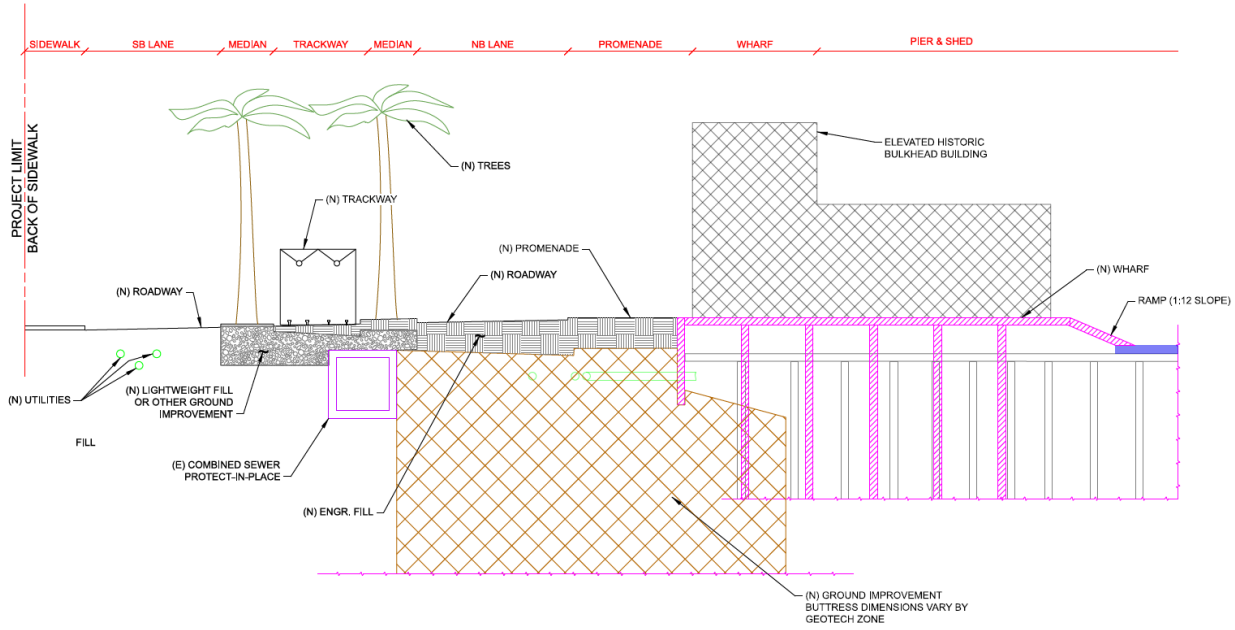


Figure 16. Example Cross-Section with an Elevated Shoreline, Elevated and Rebuilt Wharf, Elevated Structures, and a Ramp Down to the Existing Finger Pier (e.g., Pier 3)

1.5.12 Paved Levee

The levees would be designed as a raised earthen bank with a trapezoidal cross-section with a wider base that slopes up to a narrower crest to fortify against flooding risks (Figure 17). For alternative development, the side slopes were assumed to be no steeper than 3H:1V. It is likely that in locations where vehicle passage is necessary the slopes may range from 5H–10H:1V and on piers the slopes may be 12H:1V to accommodate Americans with Disabilities Act (ADA) accessibility requirements. The required levee height and width is dependent on local existing elevations and the final flood side design side slope and configuration. The height of the levee

could range from one to 10 feet to achieve the target design elevation of 13.5 feet in reach 2 and 3 or 15.5 feet NAVD88 in reach 4. The crest width of the levee may range from 10 to 20 feet. Final levee dimensions would be determined during PED.

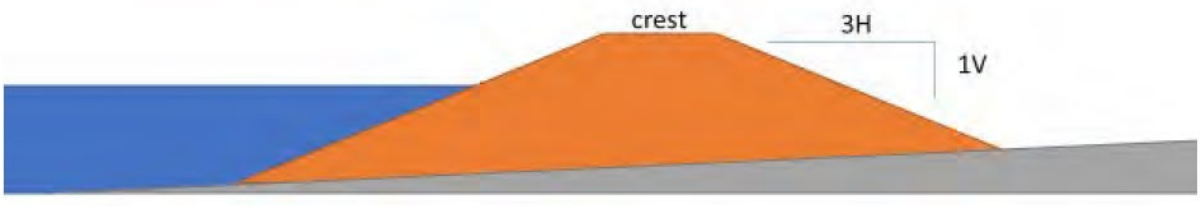


Figure 17. Typical Cross Section of a Levee

To construct the levees, first any existing vegetation, structures, roadways or parking lots along the proposed alignment would be removed and all material disposed of offsite. If utilities are within the alignment, they would need to be relocated prior to construction beginning. The project site would then be prepared for the levee foundation, which may include but is not limited to grading/stripping earthwork, adding or removing subgrade materials, drainage improvements, ground improvements, etc. The levees would be constructed of imported impervious earthen fill material, assumed to be procured from a commercial source near San Francisco and delivered to each site via dump truck. Fill would be placed in layers and compacted to reach the desired strength, width and height. For levees with a crest height ≥ 4 ft, a 20-foot-deep continuous vinyl sheet pile seepage barrier would be installed along the centerline of the structure using a vibratory or impact hammer to prevent undermining of the levee. Once complete, the levee would be dressed in a combination of commercially sourced bedding stones, rip rap/armoring stones, concrete, and/or pavement depending on the location of the structure and long-term use (Figure 18). Any existing bike lanes, bay trails, or roadways disrupted by the new structure would be relocated or built into the overall design of the structure (e.g. crest may be converted to a paved bike path or walking trail). Final levee dimensions and site-specific construction requirements would be determined during PED (Figure 19).

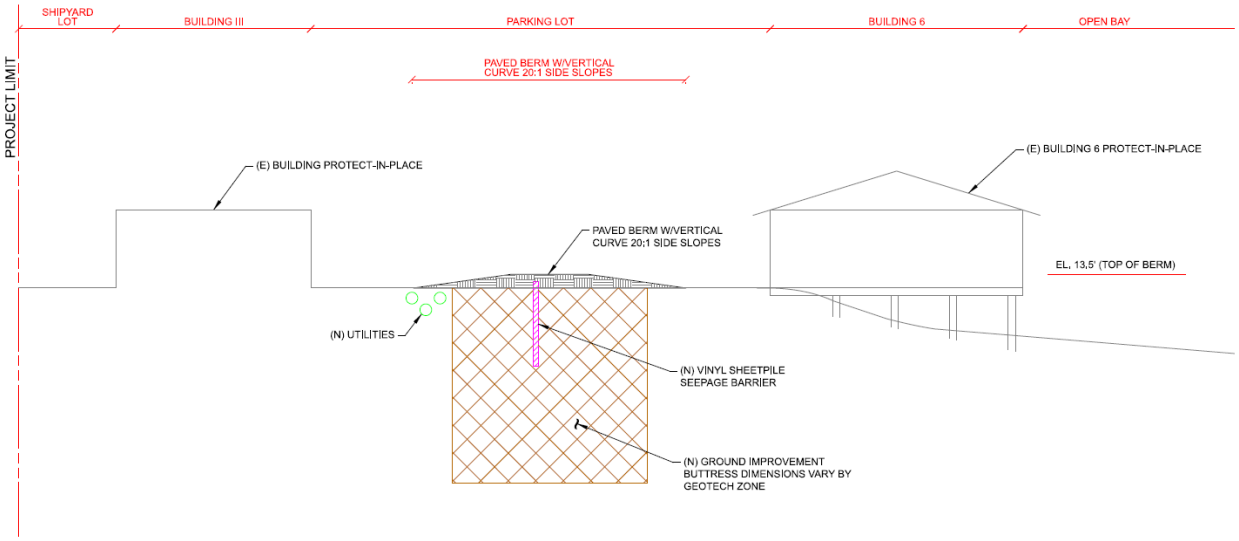


Figure 18. Example Cross-Section of a ≥ 4 ft Levee with a Paved Surface (e.g., Shipyard)

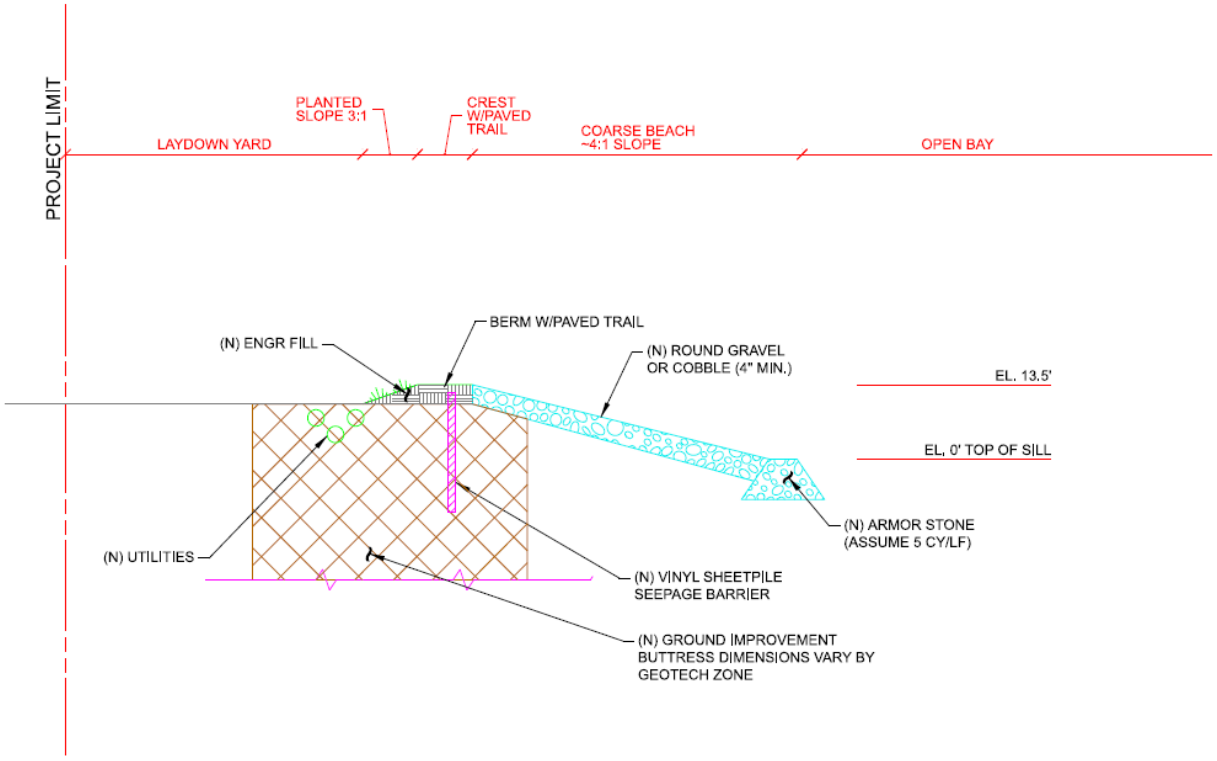


Figure 19. Example Cross-Section of a ≥ 4 ft Levee with a Paved Trail on the Crest and Armoring Stones on the Bayward Slope (e.g., Warm Water Cove)

1.5.13 Planted Levees with EWN® Features

The planted levees would be constructed in the same manner as the Paved Levees measure except that the levee surface would be dressed in more native materials and pervious type

surfaces and the side slopes may have gentler slopes to incorporate EWN® features. This style levee typically connects the levee to terrestrial or aquatic habitat and can provide high quality transition zone habitat when vegetated with native plants. The slopes of these structures would typically vary between 10H:1V in space constrained areas to 30H:1V in isolated areas where real estate is not restrictive.

Each levee would be constructed of the same commercially sourced imported impervious earthen fill material as the paved levee, but the topsoil would need to be specified based on the vegetation type anticipated to cover the slope. The final design of the planted levee and the type of EWN® incorporated at each location would be dependent on site-specific conditions including real estate constraints, adjacent habitat types that can be connected, desired species composition and recruitment, and long-term use of the area. Each design would include erosion control and stabilization of slopes using biological, mechanical and ecological concepts while providing floodable area in storms and extreme tides. The additional EWN features may be constructed of many different materials and textures to create a layered approach that can be refined to suit site and design needs. Additionally, each design considered would avoid introducing material into open water areas to avoid bay fill, while over the long-term would increase available aquatic habitats as RSLC occurs.

For space constrained locations, such as areas along the lower creek banks of Islais and Mission Creeks, creek enhancements such as habitat shelves or terraces, planted edges, live crib walls, and other measures that increase surface complexity could be constructed within the same footprint as the traditional levee proposed (Figure 20).

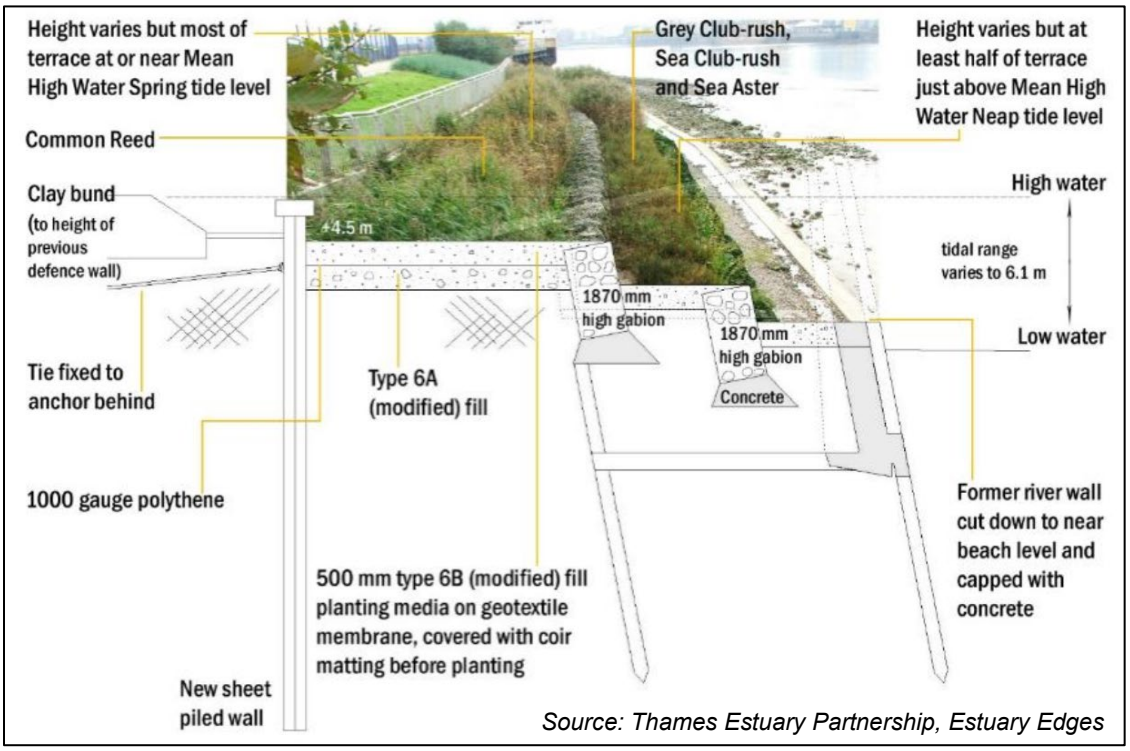


Figure 20. Example Creek Enhancements on the Thames Estuary.

Where space is available, a gentle slope may be graded to support multiple transition zones and may feature a levee with side slopes greater than 10H:1V. At the crest, upland habitat would be created and transition to riparian, marsh and/or beach habitat to open water on the bayward side slope (Figure 21 and Figure 22). For levees with a steeper grade slope, vegetated riprap may be incorporated while gentler slopes may rely entirely on native materials.

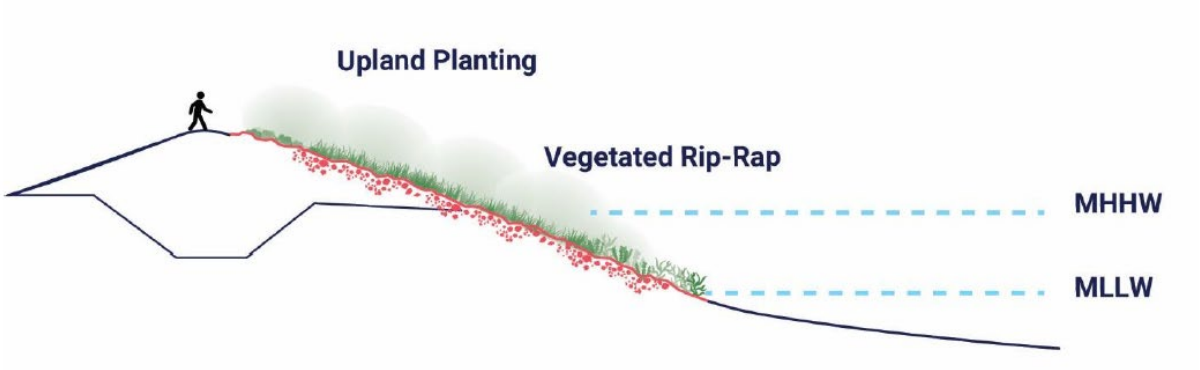


Figure 21. Example Cross-Section of a Planted Levee Where a Moderate Amount of Space is Available (~10H:1V slope).

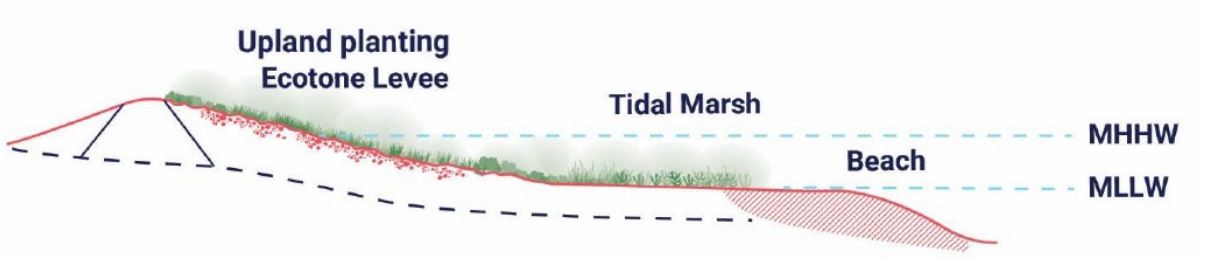


Figure 22. Example Cross-Section of a Planted Levee Where Considerable Space Available (~ 30H:1V slope).

Vegetated riprap, or ecological armoring, is armoring a direct replacement for traditional riprap that aims to replicate the natural processes and functions of rocky, intertidal habitat. Interlocking layered armored protection units or differently shaped riprap, sometimes with integrated tide pools, are designed to mimic natural intertidal conditions and create microhabitats, including vegetation establishment (Figure 23). Units can be stone (riprap), concrete, or other precast materials. In suitable environments, the units may be vegetated by filling in voids with soil and planted with upland, riparian or intertidal species.



Figure 23. Example of Ecologically Engineered Articulated Concrete Block Mattress Used as Ecological Armoring (Source: Courtesy of ECOncrete Tech, Ltd.)

1.5.14 Sheet Pile Wall with EWN® Features

At locations identified for Sheet Pile Wall with EWN® Features, a standalone sheet pile wall would be constructed as a floodwall, unlike in other measures where a sheet pile wall would be constructed in combination with another feature (e.g., levee or seawall). A sheet pile wall is a construction feature involving driving interlocking sheets of material into the ground to act as a barrier to contain water, for bank stabilization, and to prevent water from overflowing into vulnerable areas. The measure may be constructed using steel and/or cast-in place concrete materials using the same techniques described previously. The sheet pile wall would be constructed using land-based equipment.

As part of this measure, EWN® features that would be used in space constrained locations would be incorporated into the overall design to provide additional protection to the floodwall (Figure 24). The EWN® features would be constructed as described in the Planted Levees description.

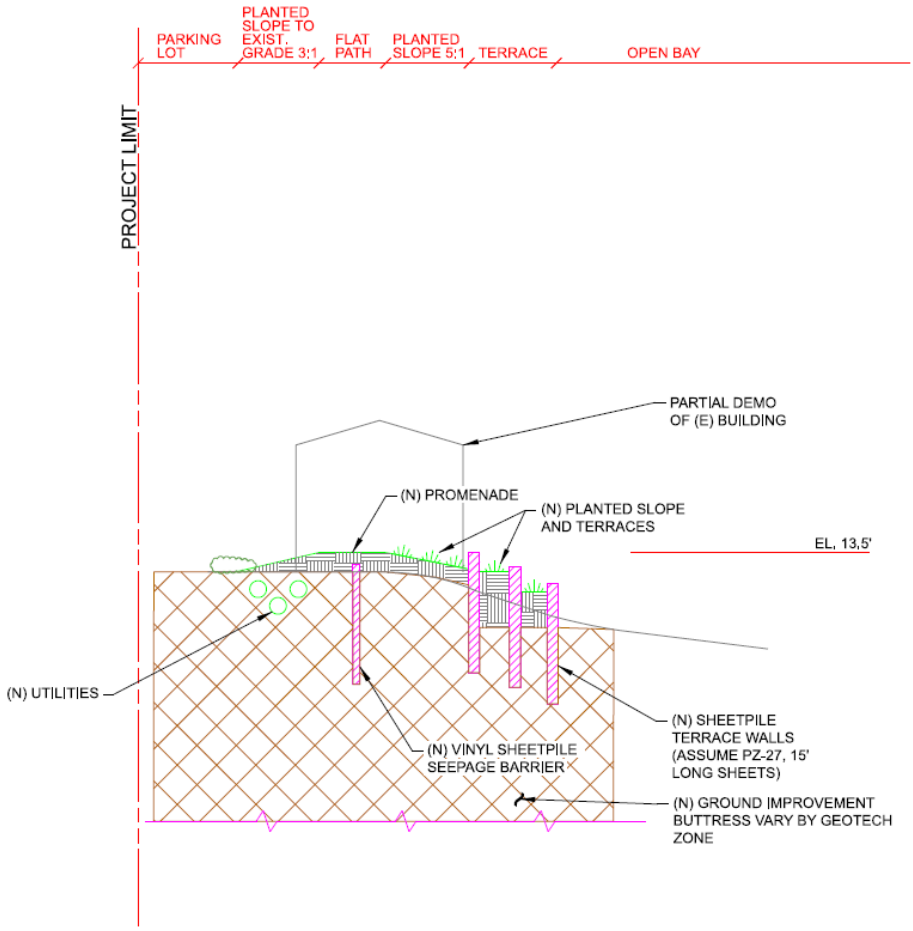


Figure 24. Example Cross-Section Using Sheet Pile Walls and EWN® Features (e.g., Mission Creek North)

1.5.15 EWN® -- Marsh/Coarse Beach Restoration

Marsh and coarse beach restoration involves the restoration of degraded existing coastal wetlands (e.g., salt, brackish, and tidal freshwater marshes), mudflats, and/or coarse beach found in the proposed measure location. To restore the target habitat type at each location, sediment and other natural materials (cobble, gravel, larger rock size) would be introduced to the site to reach a target design elevation that would support the long-term viability of the desired habitat (Figure 25).

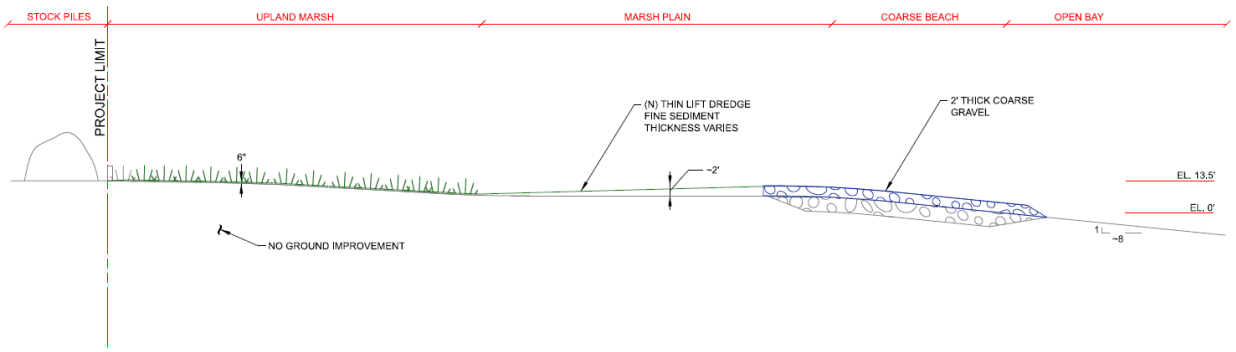


Figure 25. Example Cross-Section of Marsh and Coarse Beach Restoration Proposed at Pier 94 Wetlands

It is assumed material used to augment or nourish the marsh or beach would come from a commercially sourced material or from dredged material removed during normal operations and maintenance cycles (i.e. no new dredging would be pursued to implement this measure). The source of material would be determined during PED, but in any case, material placed at the site must have similar properties to the existing marsh or beach or meet the conditions of the target habitat type, if being created rather than restored.

To construct the marsh or beach, the material would be dumped in place (commercially sourced material) or pumped through a series of pipelines (dredged material) into the site until the surface profile is built up to the target elevations, which would be determined during PED and based on the target species, salinity and flooding regime and site conditions. Heavy machinery would be used to move sediment and facilitate construction which could include bulldozers, front-end loaders, track-hoes, marsh buggy, and backhoes. As necessary, temporary containment dikes would be constructed from in-situ material around the nourished areas to minimize material movement and to delineate work areas. The dikes would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages deemed appropriate for the site.

It is assumed that work would begin in an individual cell and continue until that cell is completed, with attempts made to not place material in more than one cell at a time to minimize the disturbance to existing marsh processes. Figure 26 shows an example of marsh restored at Heron's Head and Figure 27 shows an example of coarse beach restored in San Francisco that both would be suitable reference sites for restoration targets.

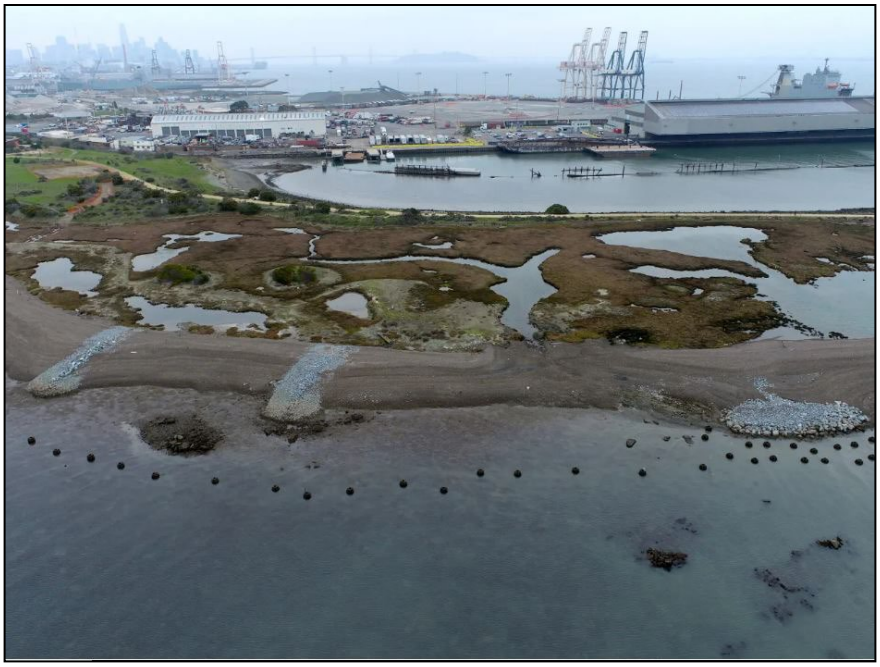


Figure 26. Tidal Marsh at Heron's Head in San Francisco, CA. Source: Port of San Francisco.



Photo Credit: SFEI

Figure 27. Example Coarse Beach Restoration in San Francisco

1.5.16 EWN® -- Rocky Intertidal Bluffs

Rocky Intertidal Bluffs would only be constructed at Rincon Park just south of the Ferry Building. This particular EWN® feature integrates an engineered rocky tidal habitat into the shoreline elevation and bulkhead seawall design as a way to minimize wave runup and promote greater biodiversity along a steep shoreline rather than relying on traditional riprap or other engineered armoring to protect the new bulkhead seawall (Figure 28). Approximately 2.0 acres of new intertidal and subtidal habitat would be constructed bayward of the new seawall.

To construct the rocky intertidal bluff, a foundation of compacted sediment would be placed along the mudline/bay bottom and built up to achieve a target profile that slopes from the new seawall to the mudline. On top of this foundation, a combination of sand, gravel, rock, and/or pre-cast material like ecological armoring of varying sizes would be placed using cranes and heavy machinery to create tidepools and bluff areas to increase surface complexity (grooves, crevices, nooks, etc.). After construction is complete, the cofferdam would be removed, and the area would be subject to inundation. Minor refinements and adjustments to material in the rocky intertidal bluff post-construction, such as moving, replacing or adding more stone or other materials, is anticipated to be needed to meet the design goals.

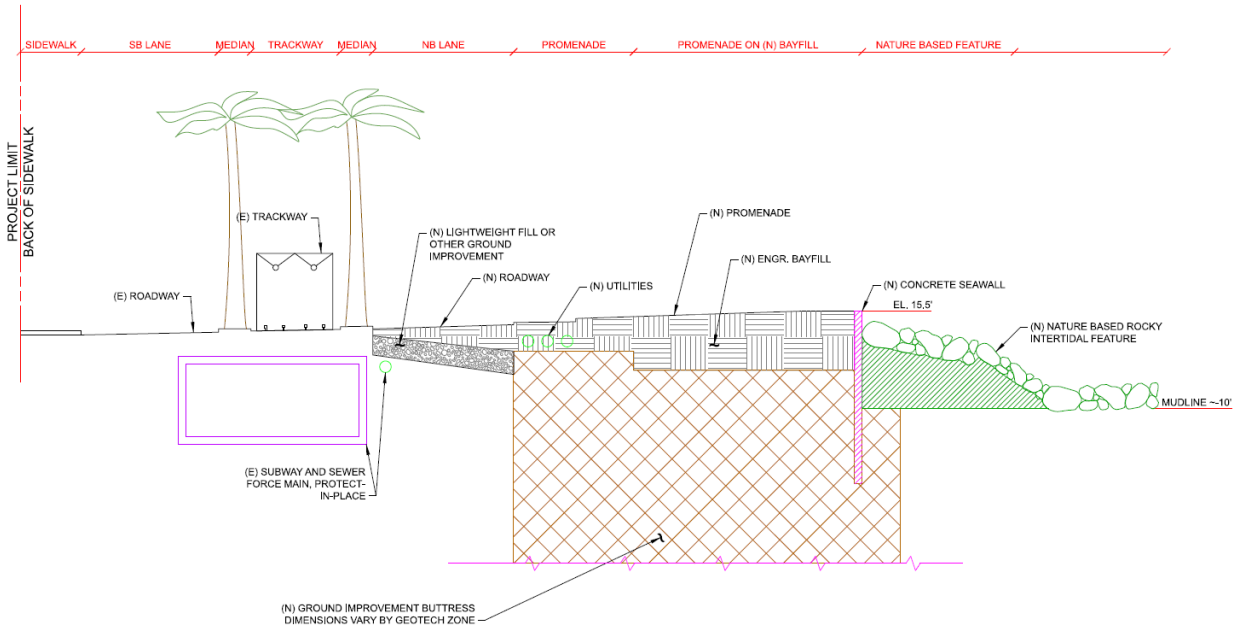


Figure 28. Cross Section of Intertidal Rocky Bluff at Rincon Park

1.15.17 EWN ® -- Living Seawalls

Living seawalls consist of structural elements combined with traditional seawalls that create varied micro-habitat conditions through surface relief and material composition (Figure 29). The introduction of surface complexity (e.g., surface texture, grooves, crevices, and nooks) to traditionally smooth surfaces promote vegetation growth, provides foraging habitat, and creates shelter from predation.

Living seawalls would be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design would incorporate textures to increase surface complexity). These elements would be incorporated as part of the pre-cast or cast-in-place forms used to construct the walls or piles. No additional specialized equipment or methodology is necessary to incorporate this added EWN feature and should not increase the construction duration.

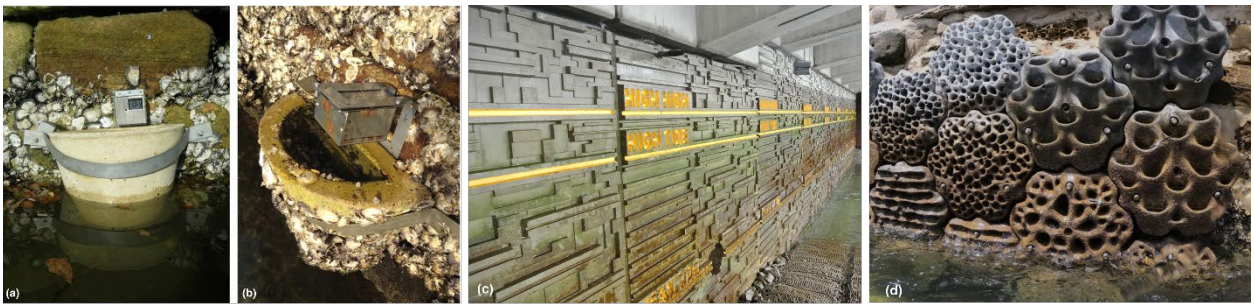


Figure 29. Examples of living seawall/vertical enhancements that could be installed on vertical shorelines. These could consist of pre-cast pots as shown in (a), (b), or (d) and pre-cast panels (c). Source: Morris et al. 2017; Waterfront Seattle; van Remortel 2022.

1.15.18 Ground Improvements

Ground improvements are proposed to be incorporated into several of the structural measures to address both static and seismic loading conditions because of poor soil conditions and the increased weight of the new construction. A deep soil mixed (DSM) stabilization buttress with a 1:1 height to depth ratio (50 feet by 50 feet for Zone 1 and 100 feet by 100 feet for Zone 2) is currently assumed to be sufficient to stabilize the foundation and shoreline soil but would be further refined during PED when site-specific conditions are known. The DSM process forms columns of cemented material in the ground by mechanically mixing the in-situ soil with an introduced binder agent such as cement or lime. The binder can be introduced either by injection of a wet slurry or dry binder systems through the mechanical mixing tool. A grid of individual or overlapping soil mixed columns would make up the buttress.

The installation of DSM columns involves the introduction of a rotating auger into the subsoil which disrupts the existing soil structure and mixes it with the injected binder. Typically, one to six augers are mounted to a drilling rig and each auger consists of a drilling rod and cross bars. The soil mixing process is aided by injecting the cement binder through nozzles located at the end of the drilling rod. The column formation stage starts after reaching the target depth, which is usually divided into several stages where the auger is lifted and lowered to ensure adequate mixing of the soil with the binder and to form a homogeneous column. The width of the column would be determined during PED but could range from 2 to 9 feet wide.

1.6 Avoidance, Minimization, and Conservation Measures

This section outlines avoidance and minimization measures (AMMs), best management practices (BMPs), and conservation measures proposed by the USACE to avoid and minimize potential project effects on federally listed species and their habitat within the action area, including steelhead, chinook salmon, green sturgeon, critical habitat, and EFH.

These proposed measures are reflective of criteria established by the USACE for standard practices in construction activities and conditions of Biological Opinions for other San Francisco projects with similar activities.

1.6.1 Aquatic Resources

The USACE and its contractors shall minimize impacts on fish, including protected species, by implementing the following measures

- Prevent fish entrapment and entrainment during dewatering, such that fish rescue operations shall occur where dewatering and resulting isolation of fish may occur. Fish rescue and salvage operations shall occur prior to and during dewatering. If the enclosed area is wadable (less than 3 ft deep), fish can be herded out of the enclosure by dragging a seine (net) through the enclosure, starting from the enclosed end and continuing to the opening. After completing fish herding, the net or an exclusion screen shall be positioned at the opening to prevent fish from reentering the enclosure. Screens shall be checked periodically and cleaned of debris to permit free flow of water.
- Sheet piles, block nets, or other temporary exclusion methods (e.g., silt curtains) could be used to exclude fish or isolate the construction area prior to a fish removal process.
- A dewatering plan shall be submitted as part of the SWPPP and Water Pollution Control Program, detailing the location of dewatering activities, equipment, and discharge point. Dewatering pump intakes shall be screened to prevent entrainment of fish in accordance with the NMFS screen criteria.
- A qualified fish biologist or fish rescue team shall be onsite during the dewatering process to minimize the number of fish that become trapped in isolated areas or impinged on pump screen(s) or isolation nets.
- Prior to any in-water construction that would require pile driving, a NMFS-approved sound attenuation monitoring plan to protect fish and marine mammals shall be implemented during construction.
- All in-water construction shall be conducted within the environmental work window between June 1 and November 30, designed to avoid or minimize potential impacts to fish species.
- A soft start technique (release of pile-driving hammer without hydraulic pressure) to impact hammer pile driving shall be implemented, at the start of each workday or after a break in impact hammer driving of 30 minutes or more, to give fish and marine mammals an opportunity to vacate the area.
- During in-water installation of piles, when feasible, vibratory hammers should be used in place of impact hammers, as well as cushion blocks should be used.
- During in-water installation of piles, when feasible, bubble curtains will be considered for use with impact hammers to reduce impacts to fish.
- Functional grating or glass prisms will be considered in the design for new wharf decking to maximize light transmittance in nearshore zones (first 10-15 feet from the bulkhead).
- During construction near the water, artificial light should be directed away from sensitive habitats and species, to include shielding and/or downward-directed, to prevent disruption to aquatic species.
- Ecological armoring features will be designed to the extent feasible to include tide pools or water-retaining shapes over flat textured panels where practicable to increase surface area for invertebrate prey colonization.
- Rocky intertidal bluffs will be designed to the extent feasible include variable slopes, rather than uniform, to create micro-habitats and velocity refugia for fish.

The USACE and its contractors shall minimize impacts on waters of the U.S. and waters of the state, including wetlands, by implementing the following measures:

- The Recommended Plan shall be designed to avoid, to the extent practicable, work within wetlands and/or waters under the jurisdiction of the USACE, the regional waterboard, the California Department of Fish and Wildlife, and the Bay Area Conservation and Development Commission. Permits or approvals shall be sought from the regulating agencies as required. Where wetlands or other water features must be disturbed, the minimum area of disturbance necessary for construction shall be identified and the area outside avoided.
- Prior to construction within 50 ft of any wetlands and drainages, appropriate measures shall be taken to ensure protection of the wetland from construction runoff or direct impact from equipment or materials, such as installation of a silt fence, and signs indicating the required avoidance. No equipment mobilization, grading, clearing, or storage of equipment or machinery, or similar activity, shall occur until a qualified biologist has inspected and approved the fencing installed around these features. The contractor shall ensure the temporary fencing is maintained until construction activities cease.
- Where disturbance to jurisdictional wetlands or waters cannot be avoided, any temporarily affected areas shall be restored to pre-construction conditions or better at the end of construction, in accordance with regulating agencies.

1.6.2 Water quality

In order to avoid and/or minimize potential impacts to waters of the U.S. and state, water quality, and biological resources, the following minimum construction BMPs would be implemented as part of the proposed project. These minimum measures would be subject to modification and additions based upon regulatory and resource agency review.

- Unless otherwise specified in the project biological opinion, in-water construction activities shall be restricted to the NOAA approved environmental work window (June 1 to November 30).
- No debris, trash, creosote-treated wood, soil, silt, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products shall be placed in a location where it would be subject to erosion by rain, wind, or waves and allowed to enter jurisdictional waters, including as a result of fueling activities and storage of hazardous materials.
- No fresh concrete or concrete washings shall enter into jurisdictional waters. Fresh concrete would be isolated until it no longer poses a threat to water quality using appropriate measures, including exclusion of poured concrete from jurisdictional waters, such as open San Francisco Bay waters. Contractor(s) shall use only designated concrete transit vehicle cleanout stations for cleanout.
- Protective measures shall be utilized to prevent accidental discharges to waters during fueling, cleaning, and maintenance.
- Floating booms shall be used to contain debris discharged into waters and any debris shall be removed as soon as possible, no later than the end of each workday.

- Machinery or construction materials not essential for project improvements shall not be allowed at any time in the intertidal zone. The construction contractor shall be responsible for checking daily tide and current reports.
- Well-maintained equipment shall be used.
- A spill prevention contingency plan for hazardous waste spills into San Francisco Bay shall be prepared for review and approval. The plan shall include, at a minimum, floating booms, and absorbent materials to recover hazardous wastes.
- Contractors shall prepare an anchoring plan that applies to all ships, barges, and other open water vessels and describes procedures for deploying, using, and recovering anchorages.

BMPs for construction water-handling procedures and requirements for dewatering discharges in the project area include:

- Dischargers shall not violate any discharge prohibitions contained in applicable Basin Plans or statewide water quality control panels.
- The discharge does not cause or contribute to a violation of any water quality standard.
- The discharge is not prohibited by the applicable Basin Plan.
- The discharger has included and implemented specific BMPs required by their permit to prevent or reduce the contact of the non-stormwater discharge with construction materials or equipment.
- The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants.
- The discharge is monitored and meets the applicable numeric action levels.

1.6.3 Sediments and Erosion Control

BMPs would be used to manage sediment and erosion during the construction. Construction period preparedness and weather condition BMPs control erosion and sediment through management and monitoring that includes:

- Ensuring the contractor has the appropriate equipment and materials available at the start of construction to complete the project within the planned time frame.
- All disturbed areas are treated with erosion control measures.
- Coordination between vegetative planting and grading is in place prior to construction.
- Daily weather monitoring for possible precipitation events and a plan in case of significant rainfall.
- Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control erosion, storm water runoff, sedimentation, and other construction-related pollutants during all phases of construction, until the construction is complete and all disturbed areas are permanently stabilized throughout the project area.

The short-term increase in sediment would be reduced by implementing the following erosion control measures during construction:

- All soils would be stabilized within 14 days of completed work.
- Construction equipment would be limited to the actual area being disturbed and vehicles may not travel in areas outside of designated staging areas or access routes.
- Short-term staging of soil material (less than 1 week) would be surrounded by a silt fence, fiber rolls, or other perimeter.
- Long-term staging of soil material (longer than 1 week) would be placed away from surface waters, vegetated, and surrounded by a levee perimeter to control runoff and erosion.
- Excavation would be limited to the extent practicable. All excavated material that is not relocated to another portion of the project area would be completely removed to a disposal site located outside the project area.
- Existing vegetation would be left in place to the maximum extent possible.
- Bare ground would be monitored for dryness and watered, if necessary, to reduce wind and water erosion.
- The contractor would be required to conduct water quality tests specifically for increases in turbidity and sedimentation caused by in-water construction activities. Water samples for determining background levels would be collected in San Francisco Bay in the vicinity of the construction site prior to construction. Water samples in the San Francisco Bay in the vicinity of the construction site would be collected at least once per day when construction activity is in progress to compare with background/base levels. The contractor would monitor turbidity and settleable solids at least daily and turbidity at least hourly when a turbidity plume is visible. If turbidity limits are exceeded, the contractor would slow the rate of earthwork or use other means to comply with the requirements, including stopping construction activities until the plume has cleared.
- Sediment barriers would be installed on graded or other disturbed slopes, as needed, to prevent sediment from leaving the project sites and entering nearby surface waters.
- The contractor would have a designated vehicle and equipment maintenance staging area that is self-contained to protect groundwater, surface water, and soils from contamination.
- Construction traffic would be restricted to predetermined routes.
- Traffic during wet weather or within the wet zone would be minimized.
- Pivoting excavators would be used within the wet zone to prevent rutting and excess erosion.
- A spill prevention and containment countermeasure plan that addresses all potential mechanisms of contamination would be developed. Suitable containment materials would be on site in the event of a spill. All discarded material and any accidental spills would be removed and disposed of at approved sites.
- Equipment and vehicles operated within the floodway would be checked and maintained daily to leaks of fuels, lubricants, and other fluids to surface waters. Hardened armoring

would be used in areas susceptible to high erosion rates as identified by hydrologic and sedimentation modeling.

1.6.4 Noise

Best practices to minimize construction noise include the following:

- Limiting heavy equipment use to daytime hours not regulated by San Francisco, between 7:00 a.m. and 8:00 p.m.
- Limiting pile driving to times of day that would be least disruptive to residences, hotels, motels, hospitals, or convalescent homes.
- Locating stationary equipment (e.g., generators, pumps, cement mixers, idling trucks) as far as possible from noise-sensitive land uses.
- Requiring that all construction equipment powered by gasoline or diesel engines have sound-control devices, such as exhaust mufflers, that are at least as effective as those originally provided by the manufacturer and that all equipment be operated and maintained to minimize noise generation.
- Using equipment powered by electric motors instead of gasoline- or diesel-powered engines when feasible.
- Preventing excessive noise by shutting down idle vehicles or equipment.
- Using noise-reducing enclosures around noise-generating equipment.
- Using noise-reducing shrouds for impact pile drivers, where feasible.
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (e.g., terrain, structures) to block sound transmission to noise-sensitive land uses. The barriers should be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment.

1.6.5 Vibration

Measures to reduce ground-borne vibration from pile driving include:

- Using smaller, lower vibration generating equipment within 100 feet of potentially affected buildings.
- Using alternative pile-driving methods such as vibratory hammers, hydraulic press-in driving, or use of predrilled pile holes.
- Preparing a pile driving schedule that includes driving method(s), locations, pile types, sizes, number of blows and times of day that driving would be done.
- Conducting vibration monitoring at potentially affected buildings to measure levels from vibration-producing activities.
- Prepare a building conditions report prior to and after construction for potentially affected buildings. If new cracks or damages are found, the construction contractor would remediate building damages found to occur during construction.

- Coordinating with managers of buildings containing sensitive equipment to determine actions for avoiding impacts on vibration-sensitive equipment, based on specifications of equipment and hourly/daily schedule of use.

2.0 Species and Habitat Descriptions

The list of threatened, endangered, proposed for listing, or candidate species addressed in this assessment was compiled from an official species listed provided by NMFS (Attachment 1).

2.1 Consultation History

The following lists the communications and consultations to date between the USACE and NMFS, with the most recent activities presented first:

- 13 January 2026 – USACE accepted NMFS's recommendations and incorporated the changes into this assessment
- 12 January 2026 – NMFS provided recommendations to update effects determinations for ESA species, critical habitat, and EFH
- 29 December 2025 – USACE requested to initiate formal consultation with NMFS under ESA and MSA
- 12 December 2025 – NMFS provided recommendations to the USACE to be considered as conservation measures for addition into the BA and EFH assessment.
- 15 July 2025 – USACE sent request for technical assistance to NMFS inviting them to review and comment on the BA and EFH assessments.
- 1 July 2025 – coordination meeting between USACE, NMFS, and Port of San Francisco to update on the Recommended Plan and discuss strategies for handling consultation for ESA and EFH on the feasibility study.
- January 24, 2024 – resource agency working group meeting
- April 27, 2023: received a species list for ESA and EFH from Brian Meux (NMFS).
- December 6, 2022: a coordination meeting was held with NMFS, USACE, and Port of San Francisco regarding the proposed project with the intent to provide a brief description and introduction, gain understanding of NMFS concerns in the project area and potential measures being considered, and determine expectations for level of detail, modelling, and impacts analysis for consultation.
- October 5, 2022: a formal letter was sent by USACE to NMFS inviting them to be a cooperating agency on the feasibility study. NMFS formally accepted to act as a cooperating agency.

2.1.1 Future Consultation

The following analysis is based on the components of the currently defined Recommended Plan's activities. This document presents a conservative view of the maximum extent of impacts that could result to federally listed, proposed, or candidate species associated with the Recommended Plan.

The Recommended Plan would concurrently be reviewed by various state permitting and other federal agencies (San Francisco Bay Conservation and Development Commission (BCDC), San Francisco Bay Regional Water Quality Control Board, U.S. Fish and Wildlife Service). Accordingly, it is possible that additional mitigation measures may be added to the Recommended Plan outside of the Section 7 and MSA consultation process. Any such measures would not change the analysis presented in this document since this analyzes the

extent of impacts anticipated to NMFS federally listed species for the purpose of the USACE's formal consultation obligations under Section 7 of the ESA and the MSA.

Pursuant to federal regulations, if subsequent to the completion of this consultation the Recommended Plan is revised either by: (1) selecting a more impactful alternative, or (2) adding more stringent mitigation measures through the National Environmental Policy Act (NEPA) process, or environmental review process, and new information reveals effects of the action may affect listed species or critical habitat in a manner or to an extent that was not previously considered, then the federal agencies with jurisdiction for actions related to potential effects on such species would need to either request a subsequent concurrence that the Recommended Plan is 'Not Likely to Adversely Affect' listed species or initiate formal consultation (50 CFR 402.16(a)(1-4)).

2.2 ESA Protected Species and Critical Habitat

The following ESA listed threatened, endangered, proposed threatened/endangered species (Evolutionary Significant Units [ESU] or Distinct Population Segments [DPS]) may be affected by the Recommended Plan:

- North American Green sturgeon southern DPS (*Acipenser medirostris*)
  Threatened (71 FR 17757; April 7, 2006)
  Critical habitat (74 FR 52300; October 9, 2009)

- Steelhead trout, Central California Coast DPS (*Oncorhynchus mykiss*)
  Threatened (71 FR 834; January 5, 2006)
  Critical habitat (70 FR 52488; September 2, 2005)

- Steelhead trout, California Central Valley DPS (*O. mykiss*)
  Threatened (71 FR 17757; January 5, 2006)

- Chinook salmon, Central Valley spring-run ESU (*O. tshawytscha)*
  Threatened (70 FR 37160; June 28, 2005)

- Chinook salmon, Sacramento River winter-run ESU (*O. tshawytscha)*
  Endangered (70 FR 37160; June 28, 2005)
  Critical habitat (58 FR 33212; June 16, 1993)

From those listed above, the action area would only intersect two of the critical habitats – Green sturgeon and Chinook salmon, Sacramento River winter-run ESU. Steelhead trout, Central California Coast DPS critical habitat does not occur within the action area (Section 2.2.2).

2.2.1 Species Accounts

North American Green Sturgeon-Southern (*Acipenser medirostris*)

Listing Status: Threatened

Life History

The green sturgeon was listed as threatened in 2006 (71 FR 17757). This anadromous fish is the most widely distributed member of the sturgeon family and the most marine-oriented of the sturgeon species, entering rivers only to spawn. Juveniles rear in fresh water for as long as 4 years before migrating to sea. Green sturgeons are thought to spawn every 3 to 5 years in deep

pools with turbulent water velocities and prefer cobble substrates but can use substrates ranging from clean sand to bedrock. Females produce 60,000 to 140,000 eggs that are broadcast to settle into the spaces in between cobbles (CBD 2023). Adult green sturgeon migrate into freshwater beginning in late February with spawning occurring in the Sacramento River in late spring and early summer (March through July), with peak activity in April and June. After spawning, juveniles remain in fresh and estuarine waters for one to four years and then begin to migrate out to the sea. The upper Sacramento River has been identified as the only known spawning habitat for green sturgeon in the southern distinct population segment (Adams et al. 2006). According to recent studies, green sturgeon adults begin moving upstream through the Bay during the winter. Adults in the San Joaquin Delta are reported to feed on benthic invertebrates including shrimp, amphipods and occasionally small fish while juveniles have been reported to feed on opossum shrimp and amphipods (NOAA 2009). Within the bays and estuaries, sufficient water flow is required to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds. Subadult and adult green sturgeon occupy a diversity of depths within bays and estuaries for feeding and migration. Tagged adults and subadults within the San Francisco Bay-Delta have been observed occupying waters over shallow depths of less than 33 feet, either swimming near the surface or foraging along the bottom.

Distribution

Green sturgeon, after outmigration from freshwater, disperse widely in nearshore coastal waters from Mexico to the Bering Sea and are common occupants of bays and estuaries along the western coast of the United States. Sturgeon that have been tagged in the Sacramento River have been reported captured in coastal and estuarine waters to the north of San Francisco Bay. Adults are found throughout the San Francisco Bay and Delta during periods of migration, while juveniles are present in the southern San Francisco Bay year-round, mostly south of the Dumbarton Bridge.

Critical Habitat

Critical habitat for the green sturgeon includes the Sacramento River, the Sacramento-San Joaquin Delta, and Suisun, San Pablo and all of San Francisco Bay below the higher high water. As discussed in Section 2.2.2, green sturgeon critical habitat occurs within the action area.

Occurrence in Action Area

Green sturgeon juveniles reside in San Francisco Bay and adults migrate to their spawning grounds through the bay. They have the potential to be present throughout all the marine portions of the action area at any point during a given year.

Threats

A principal factor in the decline of the Southern Distinct Population Segment (DPS) is the reduction of historic spawning area to a limited section of the Sacramento River. This remains a threat due to increased risk of extirpation due to catastrophic events. Insufficient freshwater flow rates in spawning areas, contaminants (e.g., pesticides), bycatch of green sturgeon in fisheries, potential poaching (e.g., for caviar), entrainment by water projects, influence of exotic species, small population size, impassable barriers, and elevated water temperatures likely pose a threat to this species. Additionally, green sturgeon may be susceptible to overfishing, as sexual maturity is not reached until 15 to 20 years of age.

Steelhead (*Oncorhynchus mykiss*), Central California Coast DPS

Listing Status: Threatened

Life History

Central California coast Steelhead were listed as threatened in 2006 (71 FR 834). Steelhead are anadromous (a migratory fish that is born in fresh water and spends a portion of its life in the sea before returning to fresh water to spawn) forms of rainbow trout. Steelhead are nearly physically indistinguishable from resident rainbow trout that also reside in the same streams for spawning, with the exception of being larger when hatched. Winter-run steelhead are at or near sexual maturity when they enter freshwater during late fall and winter, and spawn from late December through April, with peak between January and March. Juvenile typically rear in freshwater for a longer period than other salmonids, ranging from one to three years (NOAA 2021b). The actual time, however, is highly variable with individuals. Throughout their range, steelhead typically remain at sea for one to four growing seasons before returning to freshwater to spawn.

Steelhead typically enter the Bay in early winter, using the main channels in the Bay- Delta to migrate to upstream spawning habitat, as opposed to small tributaries. However, migrating steelhead may be seen in the San Francisco Bay and Suisun Marsh and Bay as early as August. Migrating fish require deep holding pools with cover such as underwater ledges and caverns. Coarse gravel beds in riffle areas are used for egg laying and yolk sac fry habitat once eggs have hatched. Because juvenile steelhead remain in the creeks year-round for several years while rearing, adequate flows, suitable water temperatures, and an abundant food supply are necessary to sustain steelhead populations. The most critical period is in the summer and early fall when these conditions become limiting.

Additionally, steelhead require cool, clean, well-oxygenated water, and appropriate gravel for spawning. Spawning habitat condition is strongly affected by water flow and quality, especially temperature, dissolved oxygen, shade, and silt load, all of which can greatly affect the survival of eggs and larvae.

Little is known about transit times and migratory pathways of steelhead within San Francisco Bay. Study results of outmigration and distribution of juvenile hatchery-raised steelhead released in the lower Sacramento River show that steelhead spend an average of 1.9 days in transit, with mean residence time ranging from 2.5-9.8 days, within San Pablo and San Francisco Bays. The study concluded that transit time was greater in the upper estuary than in the lower estuary. This could be due to the lower salinity in the upper estuary that serves as a transition zone between fresh and salt water, allowing steelhead to transition from freshwater to saltwater (Klimley et al. 2009). Once steelhead reach San Francisco Bay, salinities are similar to ocean water, which may lead steelhead to spend less time in this portion of the estuary. Although information on migratory pathways of juvenile steelhead were largely inconclusive, a positive correlation between smolt captures and water depth was observed between 3 and 37 feet, suggesting that the deeper the water, the more fish were present (up to 37 feet deep). Studies conducted by NMFS and California Department of Fish and Wildlife (CDFW) indicate that the primary migration corridor is through the northern reaches of Central San Francisco Bay (Raccoon Straight and north of Yerba Buena Island). Additionally, a recent study evaluating 30-years of Interagency Ecological Program (IEP) monthly mid-water fish trawl data and three-years of acoustic tag data of hatchery-raised salmonids suggests that the presence of out-migrating juvenile salmonids (steelhead and salmon) along the Port of San Francisco waterfront

appeared to be more the result of capture by tidal flow rather than active foraging or intentional swimming to those areas of the Bay.

Steelhead are primarily drift feeders and may forage in open water of estuarine subtidal and riverine tidal wetland habitats (California Trout 2022a). The diet of juvenile steelhead include emergent aquatic insects, aquatic insect larvae, snails, amphipods, opossum shrimp, and small fish. Adults may also feed on newly emergent fry. Steelhead usually do not eat when migrating upstream and often lose body weight.

Distribution

Includes coastal river basins from the Russian River south to Soquel and Aptos Creek, California (inclusive), and the drainages of San Francisco and San Pablo Bays, including the Napa River. They are also known to migrate to the South Bay, where they spawn in the Guadalupe River, Coyote Creek, and San Francisquito Creek. Also included are adjacent riparian zones, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay from San Pablo Bay to the Golden Gate Bridge. Major river basins containing habitat comprise approximately 6,516 square miles. These basins are located within Alameda, Contra Costa, Marin, Mendocino, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, and Sonoma counties. Historically, most streams with suitable habitat within the San Francisco Bay Estuary supported steelhead populations. Current runs are estimated at fewer than 10,000 fish in San Francisco Bay tributaries.

Critical Habitat

Critical habitat includes all natal spawning and rearing waters, migration corridors, and estuarine areas that serve as rearing areas accessible to listed steelhead in coastal river basins, from the Russian River to Aptos Creek (inclusive), and the drainages of San Francisco and San Pablo Bays. Also included are adjacent riparian zones, all waters of San Pablo Bay west of the Carquinez Bridge, and all waters of San Francisco Bay to the Golden Gate. No steelhead critical habitat overlaps with the action area.

Occurrence In Action Area

Temporary occurrence during transition through open water adjacent to project area during migration. Also suspected to forage in the shallow water areas of the Central Bay during in-migration and out-migration periods. It is likely that the action area is too far south to encounter any of this species.

Threats

The largest factor limiting growth of this species is the placement of migration barriers that prevent access to spawning habitat. Water diversions further reduce freshwater habitat quality throughout the range of these species. Other threats to steelhead include agricultural operations, forestry operations, gravel extraction, illegal harvest, streambed alteration, unscreened or substandard fish screens on diversions, suction dredging, urbanization, water pollution, potential genetic modification in hatchery stocks resulting from domestication selection, incidental mortality from catch-and-release hooking, climatic variation leading to drought, flooding, variable ocean conditions, and predation. Secondarily, the quantity and quality of summer rearing habitat with cool water pools and extensive cover for older juvenile steelhead can be considered limiting factors for steelhead in California streams.

Steelhead (*O. mykiss*), California Central *Valley*

Listing Status: Threatened

Life History

See discussion for Central Coast Steelhead

Distribution

The DPS includes naturally spawned anadromous *O. mykiss* originating below natural and manmade impassable barriers from the Sacramento and San Joaquin Rivers and their tributaries; and excludes such fish originating from San Francisco and San Pablo Bays and their tributaries. Central Valley steelhead historically occurred throughout the Sacramento and San Joaquin river systems: from the upper Sacramento/Pit River systems south to the Kings and possibly Kern River systems in wet years (Yoshiyama et al. 1996). Presently, the Central Valley contains only winter steelhead. Based on Red Bluff Diversion Dam counts, hatchery counts, and prior natural spawning escapement estimates from the early 1990s (McEwan and Jackson 1996) roughly estimated the total annual run size (hatchery and wild) for the entire system at no greater than 10,000 adult fish.

Critical Habitat

Critical habitat for the Central Valley steelhead was designated throughout the Central Valley on September 2, 2005. Critical habitat for the species is divided into 22 hydrologic units by watersheds. None of these hydrologic units occur within San Francisco Bay. However, the primary migration corridor to these hydrologic units spawning areas is through Central Bay, North Bay, and San Pablo and Suisun Bays in the Delta. The primary migration corridor is similar to that used by migrating salmon in the Bay and occurs through Raccoon Straight north of Angel Island.

Occurrence in Action Area

Primarily present during in-migration and out-migration periods. Suspected to forage in Central Bay shallow water areas (<30 feet) during in-migration and out-migration transits.

Threats

The largest factor limiting growth of this species is the placement of migration barriers that prevent access to spawning habitat (NMFS 2007). Water diversions further reduce freshwater habitat quality throughout the range of these species. Other threats to steelhead include agricultural operations, forestry operations, gravel extraction, illegal harvest, streambed alteration, unscreened or substandard fish screens on diversions, suction dredging, urbanization, water pollution, potential genetic modification in hatchery stocks resulting from domestication selection, incidental mortality from catch-and-release hooking, climatic variation leading to drought, flooding, variable ocean conditions, and predation (NMFS, 2007). Secondarily, the quantity and quality of summer rearing habitat with cool water pools and extensive cover for older juvenile steelhead can be considered limiting factors for steelhead in California streams.

Chinook Salmon, Central Valley (Sacramento) spring-run (*O. tshawytscha*)

Listing Status: Threatened

Life History

Central valley spring-run Chinook salmon were listed as threatened in 2005 (70 FR 37160). The spring-run Chinook salmon has a similar life history to the winter run salmon as discussed below

but begins its spawning migration to the Sacramento/San Joaquin Delta in late winter to spring. Adults are found in San Francisco Bay during the migratory period in the spring, and juveniles have the potential to inhabit the Bay in the fall, winter, and spring (NOAA 2023a).

Distribution
Adults utilize the coastal waters of California, migrating through the Golden Gate, Central Bay, North Bay, San Pablo Bay, Suisun Bay and into the Sacramento River. Out-migrating juveniles follow the same path in reverse. Studies conducted by NMFS and CDFW indicate that the primary migration corridor is through the northern reaches of Central San Francisco Bay (Raccoon Straight and north of Yerba Buena Island).

Occurrence in Action Area
Primarily present during migration but known to forage in central bay shallow water areas (California Trout 2022b).

Threats
Loss and degradation of spawning habitat. Restricted access to spawning habitat from river and stream blockages.

Chinook Salmon, Sacramento winter-run (*O. tshawytscha*)

Listing Status: Endangered

Life History
Sacramento winter-run Chinook salmon were listed as endangered in 2005 (70 FR 37160). The Chinook salmon is the largest and least abundant species of Pacific salmon. Like all salmonids, the Chinook is anadromous but unlike steelhead, Chinook salmon are semelparous (i.e., they die following a single spawning event). Pacific salmonids are divided into ESU's – a distinctive group of Pacific salmon, steelhead, or sea-run cutthroat trout. The Sacramento River winter run Chinook salmon ESU was listed as an endangered species on January 4, 1994, and includes all populations of winter-run Chinook salmon in the Sacramento River and its tributaries in California (CDFW 2018).

Sacramento River winter-run Chinook salmon enter San Francisco Bay between November and May/June. Their migration into the Sacramento River begins in December and continues through early August, with the majority of the run occurring between January and May and peaking in mid-March (NOAA 2023b). Adults enter freshwater in an immature reproductive state, similar to spring-run Chinook, but winter-run Chinook move upstream much more quickly and then hold in the cool waters below Keswick Dam for an extended period before spawning.

In general, winter-run Chinook spawn in the area from Redding downstream to Tehama from mid-April through August. However, the spawning distribution appears to be somewhat dependent on the operation of the gates at the Red Bluff Diversion Dam, river flow, and probably temperature. At present, winter-run Chinook salmon are found only in the Sacramento River below Keswick Dam. Fry and smolts emigrate downstream from July through March through the Sacramento River, reaching the Delta from September through June.

Historically, winter-run Chinook spawned in the upper reaches of Sacramento River tributaries, including the McCloud, Pit, and Little Sacramento Rivers. Shasta and Keswick dams now block access to the historic spawning areas (California Trout 2022c).

It is believed that winter-run Chinook salmon, like all Central Valley Chinook, remain localized primarily in California coastal waters. Coded wire tag (CWT) returns indicate that only 4 percent of winter-run hatchery production recoveries from ocean waters occurred in Oregon (Regional Mark Information System [RMIS] database). The majority of ocean tag recoveries were from the Monterey Bay, San Francisco Bay, and North Coast regions. Out-migration through Central Bay follow a similar pattern to that described for Steelhead trout above. Although reported occurring throughout Central Bay waters during out migration periods, their presence in the shallower water areas of the Bay and along the San Francisco Port may be more the result of capture by tidal flow rather than active foraging or intentional swimming to those areas of the Bay.

Chinook salmon feed on aquatic and terrestrial invertebrates and salmon eggs in freshwater. In intertidal areas Chinook salmon feed on amphipods, insects, and fish larvae. During the oceanic life stage, Chinook salmon feed on fish, large crustaceans, and squid. Adult winter-run Chinook salmon return to freshwater during the winter but delay spawning until the spring and summer. Juveniles spend about 5 to 9 months in the river and estuary systems before entering the ocean. This life-history pattern differentiates the winter-run Chinook from other Sacramento River Chinook runs and from all other populations within the range of Chinook salmon.

Distribution
Adults utilize the coastal waters of California, migrating through the Golden Gate, Central Bay, North Bay, San Pablo Bay, Suisun Bay and into the Sacramento River. Out-migrating juveniles follow the same path in reverse. Studies conducted by NMFS and CDFW indicate that the primary migration corridor is through the northern reaches of Central San Francisco Bay (Raccoon Straight and north of Yerba Buena Island; NMFS 2001, 2015).

Critical Habitat
All river reaches accessible in the Sacramento River and its tributaries in California, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Critical habitat is present within the action area, as described in Section 2.2.2.

Occurrence in Action Area
Primarily present through San Francisco Bay from December through July with peak occurrence in March. Likely most would be present further North than the extent of the action area. Suspected to forage in Central Bay shallow water areas during migration.

Threats
Loss and degradation of spawning habitat. Restricted access to spawning habitat from river and stream blockages.

2.2.2 Critical Habitat
Critical habitat is defined in Section 3(5)A of the ESA as a specific area(s) within a broader geographic zone that is occupied by the species, and on which is found physical and/or biological features essential to their conservation and may require special management considerations or protection (16 USC 1532(5)(A)). Specific areas outside of the geographical area occupied by the species may also be included in designations of critical habitat, upon a

determination that such areas are essential for their conservation. Two critical habitats occur within the project area – green sturgeon and chinook salmon.

Green sturgeon critical habitat spans approximately 320 miles (mi) of freshwater river habitat, 897 square miles (mi^2) of estuarine habitat, 11,421 square miles of marine habitat, 487 mi of the Sacramento-San Joaquin Delta, and 135 square miles of the Yolo and Sutter bypasses in the Sacramento River (50 CFR 226). All of San Francisco Bay adjacent to the project area is considered critical habitat for green sturgeon. The project area encompasses 3 square miles of Green sturgeon critical habitat (Figure 30).

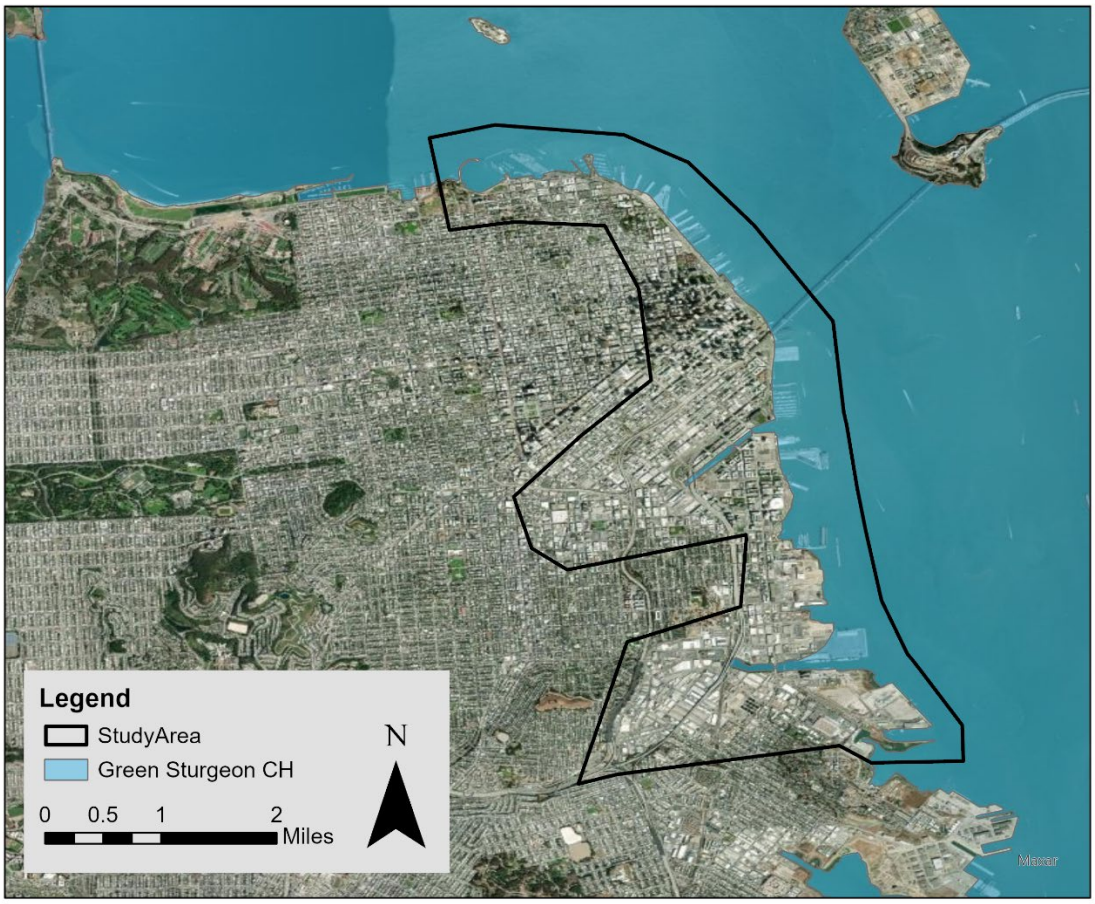


Figure 30. Green sturgeon critical habitat (CH) within the project area. Source: NMFS 2021.

There are several chinook salmon critical habitats throughout California; however, only one intersects the project area – the Sacramento River winter-run chinook salmon. The critical habitat includes the Sacramento River from Keswick Dam, Shasta County (river mile 302) to Chipps Island (River Mile 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay from San Pablo Bay to the Golden Gate Bridge (50

CFR 226). Chinook salmon critical habitat includes waters in the northern two reaches of the project area and encompasses a total area of 1 square mile (Figure 31).

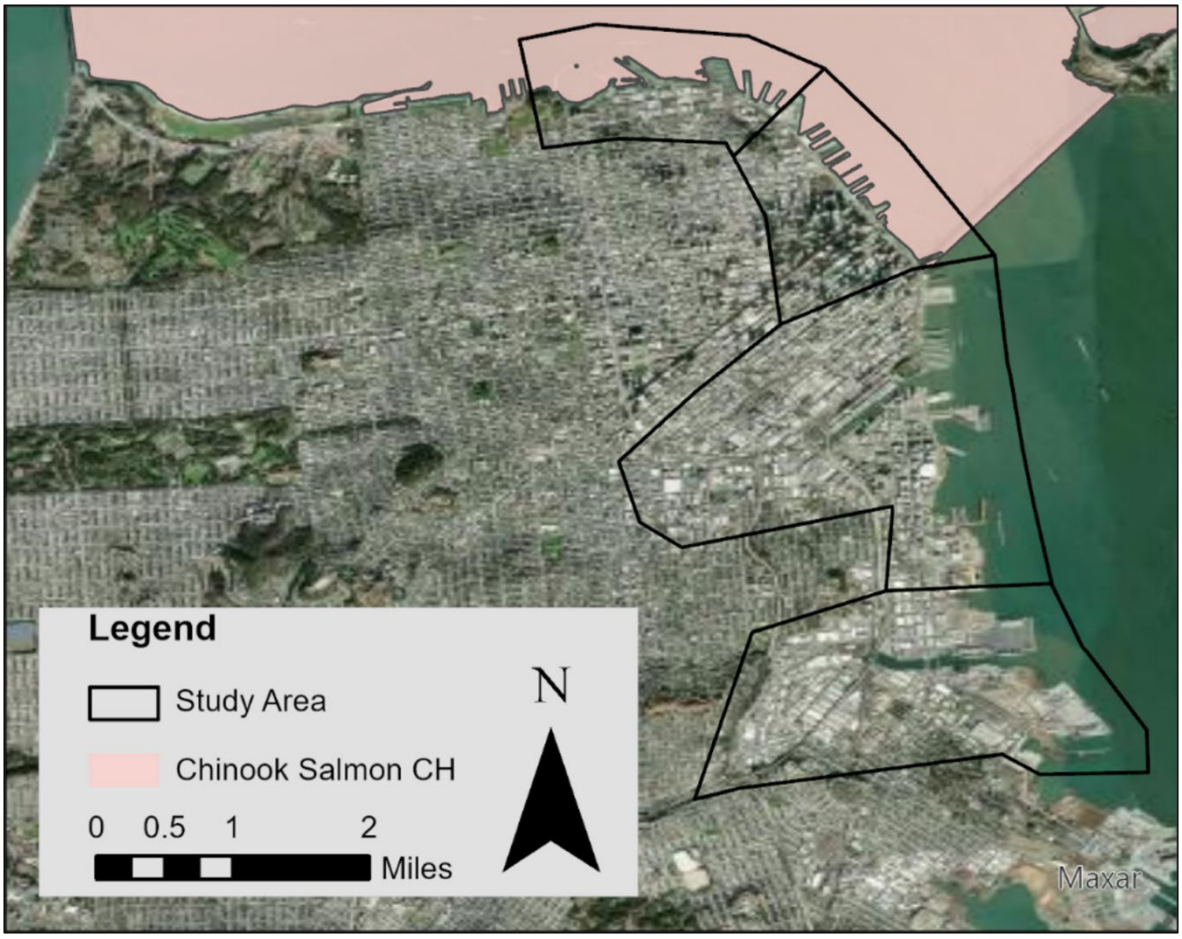


Figure 31. Chinook salmon Sacramento River winter-run CH within the project area. Source: NMFS 2021.

2.3 Essential Fish Habitat

The action area addressed within this document falls within Essential Fish Habitat, as defined in the MSA, for 20 species of commercially important fish and sharks managed under three federal fisheries management plans (FMPs):

- Coastal Pelagic FMP
- Pacific Groundfish FMP
- Pacific Coast Salmon FMP

2.3.1 Coastal Pelagic EFH

The Coastal Pelagic FMP is designed to protect habitat for fish species associated with open coastal waters. Fish managed under this plan include planktivores (aquatic organism that feeds on planktonic food) and their predators. Those found in the project area include Northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), and jack mackerel (*Trachurus symmetricus*).

2.3.2 Pacific groundfish EFH

The Pacific groundfish FMP is designed to protect habitat for more than 90 species of fish including rockfish, flatfish, roundfish, some sharks and skates, and other species associated with underwater substrate. Fifteen species are reported present in the project area including English sole (*Parophyrs vetulus*), sand sole (*P. lascaris*), curlfin sole (*Pleuronichthys decurrens*), Pacific sanddab (*Citharichthys sordidus*), starry flounder (*Platichthys stellatus*), lingcod (*Ophiodon elongatus*), brown rockfish (*Sebastes auriculatus*), Pacific whiting (*Merluccius productus*), kelp greenling (*Hexagrammos decagrammus*), leopard shark (*Triakis semifasciata*), spiny dogfish (*Squalus acanthias*), skates (*Raja* spp.), soupfin shark (*Galeorhinus galeus*), bocaccio (*Sebastes paucispinis*), and cabezon (*Scorpaenichthys marmoratus)*.

2.3.3 Pacific Coast salmon EFH

The Pacific Coast Salmon FMP is designed to protect habitat for commercially important salmonid species. Sacramento Chinook salmon (*Oncorhynchus tshawytscha*) is the only one of these species that may be seasonally present in the project area, though coho salmon (*O. kisutch*) was historically common in San Francisco Bay.

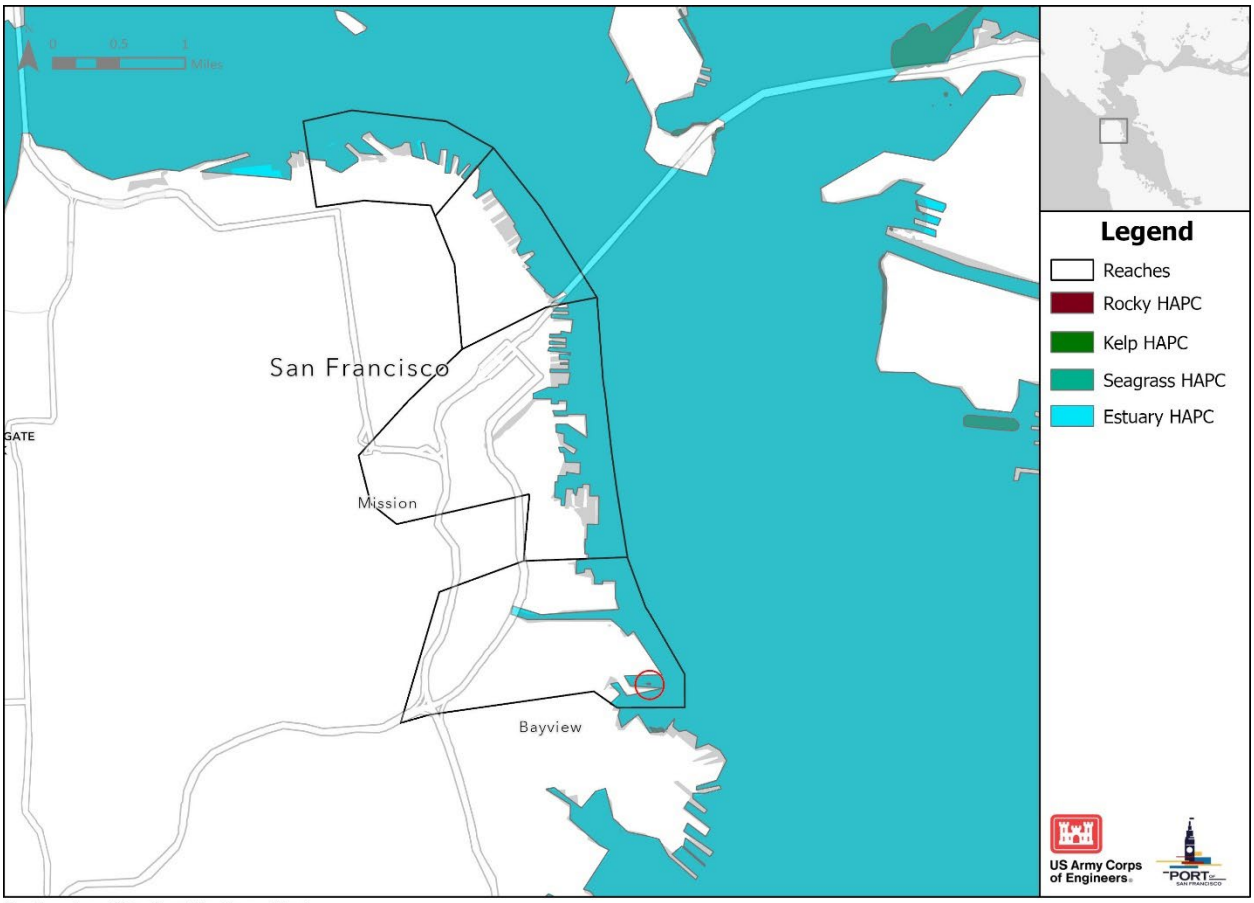
Table 3 identifies the fish species covered by the FMPs listed above as utilizing the project area, along with the life stage and relative occurrence.

Table 3. Managed fish species in the project area under the MSFMA. Life stage is indicated with A = adult, J = juvenile, L = larvae, and E = egg. Abundance is recorded as A = abundant, P = present, and R = rare.

FMP	Common name	Scientific name	Life stage	Abundance
Coastal Pelagic	Northern anchovy	*Engraulis mordax*	J, A	A
	Jack mackerel	*Sardinops sagax*	E, L	P
	Pacific sardine	*Trachurus symmetricus*	J, A	P
Pacific Groundfish	English sole	*Parophyrs vetulus*	J, A	A
	Sand sole	*Psettichthys melanostictus*	L, J, A	P
	Curlfin sole	*Pleuronichthys decurrens*	J	R
	Pacific sanddab	*Citharichthys sordidus*	E, L, J, A	P
	Starry flounder	*Platichthys stellatus*	J, A	P
	Lingcod	*Ophiodon elongatus*	J, A	P
	Brown rockfish	*Sebastes auriculatus*	J	P
	Pacific whiting	*Merluccius productus*	E, L	P
	Kelp greenling	*Hexagrammos decagrammus*	J, A	P
	Leopard shark	*Triakis semifasciata*	J, A	P
	Spiny dogfish	*Squalus acanthias*	J, A	P
	Skates	*Raja* spp.	J, A	P
	Soupfin shark	*Galeorhinus galeus*	J, A	R
	Bocaccio	*Sebastes paucispinis*	J	R
	Cabezon	*Scorpaenichthys marmoratus*	J	P
Pacific Coast Salmon	Chinook salmon	*Oncorhynchus tshawytscha*	J, A	Seasonally P
	Coho salmon	*O. kisutch*	J, A	Historically P

2.4 Habitat Areas of Particular Concern (HAPC)

There are four HAPCs within the project area identified by NMFS, including the San Francisco Estuary (estuary HAPC), seagrass, rocky reef, and marine and estuarine submerged aquatic vegetation (SAV) HAPC. The project area includes 0.29 acres of seagrass HAPC just north of Heron's Head Park; however, rocky and kelp HAPC does not appear to intersect the project area (Figure 32; NOAA 2021b). The entire in-water project area is considered estuary HAPC (Figure 32) and salmon EFH (Figure 33; NOAA 2024).



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Figure 32. HAPC in the project area and adjacent San Francisco Bay. The red circle highlights where seagrass is expected to be located within the project area.

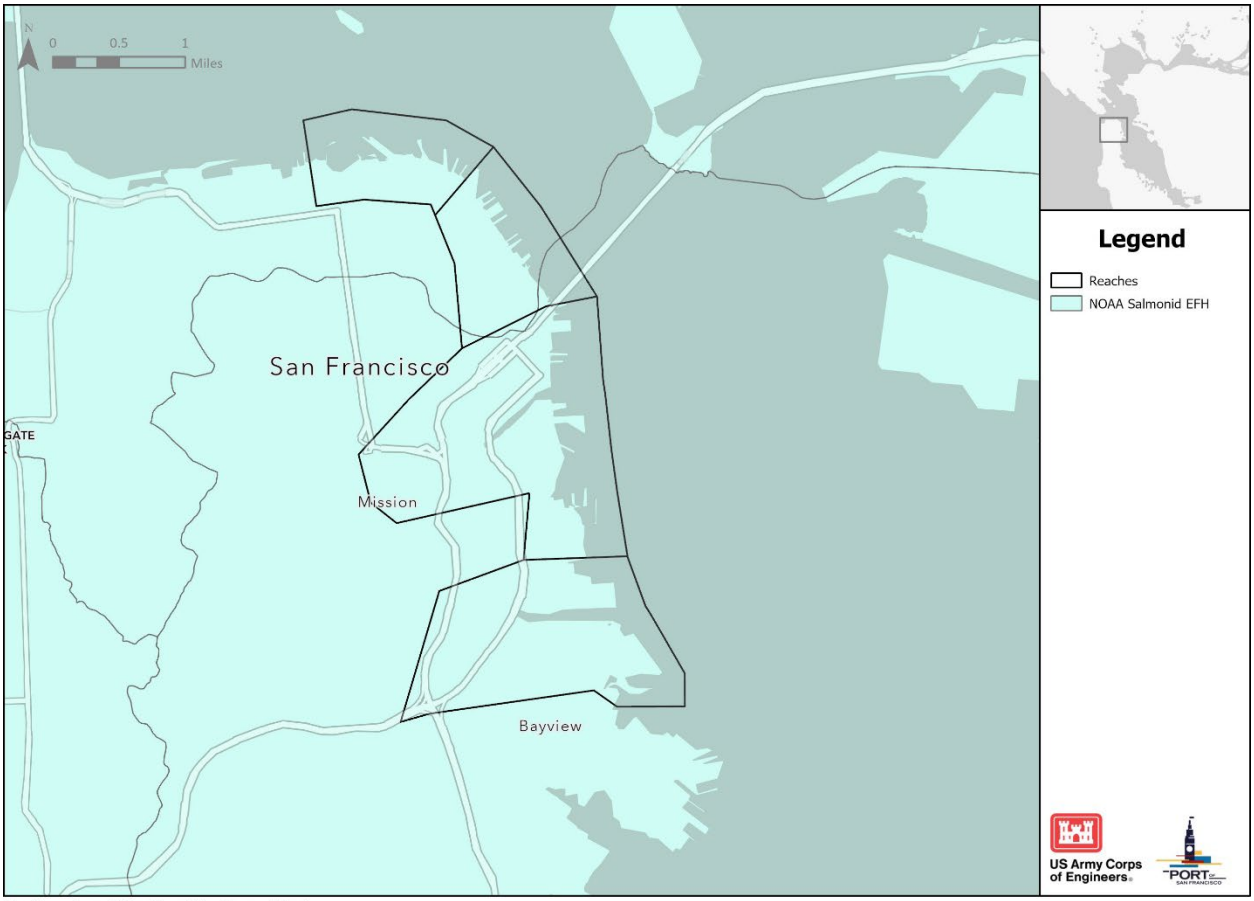


Figure 33. Salmon EFH in the project area. Source: NOAA 2024

3.0 Environmental Baseline

Environmental baseline is defined in 50 CFR 402.02 as “the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the Recommended Plan. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.”

The environmental baseline for this study includes natural and artificial features in the San Francisco Bay area and San Francisco Bay watershed located in San Francisco County. Construction is anticipated to be a phased effort with the goal for the first action measures to be completed by 2040, though this is highly dependent on Congressional funding and authorization.

The project area is largely composed of developed urban land that includes buildings, paved streets, sidewalks, parking lots, docks, and piers. These areas provide limited habitat opportunities for wildlife and do not include natural vegetation communities. Some key natural aquatic habitats in the Bay include tidal marshes, tidal flats, shallow subtidal habitats, marine and estuarine deepwater, and beaches. Tidal marsh is vegetated wetland that is subject to tidal action, extends bayward to the lowest elevation plants can grow, and extends landward to the highest area that are affected by high tides. Shallow subtidal habitats occur between 0 and -18 feet mean lower low water (MLLW) and consist of muddy bay bottom, shell fragments, oyster beds, artificial oyster reefs, eelgrass beds, seaweed beds, and rocky outcroppings (BCDC 2019). Tidal flats include mudflats, sandflats, and shellflats that occur from MLLW to mean tide level and are typically submerged at high tide. Sandy beaches are considered a type of ecotone between shallow subtidal habitats and upland or marsh (BCDC 2019).

The action area is located along the shoreline directly adjacent to San Francisco Bay. Major aquatic features include: Central Basin, an inlet to the Bay, Islais and Mission Creek channels, and estuarine and marine wetlands. Islais Creek is a tidal inlet between Pier 80 and Pier 90, which historically acted as the confluence of several small creeks and carried runoff from the southeastern portion of San Francisco and entered the bay just west of the westernmost extent of the existing tidal inlet. Urban development and alterations to the drainage system resulted in the culverting of Islais Creek and channeling most of the stream flow from Islais Creek into the city of San Francisco's combined sewer and stormwater system. Mission Creek includes a 24 acre park and tidal channel remnant of Mission Bay. Filled in the 1800's, Mission Bay and Mission Creek served military, commercial maritime, and industrial activity for over a century. In the late 1950s, a floating home and recreational harbor was established on the creek. Today, the creek serves as foraging to a variety of shorebirds and marine animals (MCC 2019).

Coastal saltmarsh is present in the reach 4, including at the Pier 94 wetlands and Heron's Head Park. Coastal saltmarsh is a wetland type flooded and drained by saltwater between high and low tides and is composed of a variety of terrestrial and aquatic species (Figure 34; NOAA 2022). However, coastal saltmarshes in the Central and South Bay are remnants of their former extent. Coastal saltmarshes can be fully tidal, or brackish if they occur near the mouth of a freshwater source. Vegetation associated with this habitat include pickleweed (*Salicornia pacifica*), marsh jaumea (*Jaumea carnosa*), alkali heath (*Frankenia salina*), cordgrass (*Spartina* sp.), salt grass (*Distichlis spicata*), alkali bulrush (*Bolboschoenus maritimus*), and cattail (*Typha* sp.). They are considered significant in the project area, particularly Heron's Head, due to the rare nature in the otherwise urban environment. The saltmarsh at Heron's Head is interspersed with areas of unvegetated salt panne (water retaining depressions). Salt pannes are often seasonally inundated, and because of this, can inhibit the establishment of vegetation, leaving a barren area.

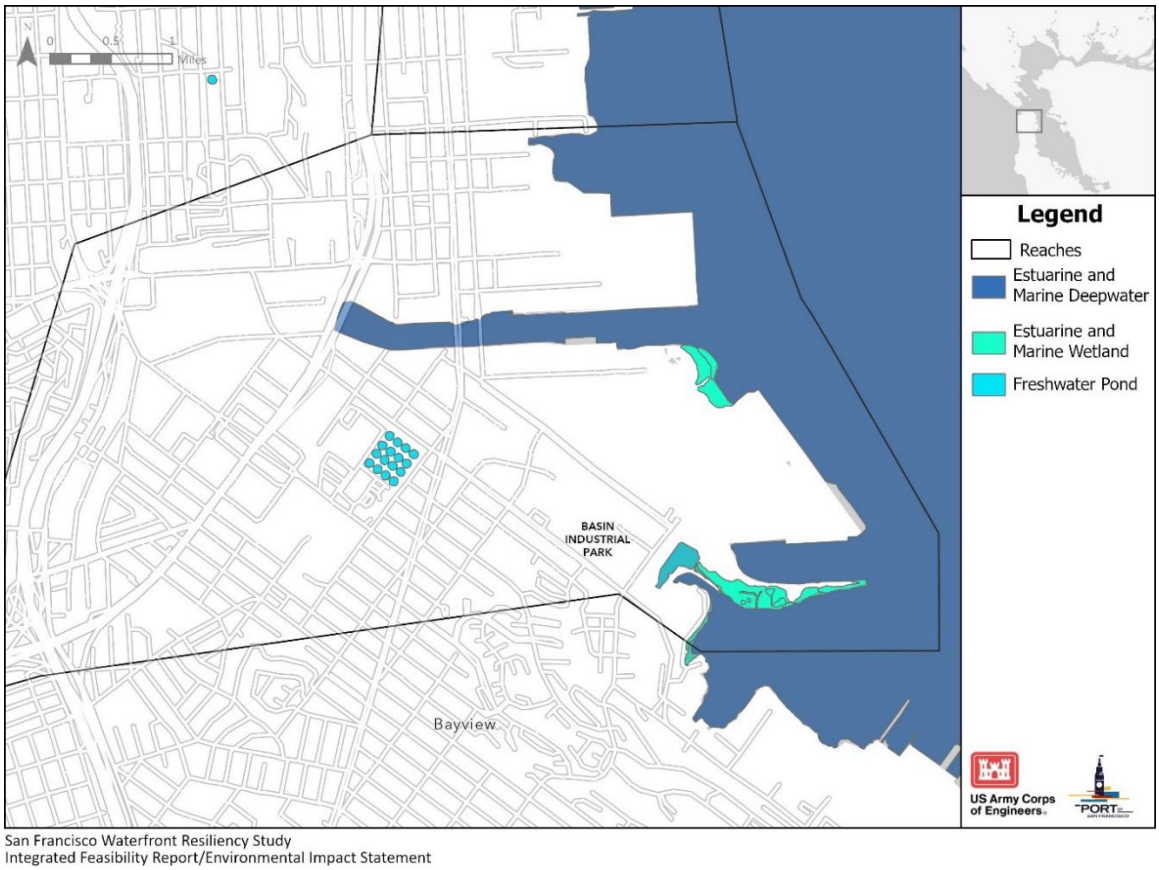


Figure 34. Wetland habitat expected in the project area. Source: National Wetlands Inventory

More than 90 percent of subtidal areas in the Bay are soft-bottom substrates, with the remaining 10 percent consisting of a mix of shellfish beds, submerged aquatic vegetation (SAV), shell deposits, rocky bottoms, and macroalgae beds (BCDC 2019). Extent of native Olympia oysters (*Ostrea lurida*) beds is unknown, in part, because they do not form tall structurally complex reefs. However, these oysters can settle on three-dimensional and/or hard substrate. Individual oysters were identified to occur in Central Bay, which incorporates the action area, from surveys in the early 2000's (BCDC 2019). The San Francisco Bay Living Shorelines Project has experimented with placing artificial oyster reefs to improve and increase habitat available for settlement. Eelgrass beds have become more widespread throughout the estuary, as compared to extents in the 1980s; however, less than 0.5 acre is present in the action area. Limited natural hard substrate occurs within the estuary, with most rock habitat encompassing boulders and bedrock. Artificial hard substrate is found throughout the estuary and include a wide variety of anthropogenic features designed to protect shorelines or shoreline structures, transportation, recreation, and restoration. These artificial features provide structural complexity in otherwise open water and are used by aquatic organisms for a variety of purposes.

Additionally, the project area includes limited areas of sandy beaches (e.g., Aquatic Park) and mudflats (e.g., Heron's Head), which are mainly composed of sandy substrates and other soft-bottom material (SFPUC 2014). These habitats support benthic fauna including amphipods, polychaetes, and flies of the intertidal zone, providing food for shorebirds. Other common

invertebrates within the intertidal environment included balanoid barnacles (Balanidae) in the high and middle intertidal zones; limpets (Patellidae, Fissurellidae), saltwater mussels (*Mytilus* spp.), and native Olympia oysters (*Ostrea lurida*) in the lower middle and low intertidal zones. Shorebirds that frequent intertidal habitats during migration or overwinter within the terrestrial project area include sanderling (*Calidris alba*), wouldet (*Tringa semipalmata*), marbled godwit (*Limosa fedoa*), and whimbrel (*Numenius phaeopus;* GFNMS and FMSA 2006). Spotted sandpiper (*Actitis macularius*) and black oystercatcher (*Haematopus bachmani*) may forage along the rocky shoreline during low tide within the intertidal zones of the project area.

4.0 Effects on Species and Habitat

The following section provides the findings of USACE on the potential effects for each species and their critical habitat, if applicable. The analysis describes the consequences to listed species that are caused by the Recommended Plan, including the consequences of other activities that are caused by the Recommended Plan. As defined in 50 CFR Part 402, as amended in 2019, a consequence "is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur." As such, the effects analysis describes those impacts that are reasonably certain to occur as a result of the Recommended Plan.

Planned measures to reduce the potential for adverse effects to protected species are provided in Section 1.6.

4.1 Effects of the Action

Potential effects from the Recommended Plan are discussed by type of ecological effect expected and the activity causing the potential effect. Because the entirety of in-water work activities would occur in areas designated as EFH under the MSA and critical habitat as designated under the ESA, the effects of the Recommended Plan analyzed in the following sections are discussed as they relate to impacts to such habitat. Additionally, it was determined that some or all components of the Recommended Plan would cause adverse effects on the following species, thus effects are assumed to apply to these species and are discussed together as they relate to such impacts.

- North American Green sturgeon southern DPS
- Steelhead, Central California Coast
- Steelhead, California Central Valley
- Chinook salmon, Central Valley spring-run ESU
- Chinook salmon, Sacramento River winter-run ESU

4.1.1 Green sturgeon critical habitat

The project area contains 3 square miles of green sturgeon critical habitat, which is approximately 0.02% of total critical habitat in marine waters. Within the project area, unavoidable impacts are anticipated across 9 acres with the addition of bay fill in reach 2, which equates to 0.01 square miles (< 0.001%) of permanent loss to green sturgeon critical habitat. Compensatory mitigation would be used to offset the severity of these impacts through old pier and pile removal. Additional temporary impacts to critical habitat are anticipated, such as pile driving and installation of cofferdams. Cofferdams would be installed during construction and removed upon completing the activity. Piles would not exceed those present under existing

wharf structures, rather there is anticipated to be a net loss in total number of pilings in the water.

The primary constituent elements (PCE) for green sturgeon critical habitat in estuarine areas include:

- Food resources that provide abundant prey for juvenile, subadult, and adult life stages;
- Water flow with sufficient flow into the bay and estuary to allow adults to successfully orient to incoming flow and migrate upstream to spawn;
- Water quality with suitable water temperature, salinity ranges, dissolved oxygen levels, and acceptably low levels of contaminants;
- Migratory corridor that provides safe and timely passage within estuarine habitats and between estuarine and river or marine habitats;
- Water depths that are diverse to provide shelter, foraging, and migration of juvenile, subadult, and adult life stages; and
- Sediment quality with sediments free of elevated levels of contaminants.

The PCE in coastal marine areas include:

- Migratory corridor that provides safe and timely passage within marine and between estuarine and marine habitats;
- Water quality with adequate dissolved oxygen levels and acceptably low levels of contamination; and
- Food resources to support subadults and adults over long-distance migrations.

The Recommended Plan is likely to adversely affect the PCEs listed below; however, effects are not expected to be significant for the following reasons:

Water Quality – the project would improve the overall water quality in the project area by providing removal of contaminant laden pilings, treatment and cleanup of any potential contamination release during construction compliant with regulatory requirements and includes Natural and Nature Based Features (NNBFs) that offer filtration benefits. Because water quality is improved in the long-term, while adverse impacts are temporary and limited, the project is anticipated to improve water quality and therefore would not affect green sturgeon long-term growth and viability.

Food Resources –prey species targeted by green sturgeon, such as benthic invertebrates, fish, amphipods, isopods, clams, etc. are likely to be impacted through injury or mortality due to pile driving, suspended solids, turbidity, bay fill, and pile removal. However, the project would not result in any measurable loss to the abundance of prey in the project area or greater San Francisco Bay. Pile driving may result in behavioral disruption of common prey items, but this would be limited to during construction. Additionally, removal of old piles may result in loss of sessile invertebrates, but this is expected to be limited and other sources of invertebrates would remain available. In the long-term the project would benefit green sturgeon prey by improving water quality and enhancing habitat due to installation of new pilings free of contaminants.

Migratory Corridors – passage may be temporarily impacted due to project construction from pile driving, cofferdams, and fish handling. Pile driving results in behavioral effects that may alter green sturgeon migration patterns; however, sound levels would not be homogeneous across the Bay, allowing green sturgeon to avoid the higher levels of sound further away from

the source. The project also is expected to use barges or support vessels to bring construction equipment and supplies to some areas of the project site. San Francisco Bay has a high number of vessels, ship, and barge traffic. Tugboats and barges are slow moving and would follow a predictable route. Green sturgeon would be able to avoid construction barges; therefore, increased vessel use within the project area would not impact this PCE.

No effects are expected for the PCEs not explained above.

Given the temporary nature of construction activities and minimal impact from bay fill, the USACE determined the Recommended Plan would not appreciably diminish the value of critical habitat for survival or recovery of green sturgeon. Rather, because a small portion of the critical habitat is impacted, it was determined this was discountable.

4.1.3 Chinook salmon critical habitat

The project area contains 1 square mile of chinook salmon critical habitat, which is approximately 0.4% of total critical habitat. Within the project area, unavoidable impacts are anticipated across 9 acres with the addition of bay fill in reach 2, which equates to 0.01 square miles (0.004%) of loss to Chinook salmon critical habitat. Compensatory mitigation would be used to offset the severity of these impacts through old pier and pile removal. Additional temporary impacts to critical habitat are anticipated, such as pile driving and installation of cofferdams. During pile replacement for wharf construction, there is anticipated to be a net loss in total number of pilings in the water.

The PCEs for Chinook salmon Sacramento River-run critical habitat were not described in the federal register notice when designated (58 FR 33212). The Recommended Plan is likely to adversely affect this critical habitat in the project area similarly to that described in Section 4.1.2. The most likely impact of the Recommended Plan would be to migration corridors. Sacramento-River run chinook salmon are primarily present through San Francisco Bay from December through July with peak occurrence in March. The primary migration corridor is through the northern reaches of Central San Francisco Bay (Raccoon Straight and north of Yerba Buena Island; NMFS 2001, 2015). If present, it is likely most fish occur further North than the extent of the action area, but they have been noted foraging in shallow waters of Central Bay during migration. Their presence in the shallower water areas of the Bay and along the San Francisco Port may be more the result of capture by tidal flow rather than active foraging or intentional swimming to those areas of the Bay.

Given the temporary nature of construction activities and minimal impact from bay fill, the USACE determined the Recommended Plan would not appreciably diminish the value of critical habitat for survival or recovery of Sacramento River-run chinook salmon. Rather, because such a small portion of the critical habitat is impacted, it was determined this was discountable.

4.1.4 In-water Construction Activities

In-water construction includes the following activities:

- Installation of temporary cofferdams (e.g., sheet-pile containment walls) which includes:
    - Removal or displacement of any hardened material that may exist where the cofferdam would be installed.
    - Removal of existing piles in the way of temporary cofferdams as applicable.
    - Installation of cofferdam with a vibratory and/or impact pile driver.
    - Removal of cofferdam with a vibratory and/or impact hammer.

- Fish handling and removal – BMP employed prior to cofferdams being dewatered
- Installation of sediment curtain(s)
- Installation of new seawall bayward of existing seawall.
- Reconstruction of wharves which includes:
    - Removal of existing pilings in the footprint of the new construction.
    - Installation of new piles.
    - Construction and installation of new platform structure.
- Installation of ecological armoring, living shoreline, and other EWN features that could be installed at the mean higher high water (MHHW) line.

In-water construction would result in impacts that would affect the listed species in different ways. Some construction effects would only impact the nearshore environment, such as exposure to elevated turbidity and suspended solids, and would impact a smaller number of species, while underwater sound effects would have a larger exposure area and would impact a greater number of species. The following analysis describes the several components of in-water construction, identifies effects from each construction component, and identifies the species exposed to the effect, and their anticipated responses to such exposure.

4.1.5 Support Vessel Operation

Delivery/storage barges and tugboats may be used to support project construction during installation of wharf platforms, cofferdams, and ecological armoring. During construction, the barges, likely moved by tugboats, would primarily navigate within San Francisco Bay in or adjacent to the project area. The barges would be expected to remain at the project site during active periods of loading, unloading, and construction activities as applicable. In extremely adverse weather conditions, barges may be moved from the project site to an existing barge moorage area as a safety precaution.

Barge traffic from the Recommended Plan would occur mostly during daylight hours and along major navigation routes within San Francisco Bay. The use of tugboats and barges for the project would contribute to the ambient sound level within the Bay. Existing noise producers in the channels and waterways include large ships, such as car carriers, other cargo ships, oil tankers, tugboats, barges, maintenance dredging equipment and recreational users, such as motorboats. Large vessels such as cargo ships and oil tankers would likely produce the greatest sound impacts. Most ships produce low frequency noise (20-500 Hz), but modern commercial ships can range as high as 188 decibels (dB) if traveling at higher speeds (Sounds in the Sea 2021). Tugboat and barge use, which are similar to larger vessels, are not expected to increase sound levels above 150 dB Root-Mean-Square (RMS) which would result in behavior effects to listed fish species (Hastings' 1990). As such, the adverse noise impacts of support vessels to ESA and EFH species are anticipated to be discountable.

4.1.6 Water/Sediment Quality Effects

Removal of piles would result in short-term disturbance of bottom sediments and resuspension of sediments. Disturbed or resuspended sediments could increase the exposure of chemical concentrations to aquatic receptors in the localized area and could result in adverse water quality and biological effects. Debris or portions of degraded creosote piles may be encountered during pile replacement. Piles that are not recommended for pulling due to known contaminant levels in the surrounding substrate would remain in place and likely be cut to reduce in-water hazards. Creosote is an effective wood preservative in the marine environment but also

contains organic compounds toxic to marine organisms. Although removal of creosote pilings may release some organic substances, removal of degraded or old pilings would improve the localized and eventually long-term water and sediment quality.

Typically, removal of piles causes only temporary resuspension of sediments. Suspended sediments in the water column can lower levels of dissolved oxygen, increase salinity, increase concentrations of suspended solids, and possibly release chemicals present in the sediments into the water column. The concentration of suspended sediments would vary based on the production rate of removal, the number of piles and duration of the construction activity, and would depend also on the methods used, the quality of equipment, and care of the operator. In all cases, increased turbidity levels would be relatively short-lived and generally confined to within a few hundred yards of the activity. After initially high turbidity levels, sediments would disperse, and background levels would be restored within hours of disturbance.

The potential effects of suspended sediment within the water column on fish include gill lacerations, increased “coughing” behavior, decreased feeding success, and avoidance behaviors (Wilber and Clarke, 2001). Sediment plumes that may be caused by pile removal are expected to be extremely small in area and short in duration. It is estimated that any potential impact due to resuspended sediments would be limited to a distance up and down current of approximately 330 feet (USACE 2022). Recent studies by the San Francisco Estuary Institute (SFEI, 2008) determined that the short-term effects of dredging on sensitive fish species due to dredging activities were minor. Considering that the volume of sediment being disturbed by pile removal would be significantly less (orders of magnitude) than of that disturbed by even a small-scale dredging operation, and the limited duration of installation activities, it can be assumed that the water quality impacts of pile removal would be small and below the threshold of concern.

Contaminants bound to suspended sediments could also degrade water quality by reducing dissolved oxygen concentrations in the water column and contaminants could leach into the water from the sediments. Substantially depressed oxygen levels (i.e., below 5.0 mg/l) may cause respiratory stress to aquatic life, and levels below 3.0 mg/l may cause mortality. However, oxygen level depression resulting from the Recommended Plan is not expected to remain depressed for long periods. Tidal flushing would be expected to ameliorate depressed oxygen levels by the ongoing introduction of oxygenated water into the action area and releases of anoxic sediment that could degrade oxygen levels would occur for relatively short time periods.

While the majority of water and sediment quality impacts from the Recommended Plan would result from pile removal and replacement, other in-water actions could produce similar effects. The configuration of ecological armoring may also result in temporary increases in suspended sediment. However, any water quality impacts related to configuring NNBFs would occur at a lesser magnitude than the in-water pile work, which itself is expected to generate effects well below the thresholds of concern. Additionally, bay fill would result in increased sedimentation during placement; however, these impacts would be contained using BMPs such as silt curtains to reduce overall spatial extent of water quality impacts.

Additionally, the maintenance and repair of shoreline structures after construction may create temporary impacts to water quality. While most of the maintenance work would occur from land, some is expected to occur in-water, e.g., ecological armoring maintenance. These activities have the potential to cause impacts to sediment quality on a small scale similar to the effects

from the maintenance of existing breakwaters. These effects are expected to be isolated, temporary, and of low overall impact to fish. The general maintenance of wharf structures would occur above, not within water, and is unlikely to result in significant effects to water quality or sediment.

Increased turbidity levels associated with construction and removal activities and in-water maintenance would be relatively short-lived and generally confined to within a few hundred feet of the activity. After initially high turbidity levels, sediments would disperse, and background levels would be restored within hours of disturbance. In addition, normal circulation and strong currents along the San Francisco waterfront rapidly circulate and disperse water temporarily affected by construction activities. It is anticipated that turbidity plumes would disperse within a matter of hours, and the particulate concentrations would be diluted to levels that would pose no major threat to water quality or aquatic wildlife.

4.1.7 Noise Effects

Noise can be assessed using sound pressure levels (SPLs) and sound exposure levels (SELs) to characterize potential effects of sound on fish. SPL characterizes the amplitude of sound and is measured in decibels, while SEL measures the energy of the received level and duration of exposure (Chapman and Ellis 1998). To assess impacts to listed species, several metrics are relevant including peak sound level (measure of maximum overpressure or underpressure created by a single event); RMS which is the quadratic mean sound pressure over the duration of an impulse; and cumulative SEL (SEL_{CUM}) which measures total exposure to sound over the period the sound is occurring (Hastings and Popper 2005). The frequency of the sound, expressed in Hertz (Hz), is also important to evaluating the potential for sound impacts. Low frequency sounds are typically capable of traveling over greater distances with less reduction in the pressure than high frequency sounds (Hastings and Popper 2005).

Concrete, wood, and steel piles that are driven within the water column can produce high intensity noise resulting in damage to soft tissues, such as gas bladders or eyes (barotraumas) and/or result in harassment of fish such that they alter swimming, sleeping, or foraging behavior or temporarily abandon forage habitat. Protected and managed fish species, including salmon, Pacific herring, anchovies, mackerel, sardine, soles, sanddab, green sturgeon, and other bottom fish use the waters adjacent to the project area for foraging and as a transit corridor between the open ocean (via the Golden Gate) and South Bay. The Recommended Plan may include driving of wood, steel, or concrete piles for seawall construction and wharf replacement. Specifics about the type and number of piles to be used would be determined during PED, as well as whether an impact or vibratory hammer is most appropriate for the material used. Generally underwater noise generated by driving wood and concrete piles is less intensive than for comparable steel piles (Table 4).

Table 4. Single-strike sound levels associated with impact driving of different piles measured at 10 meters from pile. Source: Caltrans, 2009.

Pile Size/Type	Peak Pressure (dB)	RMS Sound Pressure (dB)	Sound Exposure Level (dB)
12-inch wood drop	177	165	157
18-inch concrete impact	185	166	154
12-inch cast-in-shell steel impact	190	180	165

The striking of a pile by a pile-driving hammer creates a pulse of sound that propagates through the pile, radiating out through the water column, seafloor, and air. Vibratory pile drivers work on a different principal than pile-driving hammers and therein produce a different sound profile. A vibratory driver works by inducting particle motion to the substrate immediately below and around the pile causing liquefaction of the immediately adjacent sediment, allowing the pile to sink downward. Vibratory pile driving is only suitable where soft substrate is present. Sound levels are typically 10-20 dB lower in intensity relative to the higher, pulse-type noise produced by an impact hammer (Caltrans 2009).

Wood piles installed with an impact hammer would be expected to have sound levels that range from 170-180 dB and RMS sounds pressure levels that range from 160-168 dB within 33 feet from the piles. When a cushion block is used between the hammer and pile, sound levels would be expected to be below the established sound threshold of 183 dB for potential impact to fish less than 2 grams and 187 dB for fish greater than 2 grams (Caltrans 2009). If an impact driver, and/or concrete or steel piles were used for construction, it would be expected that sound levels would be higher than those described for wood piles. BMPs as described in section 1.6.4 would be used to reduce overall noise impacts, regardless of the material used (wood, concrete, steel) and the method of installation (impact or vibratory driver).

Scientific investigations on the potential effect of noise on fish indicate that sound levels below 187 dB do not appear to result in any acute physical damage or mortality to fish (barotraumas; FHWG 2008); however, high underwater SPLs are known to have negative physiological and neurological effects on a wide variety of vertebrate species (Hastings and Popper 2005; Turnpenny and Nedwell 1994;Yelverton et al. 1973; Yelverton and Richmond 1981), and are known to injure and/or kill fishes, as well as cause temporary stunning, and alterations in behavior (Hastings and Popper 2005; Popper 2003; Turnpenny and Nedwell 1994; Turnpenny et al. 1994). Over this continuum of effect, there is no easily identifiable point at which behavioral responses transition to physical effects, but the risk of injury appears related to the effect of rapid pressure changes, especially on gas-filled spaces in the bodies of exposed organisms (Turnpenny et al. 1994). Injuries associated with exposure to high SPLs are referred to as barotraumas, and include hemorrhage and rupture of internal organs, hemorrhaged eyes, and temporary stunning (Hastings and Popper 2005; Turnpenny and Nedwell 1994; Yelverton et al. 1973; Yelverton et al. 1975; Yelverton and Richmond 1981). Death as a result of barotrauma can be instantaneous, occurring within minutes after exposure, or can occur several days later (Abbott et al. 2002), or injuries may be sub-lethal. Sub-lethal injuries can reduce osmoregulatory efficiency and increase energy expenditure (Gaspin et al. 1976, Govoni et al. 2008), and can affect equilibrium and interfere with the ability to carry out essential life functions such as feeding and predator avoidance (Gaspin 1976; Turnpenny et al. 1994; Hastings et al. 1996; Popper 2003).

Criteria for injury to fish during noise-producing activities have previously been evaluated based on peak and accumulated exposure levels (FHWG 2008). These criteria were used to infer a determination of effects to protected fish species in the project area. Table 5 provides a summary of criteria for effects of noise on fish that would be expected to result in injury or behavioral changes (FHWG 2008). NMFS uses a SPL of 150 dB RMS as guidance for behavioral effects.

Table 5. Sound criteria for the onset of injury and behavioral disturbance to fish

Fish	Onset of Injury Threshold	NMFS Behavioral Guidance
Fish > 2 grams	206 dB peak; 187 SEL_{CUM}	150 dB RMS
Fish < 2 grams	206 dB peak; 183 SEL_{CUM}	150 dB RMS

Note: SEL_{CUM} assumes pile strike at approximately 33 ft from the strike

Noise levels that result in startle responses in steelhead trout and salmon have been documented to occur at sound levels as low as 130 dB at a frequency of 100 Hz and between 180 and 186 dB in Pacific herring (Table 6). Any disturbance to ESA listed fish species that results in altered swimming, foraging, movement along a migration corridor, or any other altered normal behavior is considered harassment.

Table 6. Species-specific noise tolerance for fish in San Francisco Bay

Fish Species	SPL (dB)	Behavioral Response	Reference
Pacific herring	180-186	Avoidance behavior	Dalen and Knutsen 1986
Salmon, steelhead	166	Avoidance behavior	Loeffelman et al. 1991
Salmon, steelhead	130-160	Startle response	San Luis and Delta Mendota Water Authority and Hanson 1996

Protected fish may be present at the onset of pile driving which could result in avoidance, startle, injury, or barotrauma depending on the proximity to the strike, developmental stage of the fish (larval, juvenile, adult), and species. It would be expected that fish vacate from the zone of peak sound production (within 33 feet of piles) when pile driving begins. The strike would lead to avoidance behavior at the onset of pile driving for fish present proximal to the strike, as well as those further away that are still within the range of sound propagation. However, barotrauma or injury to fish could also result to those within the peak sound zone immediately or within a few days of exposure. Fish not within the peak sound zone at onset would likely avoid the area while pile driving occurs.

Small fish such as herring, sardines, and anchovies as well as salmon, and sturgeon may be forced to modify their foraging and/or normal swimming behaviors in response to increased sound levels; however, the use of BMPs such as cushion blocks and a “soft start” technique can be expected to reduce transmitted sounds levels and the distance over which potentially harmful sounds levels would travel.

Noise effects to protected fish are expected to be temporary, only lasting while the construction action is occurring. Fish can suffer trauma after sound exposure, days after the noise is generated; however, noise producing activities do not emit long-term or permanent impact beyond those sustained during initial exposure. Any long-term or permanent impact would be on an individual, not the environment. Larval and/or juvenile life stages would be more prone to injury or barotrauma, though most of the ESA-listed species spend juvenile stages outside of the action area. Salmon and steelhead are the most likely to be transiting through the action area and would be expected to sustain lesser effects, such as avoidance and behavioral changes. Green sturgeons are more likely to be present within peak sound zones and would have a higher likelihood of injury or death. Given the uncertainty in number of piles, construction sequencing and timing, pile material, etc. it is difficult to evaluate the extent of impact to

protected species. That level of design detail would be developed during PED. However, it could be assumed at this stage that behavioral changes are most likely to occur for steelhead and salmon as a result of noise, while green sturgeon are more likely to suffer injury or death.

4.1.8 Shade Caused by Overwater Structures

Overwater shading is anticipated to occur with moored barges or support vessels and reconstruction of wharf structures.

Barges would increase overwater shading in staging locations during construction. A typical barge used for storage of equipment/supplies is a derrick barge that on average measures 70 feet by 200 feet. Delivery barges could be tied to a derrick which averages 55 feet by 180 feet. If two barges were present at the construction area at a time, the total surface area expected would be approximately 23,900 square feet. Additional barge support may be needed during construction and would be determined during PED.

Derrick barges would be anchored to the seafloor and are assumed to remain in place during active periods of material delivery. Delivery barges would be tied to the derrick barge and rotated as needed to provide a continuous supply of construction materials. As such, barge use would temporarily increase overwater shading when the barges are anchored during in-water construction activities. This is anticipated to be infrequent, but durations and locations would be determined during PED.

The Recommended Plan includes re-construction of wharves that require an increase in elevation as new seawall construction occurs. Re-constructed wharves would cover the same spatial extent as currently exists; thus, no increase in the area of shade structure is anticipated with this measure. The inclusion of light penetrating surfaces (e.g., clear glass blocks, grates) into the new wharf platform has not been considered to date in the design but could be reviewed during PED to improve current lighting to aquatic habitat.

In general, overwater structures create sharp, underwater light contrasts by casting shade over an area during the day. Light contrasts can also occur at night from artificial lighting surrounding a structure. Fish exposed to sharp, underwater light contrasts may be exposed to increased risk of mortality as a consequence of delays in migration from disorientation caused by lighting changes, loss of schooling refugia due to fish school dispersal under limited light conditions, and a change in migratory routes to deeper waters, which lack refugia from predators (Simenstad et al. 1999, Nightingale and Simenstad 2001).

No studies are available that provide empirical evidence supporting or refuting the hypothesis that modification of juvenile salmonid behavior in shoreline habitats resulted in changes in survival. Results were exceedingly variable and appeared to reflect the study conditions (e.g., adjacent shorelines, dock dimensions and material, artificial lighting, etc.) that affected observations. Despite considerable speculation that overwater structures increase the numbers and success of predatory fish, evidence supporting this contention is inconclusive. Quantitative assessment of predation around overwater structures is meager, and few studies have confirmed actual predation (Nightingale and Simenstad 2001).

However, it is known that light is extremely important in determining the type and distribution of diatoms, photosynthetic bacteria, phytoplankton, macroalgae, microalgae, and seagrasses. Overwater structures can reduce light levels by 90 to 100 percent below ambient, which can

significantly affect marine plant distribution and abundance. Light levels below overwater structures could significantly limit or eliminate primary production, thus leading to a less diverse community structure. Nightingale and Simenstad (2001) concluded that cumulative impacts of overwater structures in urban industrialized areas in estuaries can pose substantive risks to estuarine ecosystems, especially in areas like San Francisco Bay where estuarine habitat is extremely limited, and the shoreline is highly modified with piers, wharves, and seawalls.

Project construction could have some effects to aquatic vegetation and habitat used by salmon, green sturgeon, and MSA-managed species that would be caused by mooring barges/support vessels and during construction of wharf platforms. It would be expected that most vegetation and habitat features would recover; though, the level of impact is difficult to determine without an understanding of the duration in which over-water structures would be present in the action area. With seasonal work restrictions, it could be inferred that the impacts from increased areas of shade from barge presence would have only minor effects to chinook salmon, green sturgeon, and MSA-managed species; however, additional details determined during PED would provide more definitive assumptions.

No long-term deleterious effects of shade on habitat and on fish are expected to be caused by the permanent presence of re-constructed wharves as these features would be constructed within the existing footprint. Instead, fewer pilings would be placed in the water resulting in a net loss of piles. Additionally, the design of wharf platforms could be refined during PED to allow penetration of some light to reduce the light/dark transition that otherwise increases juvenile fish vulnerability to predation. If such refinements can be made to the wharf platform, this may offer a long-term benefit to protected fish from the increased light penetration under the permanent structures by having a small increase in abundance and diversity of prey species, having fewer deeply shaded areas to avoid during migration, and having a greater ability to detect/avoid predator fish.

4.1.9 Fish Capture and Handling

Fish, specifically green sturgeon, would likely be captured and handled during construction of cofferdams in order to remove them from the aquatic habitat being isolated. The cofferdam would be constructed to leave one section of the wall open, to facilitate fish removal between the containment wall and seawall. This section would be closed after initial fish removal has occurred. At the lowest tide, near the end of the cofferdam installation, the area between the containment wall and seawall would be swept with block nets or beach seines (two to three passes) to push fish out of the opening. The last section of the cofferdam would then be installed. After the last section of the wall is installed and during the lowest possible tide, block nets would be installed to section off smaller areas behind the containment wall.

The capture and handling of fish is intended to reduce the number of fish that would be injured or killed during construction, but in itself has some potential to result in injury or death. Mortality may be immediate or delayed. Handling of fish increases their stress levels and can reduce disease resistance, increase osmotic-regulatory problems, decrease growth, decrease reproductive capacity, increase vulnerability to predation, and increase chances of mortality (Kelsch and Shields 1996). Fish may suffer from thermal stress during handling, or may receive subtle injuries such as de-scaling, abrasions, and loss of slime layer. Handling can contribute directly or indirectly to disease transmission and susceptibility or increased post-release predation. Fish that have been stressed are more vulnerable to predation (Mesa et al. 1994; Mesa and Schreck 1989).

Based on the Recommended Plan and life-history patterns of listed species, it is expected that very few fish would be captured and handled during the installation of cofferdams. Large fish would be able to avoid the construction area and thus are not likely to be stranded behind the containment wall. Juvenile green sturgeon is the most likely listed fish that would require capture and handling. The prominent stressors affecting physiological traits for green sturgeon are elevated temperatures, salinity, low food availability and contaminants (Rodgers et al. 2019). It is not likely capture and handling would have long-term impacts to sturgeon or result in affecting physiological traits; however, this has the potential to increase stress and make the fish more vulnerable to other stressors that could be present in the environment.

4.1.10 Effects to Wetlands and Special Aquatic Sites

EFH in San Francisco Bay includes aquatic resources such as eelgrass beds and native oyster beds; both of which are protected as Special Aquatic Sites. No eelgrass impacts are anticipated in work areas that are located within the action area as no in-water construction would occur near known eelgrass beds (Merkel 2010). It is possible, that sparse undiscovered stands of eelgrass may be present between Mission Creek and Heron's Hear Park in waters shallower than 7 ft and could be impacted by activities. However, review of the Merkel (2010) survey, bathymetry profiles suggest that eelgrass is in fact absent from these areas. Based on the above, potential impacts to eelgrass are expected to be negligible to none.

It is anticipated that few oysters would be affected during the Recommended Plan, such as the replacement of piles, construction of wharf platforms, and placement of ecological armoring. These features would provide comparable habitat to removed features. Furthermore, the permanent removal of piles would result in removal of an in-water contaminant source (the majority of these older wood piles are creosote-treated), thereby improving water quality and overall habitat health. It is anticipated that few, if any, oysters may also be affected during the maintenance of associated pile-supported structures.

4.1.11 Cumulative Effects

Cumulative effects under the ESA are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area (50 CFR 402.02). Future federal actions that are unrelated (i.e., not interrelated or interdependent) to the proposed action are not considered in this assessment because they would be subject to separate consultation pursuant to Section 7 of the ESA.

The majority of state or private entity activities the USACE is aware of that are reasonably certain to occur within the action area include ongoing land-based development (public housing, commercial, industrial, etc.) and environmental restoration along Central Bay. Most of these actions have minimal in-water work, or the short-term negative aquatic impacts are outweighed by the long-term beneficial effects. In-water work conducted by state or private entities within or near the action area that may impact listed species or critical habitats would be subject to Section 6 and Section 10 compliance measures under ESA.

Land-based development projects are not likely to have direct impacts to protected fish species but may generate effects such as temporarily lowering water quality through runoff or accidental discharge. The sequencing of private/state projects and this Federal project are unlikely to occur simultaneously, rather they would be spread across multiple years and at different times throughout the year to minimize disruption to people and businesses. Restoration projects

would have a long-term beneficial impact, thus contribute minimally to the cumulative impacts of this project once habitat is established.

5.0 Conclusion and Effects Determination

This section discusses the conclusions of this BA that were formulated using the discussion of potential species present, habitat presence and suitability, and project effects discussed in previous sections.

5.1 ESA Section 7

The Recommended Plan's in-water project components consist of construction, maintenance, repair, replacement, and debris removal activities along the San Francisco waterfront from Aquatic Park to Heron's Head Park. Project actions could adversely affect green sturgeon, and may affect, but are not likely to adversely affect chinook salmon. These effects would be the result of potential:

- Water quality impairment,
- Underwater noise effects to fish and foraging habitat,
- Shade caused by overwater structures, and
- Fish capture and handling.

Implementation of proposed conservation measures are expected to result in avoidance and minimization of these potential effects as discussed below.

5.1.1 Water Quality Impairment

Localized water quality impairment can be expected to occur during pile installation and removal, as well as during other in-water maintenance and removal activities proposed under the Recommended Plan. This impairment would primarily include short-term increases in turbidity. The high tidal flushing and water exchange present in the waters adjacent to the project area and the naturally occurring suspension of sediments would result in short-term increases in suspended sediments/turbidity within the area of construction only and are not expected to result in any catastrophic or chronic adverse effects to considered species. No permanent loss or impairment of critical habitat for any of the considered species is expected as a result of predicted water quality impairments from pile installation and removal or the other maintenance and removal activities proposed.

5.1.2 Noise

The installation and removal of pilings could be expected to generate noise levels over short distances that could result in disturbance to species of concern. This disturbance would be expected to result in short-term and temporary altered swimming and foraging behavior as well as exclusion from some foraging areas surrounding the pile driving activity for steelhead, salmon, and green sturgeon. Initial placement of piles on the seafloor prior to driving could reduce the exposure of fish to peak sound levels given the natural avoidance behavior fish have to noise and disturbance. However, protected fish may also be exposed to peak sound levels at the onset of pile driving, with the severity of impact being dependent on several factors. Green sturgeon are the most likely species to suffer injury or death of the ESA-listed fish in the action area, while larval and juvenile of any protected fish species are the most likely life-stages to sustain injury or death.

In summary, the Recommended Plan would result in temporary impacts during construction, with the majority of fish capable of avoiding peak sound zones either for the duration of pile driving or immediately after the activity commences. Long-term or permanent impacts from noise are not anticipated in the environment; however, this could be expected for individuals that sustain injury or result in death from noise exposure. The permanent impacts to ESA- and EFH-managed species would be minimized through: (i) BMPs proposed in this BA; (b) avoidance and minimization measures proposed for pile driving activities; (iii) construction sequencing and timing to minimize exposure duration.

The Recommended Plan may, however, result in:

- Temporary impacts to individual green sturgeon and longfin smelt, primarily through disturbance and habitat avoidance;
- Temporary impacts to individual adult and juvenile Central California Coast DPS and California Central Valley steelhead trout, primarily through disturbance and habitat avoidance, when pile driving occurs during their migration and foraging;
- Temporary impacts to migrating and foraging adult and juvenile Central Valley Chinook Salmon if pile driving occurs during their migration period; and
- Temporary impacts to designated critical habitat for adult and juvenile Chinook Salmon, and green sturgeon, primarily through short-term turbidity and noise-related disturbance.
- Permanent injury or loss to green sturgeon, particularly juveniles, if present in the peak sound zone for pile driving.

Overall noise is not expected to have measurable impacts to the abundance or presence of protected fish in the project area.

5.1.3 Shade

The use of in-water work equipment such as support vessels and barges would cause short-term, temporary increases in shade within the project area. This disturbance could result in temporary altered foraging behavior or avoidance of typical foraging areas during vessel presence. Durations for staging in-water work equipment is uncertain; however, it is not anticipated to be long enough to result in significant or permanent changes to fish behavior, foraging capability, and/or presence.

Re-construction of wharves would also be expected to have short-term, temporary increases in shade within the project area. Final wharf dimensions are anticipated to be within the same footprint as the existing wharf, thus, no additional shading would occur long-term. The inclusion of light penetrating surfaces (e.g., clear glass blocks, grates) into the new wharf platform has not been considered to date but could be reviewed during PED to improve current lighting to aquatic habitat and reduce overall impacts to species of concern.

Light contrasts could occur at night from artificial lighting during and after construction of the wharves. This could temporarily cause behavioral changes from disorientation or mortality from loss of refugia associated with schooling, though this is not anticipated to have any long-term consequences to ESA- or EFH-listed species. Light penetration is important for type and distribution of algae and marine plants that are important for fish foraging. Temporary impacts to plant composition in the water column could be expected during construction activities, dependent on the duration of shade structures present. Overall, re-construction of wharves is

not expected to result in long-term impacts, given there is no change in the spatial extent of the structure upon construction completion.

5.1.4 Fish Capture and Handling

The capture and handling of fish is intended to reduce the number of fish that would be injured or killed during construction, but in itself has some potential to result in injury or death. Mortality may be immediate or delayed. Handling of fish increases their stress levels and vulnerability to predation, thereby increasing likelihood of future mortality. The Recommended Plan is not expected to result in high levels of mortality from capturing and handling of fish species. Juvenile green sturgeon are the most likely listed fish that would require capture and handling. Although incidental mortality cannot be ruled out as a possibility, overall it is expected to be unlikely, with fewer individuals impacted, if any than if capture and handling were not performed. In the long-term, fish capture and handling is not expected to have measurable impacts to the abundance or presence of green sturgeon in the project area.

5.2 Effects Determination

Effect determinations were made following the definitions in the ESA:

- ***No effect*** – the Recommended Plan would not affect a federally-listed species or critical habitat.
- ***May affect, but not likely to adversely affect*** – the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial; or
- ***Likely to adversely affect*** – adverse effects to listed species and/or critical habitat may occur as a direct result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or completely beneficial.

Table 7 presents the effects determination for ESA-species identified as occurring or potentially occurring in the action area and their critical habitat.

Table 7. Effects determination for ESA-species identified as occurring or potentially occurring in the action area and their critical habitat. A superscript (CH) denotes a species critical habitat in the action area. LAA = likely to adversely affect

Species	Effect	Take – Death or Injury	Critical Habitat
Green sturgeon [CH] *Acipenser medirostris*	LAA	Potential to occur from pile driving noise and/or during fish capture/handling	Habitat expected to recover within months of construction; very small area compared to habitat available with action area
Steelhead, Central California Coast DPS *Oncorhynchus mykiss*	LAA	Negligible to none; Potential to occur from pile driving noise	N/A
Steelhead, California Central Valley *O. mykiss*	LAA	Negligible to none; Potential to occur from pile driving noise	N/A
Chinook salmon [CH], Central Valley Sacramento spring-run *O. tshawytscha*	LAA	Negligible to none; Potential to occur from pile driving noise	N/A

Species	Effect	Take – Death or Injury	Critical Habitat
Chinook salmon [CH], Sacramento winter-run *O. tshawytscha*	LAA	Negligible to none; Potential to occur from pile driving noise	Habitat expected to recover within months of construction; very small area compared to habitat available with action area

5.3 MSA EFH

The Recommended Plan may adversely affect EFH by temporarily modifying localized portions of the San Francisco waterfront during construction. Permanent loss of EFH would occur with placement of bay fill; however, this loss would be offset with creation of a NNBF (i.e., rocky intertidal bluff) and removal of piers and pilings, which would improve the quality of EFH in the action area. Short-term displacement of MSA-managed species is anticipated during construction. The Recommended Plan may adversely affect EFH through:

- Localized and temporary turbidity impacts caused by the installation and removal of Pilings, cofferdams, and over-water structures.
- Disturbance of benthic foraging habitat during the installation and removal of pilings, cofferdams, and over-water structures.
- Potential temporary exclusion from occupied habitat associated with the avoidance of increased noise levels generated during pile driving, cofferdam construction, and in-water vessel operation.

Temporary impacts to EFH would be minor and generally limited to the immediate area of construction. Pile removal would generate a small, localized sediment plume around each removal site that would dissipate quickly, due to typical shoreline hydrodynamics. The installation of piles would temporarily displace some fish during active pile driving; however, the installation of piles may not cause acute barotrauma (i.e., tissue damage) and temporary displacement of fish would be short lived. Likewise, disturbed benthic sediment would quickly be recolonized by benthic invertebrates and should resemble pre-project conditions within 6 months to 1 year following disturbance. The implementation of the proposed avoidance, minimization, and conservation measures would significantly reduce the relative impact to EFH, and in conjunction with local hydrology, reduce the duration and footprint of disturbance.

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ATTACHMENT 1:
NMFS OFFICIAL SPECIES LIST

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.6.3
U.S. FISH AND WILDLIFE SERVICES CONCURRENCE LETTER

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife
Office 650 Capitol Mall, Suite 8-300
Sacramento, California 95814

In reply refer to:
2022-0082557

September 24, 2025

Robert Morrow
Chief, Environmental Branch
Southwestern Regional Planning and
Environmental Center
Tulsa District, U.S. Army Corps of
Engineers 2488 E 81st Street
Tulsa, Oklahoma 74137

Subject: Informal Consultation on the San Francisco Waterfront Coastal Flood Study Project, San Francisco County, California

Dear Robert Morrow:

This letter is in response to the U.S. Army Corps of Engineers' (Corps) July 8, 2025, letter requesting consultation with the U.S. Fish and Wildlife Service (Service) on the proposed San Francisco Waterfront Coastal Flood Study project (project) along 7.5-miles of the San Francisco Waterfront, from Aquatic Park to Heron's Head Park, in the City of San Francisco, San Francisco County, California. The Corps determined the proposed project may affect and is not likely to adversely affect the federally endangered California Ridgway's rail (*Rallus obsoletus obsoletus*; rail), California least tern (*Sternula antillarum browni*; tern), San Francisco Bay-Delta distinct population segment (DPS) of the longfin smelt (*Spirinchus thaleichthys*; longfin smelt DPS), salt marsh harvest mouse (*Reithrodontomys raviventris*; mouse) and California seablite (*Suaeda californica*; seablite), and the federally listed as threatened marbled murrelet (*Brachyrampus marmoratus*; murrelet). These species are collectively referred to as Consultation Species in this correspondence. Critical habitat is proposed for the longfin smelt DPS and exists for the murrelet, but neither are located within the proposed project area. Critical habitat has not been designated for the rail, tern, mouse, or seablite. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.) (Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR § 402).

In considering your request, we have based our evaluation on the following: (1) the Corps' July 8, 2025, letter with enclosures; (2) discussions regarding conservation measures and geotechnical investigations between the Corps and the Service in September 2025; and (3) other information

available to the Service.

Proposed Project Description

The project primarily involves raising shoreline elements, along with seismic ground improvements, environmental enhancements, and other flood protection measures (measures), along 7.5-miles of the San Francisco Waterfront, from Aquatic Park to Heron's Head Park, in the City of San Francisco, San Francisco County, California. The project is divided into four reaches (Figure 1) based on based hydrologic separability, identifiable geographic references, specific wave action within each reach, and major differences in physical structure inventory:

Reach 1 (Fisherman's Wharf): Aquatic Park, Fisherman's Wharf, Piers 31-35, and North Beach neighborhood. Measures will consist of floodproofing buildings and infrastructure and installing curb walls to floodproof the piers;

Reach 2 (Embarcadero): Northeast Waterfront and Financial District, and most of the Embarcadero Historic District. Along the Embarcadero, the shoreline would be elevated in place by raising and reconstructing bulkhead walls and pile-supported wharves north of the Bay Bridge. The reconstruction of the full Embarcadero roadway and promenade would need to be redesigned and reconstructed in future project phases. The Ferry Building and bulkhead buildings will be raised in place following construction of new pile supported foundations (wharves). At Rincon Park, just south of the Ferry Building, new bulkhead seawall will be constructed approximately 60 feet into the bay to mitigate disruption to below grade transit infrastructure and the surface transit corridor in this area, and rocky intertidal bluffs will also be constructed to integrate an engineered rocky tidal habitat into the shoreline elevation and bulkhead seawall rather than traditional riprap or other engineered armoring to protect the new bulkhead seawall. Piers will be floodproofed with concrete curbs around the perimeter. Ground improvements will be done to limit seismic risks. Living seawalls will be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design will incorporate textures to increase surface complexity);

Reach 3 (Mission Creek/Mission Bay): South Beach, Mission Creek, Mission Rock, Mission Bay, Pier 70, baseball stadium, and some surrounding dense residential areas. Measures here will continue the strategy of defending community assets in place by elevating the creek and Bay shorelines with raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls, planted levee and marsh/coarse beach restoration, and closure structures. Coastal defense will tie into existing and planned high ground at Bayfront, Agua Vista, and Crane Cove Parks, and at the Mission Rock and Pier 70 development areas. Partial reconstruction of the Embarcadero roadway south of the Bay Bridge will also occur to manage elevation change in this constrained urban area. Living seawalls will be incorporated into the design of any new vertical, concrete and/or baycrete bulkhead walls or piles; and

Reach 4 (Islais Creek/Bayview): Pier 80, Islais Creek, Cargo Way, Piers 94-96, Heron's Head Park, critical industrial, maritime, and commercial Port functions. Measures consist of raising the shoreline using bulkhead seawalls, levees, natural and nature-based features, floodwalls, closure

structures, and tying into existing or planned high ground, near Potrero Power Station and behind the Pier 94 Wetlands. This area of the waterfront contains large parcels independent of the combined sewer system, such that the elevated shoreline will require modification to handle stormwater in a safe and effective manner. Standalone sheet pile walls will be constructed as floodwalls along portions of Islais Creek and nearby Jennings Street in the Heron's Head Park area. Living seawalls will be incorporated into the design of any new vertical, concrete and/or baycrete bulkhead walls or piles.

Additionally, geotechnical activities and geophysical testing, through subsurface explorations, will be conducted across all four reaches. Geotechnical activities will include soil test borings and cone penetration tests. Geophysical testing will utilize downhole (i.e., tests conducted within boreholes or casing) and surface methods. These investigations aim to gather data for the Corps to inform best implementation of the proposed flood protection measures. The frequency (spacing) and depth of the geotechnical activities will vary along the project length, primarily based on the geologic conditions that exist. Given the variability of geology along the project's length, it is anticipated that spacings less than 500 feet will be used, with a reasonable assumption of approximately 250 feet, and that depths will vary from approximately 30 feet to 150 feet below existing grade along the project's length. Any habitat disturbance created by geotechnical activities or geophysical testing, that will remain after the project is completed, will be restored to pre-project conditions.

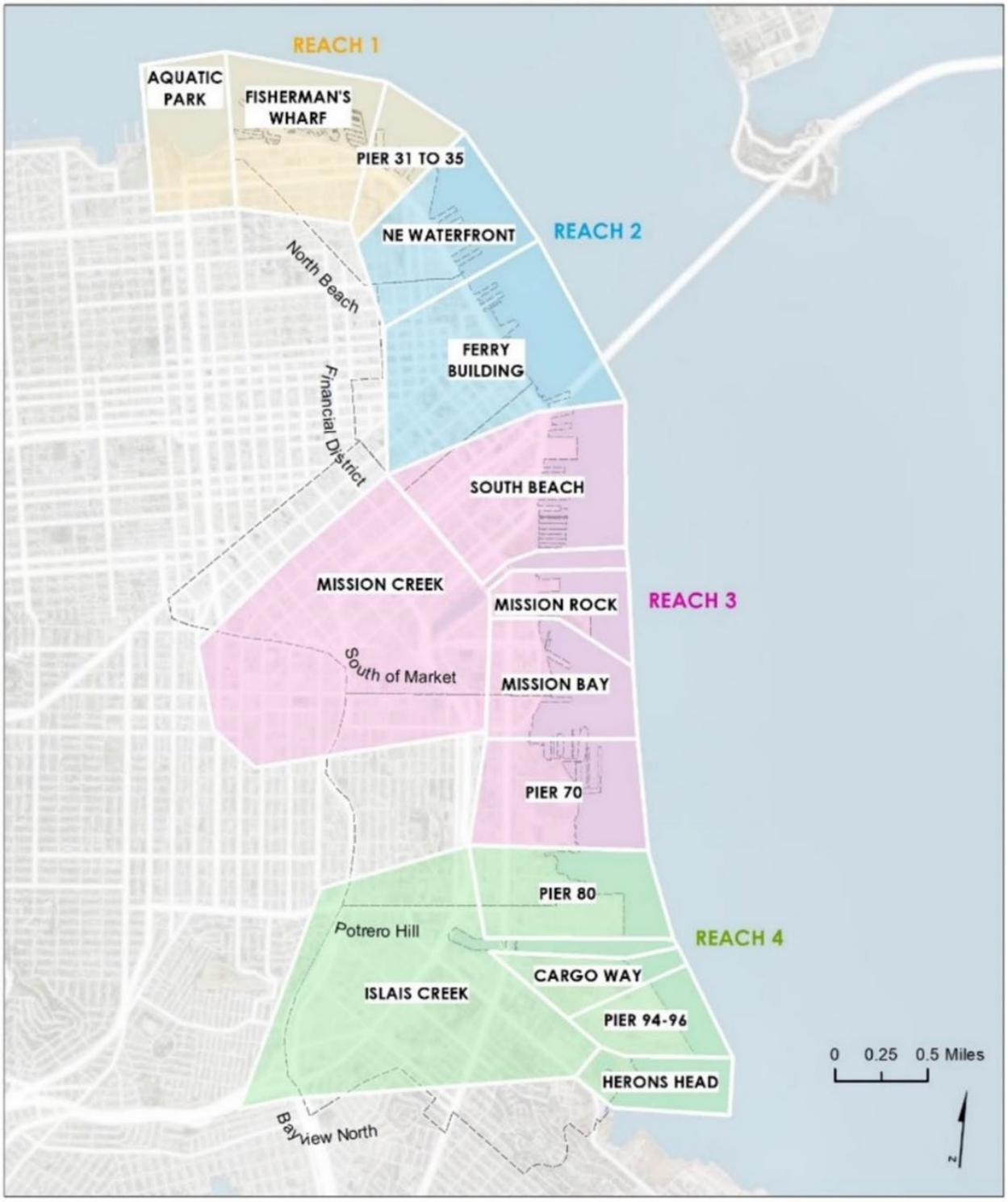


Figure 1. Reaches within the proposed project.

Conservation Measures

For the purposes of this consultation, the minimum qualifications for a "Qualified Biologist" include a bachelor's degree in biological or environmental science, natural resources management, or related discipline; field experience in the habitat types that may occur in or adjacent to the work areas; familiarity with the Consultation Species that may occur in or adjacent to the work areas; and prior preconstruction survey, construction monitoring, or construction oversight experience (relevant to the activity to be conducted)

General and All Species Measures

1. Construction Hours. Construction activities will be limited to daylight hours, to the maximum extent practicable. If nighttime construction is necessary, including in tidally influenced waters where tides may limit daylight access and work schedules, all project lighting (e.g., staging areas, equipment storage sites, roadway, and construction footprint) will be selectively placed and directed onto the roadway or work area and away from sensitive habitats. Light glare shields will be used to reduce the extent of illumination into sensitive habitats. If the work area is near surface waters, the lighting will be shielded so that it does not shine directly into the water.

2. Environmental Awareness Training. Existing and new personnel engaging in construction activities (construction personnel) will participate in environmental awareness training conducted by a Qualified Biologist prior to engaging in construction activities. Construction personnel will be informed regarding the identification, potential presence, habitat requirements, legal protections, avoidance and minimization measures, and applicable conservation measures for Consultation Species with the potential to occur in or immediately adjacent to the work area. Construction personnel will be informed of the procedures to follow should a Consultation Species be encountered during construction activities. Training may be provided in an online/virtual meeting and a training video developed under the supervision of the Qualified Biologist may be used to train new personnel, as long as a Qualified Biologist is available by phone to answer questions about the training.

3. Environmental Monitoring. A Qualified Biologist(s) will perform work area clearance at the beginning of each day and will monitor construction activities throughout the day in, or immediately adjacent to, sensitive resources and/or Consultation Species habitat, as necessary. The Qualified Biologist will confirm that all applicable conservation measures are implemented during project construction. The Qualified Biologist will have the authority to stop any work if they determine that any permit requirement is not fully implemented or if it is necessary to protect Consultation Species. The Qualified Biologist will prepare and maintain a biological monitoring log of construction work area conditions and observations, which will be kept on file.

4. Work Area and Speed Limits. Construction work and materials staging will be restricted to the smallest area practicable in designated work areas, routes, staging areas, temporary interior roads, or the limits of existing roadways. Prior to initiating construction or grading activities, brightly colored fencing or flagging or other practical means will be erected to demarcate the limits of the project activities, including the boundaries of designated staging areas; ingress and egress corridors; stockpile areas for spoils disposal, soil, and materials; and equipment exclusion zones.

Flagging or fencing will be maintained in good repair for the duration of project activities. Posted speed limits on public roadways will be adhered to and speeds will be limited to 20 miles per hour (mph) in the project area on unpaved surfaces and unpaved roads (to reduce dust and soil erosion), or in areas where Consultation Species have the potential to occur. Speeds greater than 20 mph may be permitted in the project area where Consultation Species are not expected to occur (e.g., in areas where Consultation Species have been excluded) and there is no risk of generating excessive dust (e.g., surfaces are paved, saturated, or have been treated with other measures to prevent dust).

5. Prevent Spread of Invasive Species. The spread or introduction of nonnative, invasive plant species will be avoided. Equipment will be cleaned of any sediment or vegetation at designated wash stations before entering or leaving work areas to avoid spreading pathogens or nonnative invasive species. Wash sites must be in confined areas that limit runoff to any surrounding habitat, and on a flat grade. Upland areas will use rice straw or invasive species-free local slash/mulch for erosion control; the remainder of the project area will use certified, weed-free erosion control materials. Mulch must be certified weed-free. Construction personnel will be educated on weed identification and the importance of controlling and preventing the spread of invasive weeds.

6. Equipment Maintenance and Materials Storage. Vehicle traffic will be confined to existing roads and the proposed access route(s). All machinery must be in good working condition, showing no signs of fuel or oil leaks. Oil, grease, or other fluids will be washed off at designated wash stations prior to entering work areas. Inspection and evaluation for the potential for fluid leakage will be performed daily during construction. All fuel and chemical storage, servicing, and refueling will be done in an appropriate staging area with secondary containment to prevent spills from traveling to surface water or drains. Staging areas for equipment storage and maintenance, construction materials, fuels, lubricants, solvents, and other possible contaminants, will have a stabilized entrance and exit and will be at least 100 feet from waterbodies, unless site-specific circumstances do not provide such a setback; in such cases, the maximum setback possible will be used. Fluids will be stored in appropriate containers with covers and will be properly recycled or disposed of off-site. Machinery stored in work areas will have pans or absorbent mats placed underneath potential leak areas.

7. Material Disposal. All refuse, debris, unused materials, and supplies that cannot reasonably be secured will be removed daily from the work area and deposited at an appropriate disposal or storage site. All construction debris will be removed from the work area immediately on project completion.

8. Fugitive Dust Reduction. To reduce dust, construction vehicles will be speed-restricted as described in #4, Work Area and Speed Limits, when traveling on nonpaved surfaces. Stockpiled materials susceptible to wind-blown dispersal will be covered with plastic sheeting or other suitable material to prevent movement of the material. During construction, water (e.g., trucks, and portable pumps with hoses) or other approved methods will be used to control fugitive dust as needed. Dust suppression activities must not result in a discharge to waterbodies.

9. Trash Removed Daily. During project activities all trash, especially food-related refuse that may attract potential predators or scavengers, will be properly contained in sealed containers, removed from the work area, and disposed of daily.

10. Project Cleanup after Completion. Work pads, temporary falsework, and other construction items will be removed from the work area by the end of the construction window. Removal of materials must not result in discharge to waterbodies.

11. Preconstruction Surveys. If Consultation Species and/or their habitat is present in or adjacent to a work area, a Qualified Biologist will conduct visual preconstruction surveys within 5 days prior to beginning construction to protect the species and habitat from avoidable construction-related disturbance. If construction activities at a given work area cease for more than 24 hours, and there is potential for Consultation Species to reoccupy habitat in or adjacent to that work area, the Qualified Biologist will resurvey the work area prior to resuming construction and implement applicable protection measures.

12. Airborne Noise Reduction. Equipment (including the noise abatement systems) will be maintained in good working order. Muffler (or spark arrester) damage must be promptly remedied.

13. Encounters with Species. If Consultation Species are observed, the Qualified Biologist will notify the Service within 24 hours of the observation, and a Qualified Biologist will monitor all construction activities conducted in or adjacent to the species habitat.

California Ridgway's Rail Specific Measures

Rail 1. If the rail is detected during preconstruction surveys, activities adjacent to tidal marsh areas will be avoided during the rail breeding season from February 1 through August 31 each year.

Salt Marsh Harvest Mouse Specific Measures

Mouse 1. Where a work area is in or adjacent to suitable habitat for the mouse, vegetation within the footprint of the work area plus a two-foot buffer will be removed under the supervision of a Qualified Biologist using only hand tools and operated equipment (e.g., string trimmers, high brush mowers, rakes). Only the minimum amount of vegetation necessary to implement effective mouse exclusion will be removed.

Longfin Smelt (San-Francisco Bay-Delta DPS) Specific Measures

Smelt 1. In-water work will be conducted during the general in-water work window for the San Francisco Bay: June 1 to November 30. This will avoid and minimize effects to migratory and spawning adults, incubation, and larval transport phases. Note: Once a cofferdam is in place and dewatered, the dry side of the site is no longer subject to the in-water work window.

Smelt 2. Dewatering activities will be monitored by a Qualified Biologist and any water intakes will be screened down to 20mm (> ¼ inch). The Qualified Biologist will have the authority to stop work if any smelt are observed.

California Seablite Specific Measures

Seablite 1. A minimum 50-foot work avoidance buffer around all seablite plants will be clearly

delineated with flagging or field markers, and a buffer of at least 300 feet will be used for any staging areas of all equipment for storage, fueling, and maintenance.

Conclusion

California Ridgway's Rail

The Service concurs with the Corps' determination that the proposed project may affect but is not likely to adversely affect the rail. The saltmarshes at both Heron's Head and Pier 94 provide suitable habitat for the rail, though this habitat is small, narrow, and scattered, providing marginal habitat. In south and central San Francisco Bay, and along the perimeter of San Pablo Bay, rails typically inhabit tidal marshes dominated by *Sarcocornia pacifica* and *Spartina foliosa*, especially where significant high tide refugia exist (Service 2013). No *Sarcocornia* vegetation is expected to be removed or degraded during construction activities. Construction of the project will occur adjacent to Heron's Head Park and Pier 94. Temporary impacts, associated with habitat disturbance from noise, and lighting, are expected during the project from construction activities. While a noise analysis was not completed for this consultation, the Service assumes that rails, if present, are potentially habituated to existing noise and lighting disturbance from nearby urban and industrial areas, including bulk cargo terminals, the San Francisco Bay Railroad, the Recology Recycling Center and long term lay berths used for maritime, industrial, and emergency response services at Piers 94-96, as well as from remaining planting and vegetation management activities, and associated habitat disturbance, within Heron's Head as part of the Heron's Head Shoreline Resilience Project (Service file #08FBDT00-2020-F-0164).

California Least Tern

The Service concurs with the Corps' determination that the proposed project may affect but is not likely to adversely affect the tern. Typically, terns forage in shallow nearshore waters and nest on sandy beaches with no to minimal human disturbance (Service 2020). There is small sandy beach, approximately 0.25-mile-long, at Aquatic Park within the project footprint. This beach is a popular tourist destination and is, therefore, not suitable nesting habitat for terns, and no construction activities will occur on the beach. In addition, no existing nesting colonies occur within the project footprint; the closest nesting area is Alameda Point, Alameda, CA, approximately 3 miles away across the San Francisco Bay (Service 2020). Terns at Alameda Point have been known to forage within 4 miles of their nesting area (TetraTech 2006, as cited in ERDC 2016) which is within the project footprint. Temporary impacts associated with disturbance from noise, emissions, fugitive dust, or turbidity generating activities during the project from construction activities are expected. The Service assumes that any foraging terns, if present, are potentially habituated to existing noise and lighting disturbance from nearby urban and industrial areas, including existing vehicle, pedestrian, and pier traffic (commercial vessels, ferries, recreational boats, etc.), nearby ship maintenance and restoration, as well as reconstruction and renovation work to the Hyde Street Pier (adjacent to the sandy beach). Additionally, any temporary impacts from emissions, fugitive dust, and turbidity are expected to be short in duration, not expected to rise above ambient conditions within the San Francisco Bay, and implantation of Conservation Measures will minimize contaminants and debris from entering

the air and water.

Longfin Smelt DPS

The Service concurs with the Corps' determination that the proposed project may affect but is not likely to adversely affect the longfin smelt DPS. The longfin smelt DPS range is scattered through bays, estuaries, and streams to include the Central San Francisco Bay in the project area. Longfin smelt DPS are pelagic forage fish that exhibit facultative anadromous life history (Moyle 2002), adapted to cold- and cool-water habitats; thus, their presences in the San Francisco Estuary are influenced by variation in seasonal water temperatures. Young fish transition seaward during summer months as water temperatures warm and are speculated to return to estuarine habitats in the fall to early winter. Spawning in the San Francisco Estuary typically occurs December through April, with peaks in January and February, though this would occur outside of the project area in fresh or low-saline waters north of Central Bay (Service 2022). Any disturbance to longfin smelt DPS habitat is expected to be short in duration, occur in stages across the project area, and localized work activities are not expected to rise above ambient conditions within the San Francisco Bay, and the proposed project proponent will implement proposed Conservation Measures to minimize contaminants and debris from entering the water.

Salt Marsh Harvest Mouse

The Service concurs with the Corps' determination that the proposed project may affect but is not likely to adversely affect the mouse. The mouse is generally restricted to brackish and saline marshes but frequently uses terrestrial grassland habitats adjacent to marsh and grass-*Sarcocornia* ecotones (Geissel *et al*. 1988). Saltmarshes at both Heron's Head and Pier 94 could provide suitable habitat for the mouse, though the closest known observation of the mouse is approximately 6 miles northeast and across the San Francisco Bay at Radio Beach Shoreline. Construction activities will not occur in the saltmarshes where the mouse could occur and no *Sarcocornia* vegetation, the preferred habitat for the mouse, will be removed or degraded during construction activities.

California Seablite

The Service concurs with the Corps' determination that the proposed project may affect but is not likely to adversely affect the seablite. The seablite grows in a small, restricted area within the intertidal zone of salt marshes, which are present at Heron's Head Park and Pier 94. At both Heron's Head Park and Pier 94, reintroduction efforts occurred in 1999 and 2006, respectively. Post-construction monitoring surveys for the Heron's Head Shoreline Resilience Project in 2024 found 49 seablite plants across Heron's Head Park and at Pier 94, reproductive plants were present in 2020 and are presumed extant (Service 2023a). Construction activities will be avoided in saltmarshes where seablite is present, and no seablite plants will be removed or degraded during construction activities.

Marbled Murrelet

The Service concurs with the Corps' determination that the proposed project may affect but is not likely to adversely affect the murrelet. Murrelet nest in old-growth forest, preferably large unfragmented stands. The closest known breeding area for murrelets is south of San Francisco Bay in forested areas of the Santa Cruz Mountains (Felis *et al* 2022) and no suitable nesting habitat for the murrelet occurs in the project area. Murrelets primarily forage in marine waters, usually within 1.2 to 3 miles of shore, typically in waters less than 100 feet deep (Service 2023b). There has been an unconfirmed 2025 sighting of the murrelet off the ocean side of the City of San Francisco, according to e-Birds website: https://ebird.org/region/US-CA-075, approximately 7 miles away. If foraging murrelets are present, though unlikely, the Service assumes that any foraging murrelets are potentially habituated to existing noise and lighting disturbance from nearby urban and industrial areas, including existing vehicle, pedestrian, train, and pier traffic (commercial vessels, ferries, recreational boats, etc.), and existing construction and restoration projects. Additionally, any temporary impacts from emissions, fugitive dust, and turbidity are expected to be short in duration, not expected to rise above ambient conditions within the San Francisco Bay, and implantation of Conservation Measures will minimize contaminants and debris from entering the air and water.

REINITIATION—CLOSING STATEMENT

This concludes informal consultation on San Francisco Waterfront Coastal Flood Study Project. As provided in 50 CFR §402.16,

(a) Reinitiation of consultation is required and shall be requested by the Federal agency, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

(1) If the amount or extent of taking specified in the incidental take statement is exceeded;

(2) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or

(4) If a new species is listed or critical habitat designated that may be affected by the identified action.

(b) An agency shall not be required to reinitiate consultation after the approval of a land management plan prepared pursuant to 43 U.S.C. 1712 or 16 U.S.C. 1604 upon listing of a new species or designation of new critical habitat if the land management plan has been adopted by the agency as of the date of listing or designation, provided that any authorized actions that may affect the newly listed species or designated critical habitat

will be addressed through a separate action-specific consultation. This exception to reinitiation of consultation shall not apply to those land management plans prepared pursuant to 16 U.S.C. 1604 if:

(1) Fifteen years have passed since the date the agency adopted the land management plan prepared pursuant to 16 U.S.C. 1604; and

(2) Five years have passed since the enactment of Public Law 115-141 [March 23, 2018] or the date of the listing of a species or the designation of critical habitat, whichever is later.

Please address any questions or concerns regarding this response to Lauren Estenson, Fish and Wildlife Biologist, at lauren_estenson@fws.gov or, Stephanie Millsap, Assistant Field Supervisor; Watershed Planning Division, at stephanie_millsap@fws.gov. Please refer to the ECOSphere# 2022-0082557-S7 in any future correspondence regarding this concurrence.

Sincerely,

Heather Swinney
Deputy Field Supervisor

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

ANNEX D.6.4
NMFS CONDENSED BIOLOGICAL OPINION AND EFH CONCURRENCE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802

July 8, 2026 **Refer to NMFS No:** WCRO-2025-03024

Robert M Morrow, PMP
Chief, Environmental Branch
Southwest Regional Planning and Environmental Center
U.S. Department of the Army
Tulsa District, Corps of Engineers
2488 East 81st Street
Tulsa, Oklahoma 74137

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the San Francisco Waterfront Coastal Flood Study in the City and County of San Francisco, California

Dear Mr. Morrow:

This letter responds to your December 29, 2025, request for initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to Section 7 of the Endangered Species Act (ESA) and Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for the subject action.

We reviewed the U.S. Army Corps of Engineers' (Corps) consultation request and related initiation package. Where relevant, we have adopted the information and analyses you have provided and/or referenced only after our independent, science-based evaluation confirmed they meet our regulatory and scientific standards. In our biological opinion (opinion) below, we indicate what parts of your document we have incorporated by reference and where that information is being incorporated.

On December 29, 2025, NMFS received a letter from the Corps requesting formal consultation for this project, which included a biological assessment (BA). On January 12, 2026, NMFS requested clarification by email regarding the Corps' effects determinations to ensure the administrative record is accurate and aligns with the analysis required for the condensed biological opinion format. On January 13, 2026, the Corps responded by email with revisions to the effects determinations. The effects determinations were revised to "Likely to Adversely Affect" (LAA) all listed species in the action area, specifically adding Central Valley (CV) spring-run Chinook salmon (*Oncorhynchus tshawytscha*), CV steelhead (*O. mykiss*), and Central California Coast (CCC) steelhead to the LAA determination (previous LAA effects determinations were only for Sacramento winter-run Chinook and southern Distinct Population Segment (sDPS) of North American green sturgeon [*Acipenser medirostris*]). The Corps' effects determinations were also revised to LAA designated critical habitat of Sacramento River winter-

run Chinook salmon, CCC Steelhead, and sDPS green sturgeon. Additionally, the Corps clarified that the effects of project actions may adversely affect essential fish habitat (EFH) designated under the Pacific Salmon, Pacific Groundfish, and Coastal Pelagic Species Fishery Management Plans (FMPs). Sufficient information was received by NMFS to initiate consultation on January 13, 2026.

We used generative Google Gemini artificial intelligence (AI) to assist with the initial drafting of this biological opinion. All outputs from generative AI that were incorporated into the biological opinion were reviewed for accuracy by qualified staff members, and edited as necessary to ensure use of the best available scientific and commercial data. NMFS retains all responsibility for the content of this biological opinion.

On March 30, 2026, in *Center for Biological Diversity v. Burgum*, No. 24-cv-04651 (N.D. Cal.), the U.S. District Court for the Northern District of California vacated aspects of four provisions from the 50 CFR part 402 regulations governing interagency consultation under section 7 of the Endangered Species Act and reinstated the provisions that were previously in effect. Consistent with the Court's ruling, these are the governing provisions for this consultation:

> "*Destruction or adverse modification* means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features." (50 CFR 402.02 (2018)).
>
> "*Effects of the action* refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration."[1] (50 CFR 402.02 (2018)).
>
> 50 CFR 402.14(g)(8): "In formulating its biological opinion, any reasonable and prudent alternatives, and any reasonable and prudent measures, the Service will use the best

[1] This definition includes the second sentence of the definition of "effects of the action." That sentence provided the definition of "environmental baseline" in effect as of 2018. In the 2019 rule amending the 50 CFR part 402 regulations, the Services established "environmental baseline" as a stand-alone definition. 84 Fed. Reg. 44976, 45016 (August 27, 2019). In the 2024 rule, the Services made minor revisions to the "environmental baseline" definition. 89 Fed. Reg. 24268, 24298 (April 5, 2024). The Court's ruling did not touch upon that definition of "environmental baseline," and it, therefore, remains valid. The definition is also fully consistent with the definition of "effects of the action" from 2018.

> scientific and commercial data available and will give appropriate consideration to any beneficial actions taken by the Federal agency or applicant, including any actions taken prior to the initiation of consultation." (50 CFR 402.14(g)(8) (2018)).

50 CFR 402.16(a): "(a) Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and . . . ." (50 CFR 402.16(a) (2023)).

NMFS adopts the Project Description (Section 2) of the San Francisco Waterfront Coastal Flood Study Biological Assessment (BA; Corps 2025) and summarizes it below. This project consultation is limited to the "First Actions" of the feasibility study that address near-term sea level rise risks and have a 2030 to 2062 construction timeline. Due to the scale of the project, construction is expected to occur almost every year between 2030 and 2062, though the exact pace of construction for these First Actions is highly dependent on Congressional authorization, funding infusions, and beneficial sequencing. Additionally, while all in-water work is strictly limited to the established in-water work window (June 1 to November 30), terrestrial and out-of-water construction activities associated with the First Actions will occur year-round outside of this window. Second Actions may be executed if monitoring confirms that sea-level rise has reached pre-defined thresholds, and are not included in this consultation. Second Actions will not depend on the completion of the First Actions, nor do the First Actions depend on the Second Actions to function (i.e., First Actions are evaluated as having independent utility and stand alone in their flood risk management purpose). Following this current feasibility study, the project must move through the Preconstruction Engineering and Design (PED) phase, which is expected to start in several years, before construction begins.

The project (i.e., First Actions) manages coastal flood risk through a suite of structural (e.g., wharfs, seawalls, floodwalls, levees) and non-structural (e.g., floodproofing, retreat, building demolition) measures that will function as a system and are implemented over time, based on the risk of rising sea levels. The project proposes shoreline stabilization through the repair, replacement, or elevation of existing hardened shoreline. The project involves the reconstruction of approximately 21,000 linear feet (LF) of seawalls, raising the elevation of approximately 11,500 LF (24 acres) of shoreline, and stabilizing approximately 1,800 LF (2 acres) of paved levees. Additionally, the project includes the construction of approximately 1,000 LF of vertical floodwalls (T-Walls). Overwater structure work includes the replacement of bulkhead wharves (Reaches 2, 3, and 4) with elevated, reinforced structures comprising approximately 660,000 square feet (approximately 15 acres) of wharf reconstruction. As part of the proposed action, 27 acres of EWN features are integrated in the project design to minimize anticipated ecological impacts. These Engineering With Nature (EWN) features include approximately 11,800 LF (20 acres) of planted levees (transition zone habitat), approximately 5 acres of marsh/beach restoration (intertidal/shallow water refugia), and approximately 2 acres of rocky intertidal bluff (high-complexity substrate).

Pile driving will be required for the installation of deep foundations for T-walls, seawalls, and wharves. Pile driving will be restricted to the work window of June 1 to November 30 and is limited to daytime hours. Construction will also require dewatering and fish relocation through the use of temporary cofferdams and dewatering segments of various lengths along the shoreline,

extending up to approximately 1,000 linear feet. It is possible that cofferdams may need to be constructed along a significant portion of the seawall construction. Cofferdams will be installed in segments of approximately 50 linear feet (variable) at a time to manage the construction footprint, and dewatered segments may include several contiguous cofferdams. For example, a dewatered segment of shoreline may require a span of 250 linear ft of cofferdam to build a project structure, and that it would be constructed in approximately 50-foot segments across that 250 linear feet of shoreline.

The following avoidance and minimization measures will be implemented during cofferdam and dewatering construction:

- Fish Rescue and Salvage: Operations will be conducted prior to and during the dewatering process to prevent fish entrapment and entrainment.
- Cofferdam Open-Side Construction: The cofferdam will be constructed leaving one section of the wall open to facilitate fish removal. At the lowest tide near the end of installation, the area between the containment wall and the seawall will be swept with block nets or beach seines (two to three passes) to push fish out through the opening. The final section of the cofferdam will only be installed after this initial fish removal has occurred. Once the final section is installed, and again during the lowest possible tide, block nets will be used to section off smaller areas behind the containment wall for further fish rescue before dewatering. A qualified fish biologist will be onsite during this entire dewatering process to minimize entrapment.
- Screened Intakes: Dewatering pump intakes will be screened according to National Marine Fisheries Service (NMFS) criteria to prevent the entrainment of fish.
- Qualified Personnel: A qualified fish biologist or rescue team will be onsite during dewatering to minimize fish trapping or impingement on screens and nets.
- Environmental Work Window: To avoid sensitive periods, all in-water construction, including cofferdam activities, will be restricted to the period between June 1 and November 30.
- Dewatering Plan: A specific plan detailing equipment, locations, and discharge points will be submitted as part of the Stormwater Pollution Prevention Plan (SWPPP).
- Standard construction best management practices (BMPs) to avoid and minimize environmental impacts to aquatic resources, including turbidity monitoring during construction.

BIOLOGICAL OPINION

We examined the status of each species that would be adversely affected by the proposed action to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. We also examined the condition of critical habitat throughout the designated area and discuss the function of the physical or biological features essential to the conservation of the species that create the conservation value of that habitat.

NMFS adopts the Status of the Species and Critical Habitat (Section 4), and summarizes it below, supplemented by the best available scientific data from NMFS recovery plans and 5-year status reviews. This biological opinion considers the effects of the proposed action on

endangered Sacramento River winter-run Chinook salmon and their designated critical habitat; threatened Central Valley spring-run Chinook salmon; threatened California Central Valley steelhead; threatened Central California Coast steelhead and their designated critical habitat; and the threatened southern distinct population segment (sDPS) of North American green sturgeon and their designated critical habitat.

The life histories, population dynamics, and current biological status of these species are influenced by habitat degradation, altered hydrologic regimes, and the extensive modification of estuarine shorelines. Comprehensive details regarding the status of these populations, their historical abundance, and the specific physical and biological features (PBFs) essential for their conservation are detailed in their respective NMFS recovery plans and 5-year status reviews (NMFS 2012, NMFS 2014, NMFS 2016; NMFS 2016a; NMFS 2018; NMFS 2021; NMFS 2023; NMFS 2024; NMFS 2024a; NMFS 2024b), which are incorporated herein by reference.

"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). NMFS adopts the Action Area (Section 3) of the BA (Corps 2025). The action area is defined by the spatial extent of the project's physical and chemical effects, spanning approximately 7.5 miles of the San Francisco waterfront. This area encompasses the construction footprint (e.g., seawalls, wharves, ground improvements) and extends into the water column to the limits of hydroacoustic impacts and turbidity plumes. The physical environment is characterized by a highly urbanized shoreline composed of man-made structures such as piers, wharves, and seawalls, with deep water depths adjacent to the edge of the fill. Water quality is influenced by tidal circulation and seasonal urban runoff. The action area encompasses the direct construction footprint along the San Francisco waterfront. However, because the extent of physical and biological effects exceeds the immediate construction footprint, the action area also includes:

- the geographic boundaries of all proposed aquatic and riparian habitat modifications, including EWN features designed to minimize anticipated ecological impacts;

- the underwater acoustic footprint extending into the San Francisco Bay to the point where pile driving and construction noise attenuates below established thresholds for physical injury and behavioral disturbance for listed fish species; and

- the spatial extent of water quality degradation, specifically the maximum tidal excursion of temporary turbidity plumes generated during in-water structural modifications and shoreline armoring.

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that

are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

NMFS adopts the Environmental Baseline (Section 5) from the BA (Corps 2025) and summarizes it below. The action area is situated along the San Francisco waterfront, a heavily urbanized interface between the city and the San Francisco Bay. The baseline condition of the aquatic habitat is significantly altered by over a century of development, including the construction of seawalls, piers, and wharves. These man-made structures dominate the shoreline, resulting in a scarcity of natural intertidal vegetation, shallow water refugia, and floodplain connectivity. Water quality within the action area is influenced by tidal exchange with the Pacific Ocean but is degraded by urban runoff, legacy contaminants, and disturbance and turbidity associated with maritime activities. Despite these stressors, the action area functions as a vital migratory corridor and rearing area for adult and juvenile salmonids and green sturgeon transiting between the Sacramento-San Joaquin River Delta and the Pacific Ocean. Juvenile salmonids and green sturgeon use the area for rearing and foraging, although the quality of this habitat is limited by the lack of natural shoreline habitat complexity and cover. Consequently, the existing shoreline infrastructure directly influences the current survival, growth, and migration success of these listed populations within the action area. Designated critical habitat for Sacramento River winter-run Chinook salmon, CCC steelhead, and sDPS green sturgeon is present, with PBFs including migratory corridors, water quality, and sediment quality.

NMFS adopts the Effects Analysis (Section 6) of the BA (Corps 2025). Specifically, NMFS adopts the assessment of effects related to turbidity, chemical contamination (including creosote-treated pile removal), and visual disturbance during construction activities. The BA adequately demonstrates that these stressors will be localized, transient, and effectively minimized by Best Management Practices (BMPs). Post-construction NMFS adopts the assessment of effects related to water quality, including permanent removal of old creosote-treated wood piles, and upland development impacts including stormwater management. NMFS supplements the effects analysis for hydroacoustic impacts, fish capture/relocation, and permanent habitat alteration below to evaluate the extent of incidental take and effects to critical habitat PBFs.

The proposed installation of wharf structures and T-walls requires the impact driving of piles. NMFS adopts the hydroacoustic analyses in the BA for wood, concrete, and steel piles ranging from 12-inch to 24-inch piles, including driving the cofferdam sheet piles (BA Section 4.1.7). While 24-inch octagonal concrete and steel piles are the primary method proposed, the project description (BA Section 2.3.4) indicates that 36-inch steel pipe piles may be required for T-wall foundations in areas of high seismic load or deep bedrock. This represents the worst-case scenario for hydroacoustic impacts, as larger steel piles generate significantly higher intensity underwater sound pressure waves that propagate further through the aquatic environment. NMFS uses the dual-metric criteria established by the Fisheries Hydroacoustic Working Group (FHWG 2008) to evaluate the potential for injury and behavioral effects. The onset of physical injury is expected if peak sound pressure levels (SPL) exceed 206 dB (re: 1 µPa) or if the cumulative sound exposure level (SEL) exceeds 187 dB (re: 1 $\mu Pa^2 \cdot sec$) for fish greater than 2 grams and 183 dB (re: 1 $\mu Pa^2 \cdot sec$) for fish less than 2 grams (FHWG 2008). The threshold for behavioral disruption (harassment) is 150 dB RMS (re: 1 µPa).

Based on compendium data (Molnar et al. 2020), impact driving of 36-inch steel pipe piles typically generates the following at 10 meters from the sound source unattenuated: single-strike peak sound pressure levels (SPL) of up to 213 dB (re: 1 µPa); single-strike SEL up to 185 dB (re: 1 $\mu Pa^2 \cdot sec$); and RMS SPL up to 193 dB (re: 1 µPa). The project incorporates bubble curtains, a best management practice (BMP) expected to provide 5 dB to 10 dB of attenuation depending on conditions. Given that pile driving operations typically involve hundreds to thousands of strikes per day, the worst case scenario of 20 piles per day and up to 5,000 strikes per pile in open water wet conditions will be assumed. Under these worst-case conditions, the zone of injury for pile driving will expand significantly during sustained operations; with peak pressure impacts extending approximately 13.6 meters from the source and cSEL extending approximately 1,000 meters from the source for fish over and under 2 grams. The 150 dB RMS behavioral threshold will be exceeded over a radius extending approximately 3,415 meters into the open water of the Bay.

The in-water work window (June 1 – November 30) minimizes overlap with the primary migration season of juvenile salmonids. However, the San Francisco Estuary serves as a critical rearing environment where juvenile fish monitoring demonstrates complex, extended estuarine use (Speegle et al. 2013). Extended estuarine rearing is strongly linked to the long-term survivorship of juvenile Chinook salmon (Sturrock et al. 2015). Furthermore, sDPS green sturgeon are present in the San Francisco Bay estuary year-round for rearing and foraging. As benthic foragers, green sturgeon are more likely to be in close proximity to the T-wall and wharf foundations where pile driving occurs. Individuals present within the expanded zone of injury during impact driving of 36-inch piles are reasonably certain to experience physical injury (auditory tissue damage, barotrauma) or severe behavioral disruption (abandonment of foraging habitat) despite the use of bubble curtains. NMFS concludes that incidental take in the form of harassment and injury is reasonably certain to occur, particularly to sDPS green sturgeon and rearing juvenile salmonids.

To facilitate the reconstruction of 21,000 linear feet of seawall, the applicant must isolate and dewater work zones using cofferdams. To prevent lethal stranding of fish within these dewatered zones, the applicant proposes to capture and relocate fish. The act of capturing ESA-listed species constitutes "take" (capture/collect) under Section 9 of the ESA. While relocation is a minimization measure intended to reduce mortality, the capture process itself results in stress and potential injury. NMFS generally assumes a capture-related mortality rate of 3-percent or less when operations are conducted by qualified biologists using standard methods. For this project, the overall 3-percent mortality threshold is broken down into two specific categories: dewatering and stranding mortality (less than 1-percent) and capture and relocation mortality (less than 2-percent). This 2-percent capture mortality limit functions as a conservative biological buffer against environmental stochasticity; actual observed handling mortality historically averages between 0.2 percent and 0.6 percent, as demonstrated by comprehensive analyses of Humboldt County relocation data (Collins 2004) and supported by extensive California Department of Fish and Wildlife (CDFW) Fisheries Restoration Grant Program (FRGP) annual monitoring reports (CDFW 2014, 2015, 2016, 2017, 2018, 2019). Further, a NMFS (2012a) review of all FRGP annual monitoring reports of dewatering and relocation activities for 99 projects across 8 years showed less than 1-percent of relocated steelhead perished. NMFS will apply a bifurcated take approach for this phase, establishing a physical surrogate for unobservable stranding

mortality and a direct 3-percent maximum lethal take limit for all listed fish captured and handled.

The placement of cofferdams will enclose waters that may contain green sturgeon and to a lesser extent rearing juvenile salmonids. NMFS expects that less than 1-percent of the listed fish within the enclosed area will evade capture, remain in the dewatered zone, and die (dewatering and stranding mortality). As water recedes within the cofferdam, uncaptured fish become trapped in shallow, cohesive mud depressions where they rapidly succumb to asphyxiation due to hyper-turbidity (suspended sediment clogging their gill lamellae) before actual desiccation occurs. This stranding mechanism is particularly hazardous for sDPS green sturgeon; their obligate benthic morphology, heavy armor, and cryptic coloration make them virtually invisible in hyper-turbid, cohesive estuarine muds, drastically increasing their risk of undetected stranding and asphyxiation during visual salvage sweeps.

NMFS expects less than 2-percent mortality to occur directly from the capture, handling, and relocation activities, inclusive of secondary and delayed effects (capture and relocation mortality). Capture methods (seines, dip nets) and handling induce physiological stress (cortisol production) and physical injury (scale loss, mucus layer abrasion) which can lead to delayed mortality or increased susceptibility to disease/predation. Specifically, scale loss and epidermal abrasion during estuarine seining lead to sudden, massive osmotic shock and rapid hemoconcentration as juvenile salmonids transition to hypoosmotic regulators. Relocating stressed and disoriented fish back into the constrained, highly modified San Francisco waterfront could create highly exploitable targets, potentially triggering opportunistic feeding by avian and piscine predators (i.e., post-release predation). Restricting activities to the work window minimizes the density of listed species present. However, given the massive linear extent of the seawall work (21,000 LF), the probability of encountering and handling listed individuals is high. NMFS concludes that take in the form of capture, harassment, and lethal injury (associated with capture mortality) is reasonably certain to occur. While quantifying the total number of individuals lost to unobservable stranding is not practicable (requiring the 21,000 LF surrogate), it is practicable to monitor and quantify the direct mortality of listed individuals that are actively captured and handled.

Quantifying the exact number of individual fish that will be harassed, injured, or killed is not practicable. Listed salmonids and green sturgeon in the San Francisco Bay are highly migratory, widely dispersed, and remain almost entirely submerged. Their presence and densities in the action area fluctuate dynamically based on tides, seasonal migrations, and complex environmental variables. Individuals that suffer injury or mortality - whether from hydroacoustic barotrauma or capture stress - are highly unlikely to be observed by biological monitors; incapacitated or dead fish typically sink to the benthic substrate, are swept away by strong tidal currents, or are rapidly consumed by avian and aquatic scavengers. Because it is biologically and physically impracticable to quantify the absolute number of individuals taken, NMFS relies on causal ecological surrogates to establish the extent of anticipated take, consistent with 50 CFR 402.14(i)(1)(i). Therefore, NMFS defines the extent of take using a causal surrogate: 21,000 linear ft of seawall for the associated fish capture; the installation of 660,000 square feet (approximately 15 acres) of wharf and associated 1,000 linear feet of T-wall during the June 1 to November 30 window. This wharf and T-wall surrogate is causally linked to the take because the

acoustic energy and the size of the injury zone are directly proportional to the pile size and number of strikes. Exceeding this length, using piles larger than 36 inches, or driving outside the window may exceed the analyzed extent of take.

The project will result in the permanent loss of approximately 9 acres of benthic and water column habitat due to the expansion of seawalls, bulkheads, and the installation of new piles. This constitutes a permanent modification of designated critical habitat PBFs, specifically those related to migratory corridors and rearing habitat (e.g., water quality, forage, and free passage). Estuarine shoreline stabilization replaces natural, gently sloping soft-bottom mudflats and shallow subtidal zones with featureless, vertical concrete and steel structures, triggering a cascade of adverse ecological effects (Munsch et al. 2017; Gittman et al. 2016). First, it permanently eliminates the dense benthic invertebrate communities (e.g., polychaete worms, amphipods, bivalves) that form the base of the food web, directly reducing the carrying capacity of the action area for rearing juvenile salmonids and foraging green sturgeon. Second, rigid, vertical armoring increases reflected wave energy and alters nearshore hydrodynamics. This wave reflection scours adjacent soft-bottom habitats, coarsening the substrate and creating high-energy conditions that suppress the future establishment and expansion of Submerged Aquatic Vegetation (SAV). While current surveys indicate eelgrass (*Zostera marina*) presence in the immediate project footprint is extremely limited (BA; less than 0.5 acres) and direct construction impacts to known beds are avoided, the permanent hardening of the shoreline precludes the shallow-water recovery of these vital habitats within the action area.

Furthermore, expanding traditional seawalls creates structurally uniform, deeper-water corridors that lack the microtopography and shallow-water refugia of natural shorelines. This habitat simplification excludes smaller juvenile salmonids from preferred nearshore resting areas and exposes them to easily exploited predator corridors, thereby increasing juvenile mortality (Munsch et al. 2015; Simenstad et al. 1982). Finally, the installation of these structures perpetuates the existing severance of the aquatic-terrestrial link. By maintaining a rigid, concrete boundary devoid of overhanging or nearby riparian vegetation, the project ensures the continued loss of terrestrial insect subsidies, which are a high-energy forage requirement for outmigrating salmon smolts (Morley et al. 2012).

The BA proposes that reconstructing the wharf within its existing footprint maintains the current environmental baseline and results in no new adverse effects. While we recognize this approach, NMFS must evaluate the temporal scope of the new action under the ESA. Replacing an aging structure with a new long-term design life does not maintain a static baseline; rather, it authorizes a new, half-century or more duration of shading impacts that would otherwise cease if the structure were allowed to retire. Because this new authorization ensures a localized habitat deficit for approximately a half-century (depending on build and conditions), it constitutes an ongoing, project-caused ecological impact. We must therefore evaluate this extended degradation of habitat function as an adverse effect to the designated critical habitat.

The perpetual shading generated by solid overwater structures severely attenuates ambient Photosynthetically Active Radiation (PAR), actively suppressing the photosynthetic capacity of submerged aquatic vegetation, microphytobenthos, and benthic macroalgal assemblages. This extreme light limitation shifts the under-pier environment from a highly productive autotrophic

system to a degraded heterotrophic state. This localized collapse in primary production structurally degrades the benthic invertebrate community, driving a significant reduction in the density and diversity of epibenthic crustaceans (e.g., copepods, amphipods) that form the critical prey base for rearing salmonids and sturgeon (Haas et al. 2002; Munsch et al. 2014). By fundamentally altering the prey assemblage, the overwater footprint directly deprives these listed species of essential bioenergetic resources required for estuarine growth and survival (Nightingale & Simenstad 2001; Whitcraft & Levin 2007).

The sharp light-dark interfaces created by a continuous overwater footprint manufacture artificial predator ambush zones and disrupt essential migratory behaviors. Outmigrating juvenile Chinook salmon and steelhead exhibit various life history diversity, including shoreline-oriented dependencies, relying on shallow, well-lit nearshore corridors for both foraging and refuge. When confronted with the stark shadow of a large overwater structure, juveniles frequently exhibit avoidance behavior, pausing or milling at the light-dark transition (Toft et al. 2007). This delayed migration increases their exposure time in the estuary. To bypass the structure, juveniles are often forced to deviate from the protective shallow littoral zone into deeper, pelagic waters, disproportionately increasing their vulnerability to larger visual piscivores holding in the shaded ambush ecotones (WDFW 2006; Tabor et al. 2011; Ono et al. 2014; Munsch et al. 2017). To prevent this long-term habitat degradation from constituting perpetual adverse effects, the degradation of physical and biological features (PBFs) caused by traditional seawalls and overwater structures can be substantially reduced through integrated structural design. Combining light-penetrating surfaces (LPS) in overhanging structures with the creation of structurally complex, shallow-water habitat (such as elevated intertidal benches) at the base of the seawall generates PBFs that support foraging and refuge for migrating juvenile salmonids. Increasing under-structure light penetration and targeting at least 5-percent Photosynthetically Active Radiation (PAR) at a 1-meter depth, in conjunction with shallow textured substrates, is required to shift juvenile salmon behavior from shade-avoidance to active foraging, thereby minimizing take from starvation, predation, and delayed migration (Sawyer et al. 2020).

Additionally, new overwater structures and piles create artificial perches that unnaturally inflate avian predation rates on listed salmonids. Terns, cormorants, gulls, and other avian species target salmonids and predation rates vary depending on salmonid estuary residency times. Predation on salmonids occurs inland and population impacts can peak sharply in coastal estuaries where out-migrating smolts bottleneck (Hostetter et al. 2023).

Interrelated and interdependent actions associated with the proposed 15-acre wharf reconstruction include the expansion and operation of adjacent upland parking facilities. These newly created impervious surfaces will concentrate vehicular hydrocarbons, heavy metals, and other toxic urban constituents. In the absence of requisite biofiltration mechanisms, stormwater runoff will transport these pollutants directly into the estuarine environment. This degradation of critical habitat water quality impairs the osmoregulatory capacity of outmigrating juvenile salmonids and delays their critical marine transition phases (Wilber & Clarke 2001).

Beyond standard legacy pollutants, the interrelated expansion of parking and staging facilities introduces high volumes of tire wear particles to the upland footprint. During precipitation events, these particles release 6PPD-quinone (6PPD-q) - an ozonation product of the ubiquitous

tire antioxidant 6PPD - which is subsequently conveyed via untreated stormwater into the estuary. 6PPD-q exhibits extreme acute toxicity to anadromous salmonids. Exposure to environmentally relevant concentrations of 6PPD-q induces rapid physiological impairment, including acute respiratory distress, loss of equilibrium, and mortality, commonly characterized as urban runoff mortality syndrome. Even at sublethal exposure thresholds, 6PPD-q severely compromises the cardiovascular and osmoregulatory capacity of outmigrating Chinook salmon and steelhead, directly degrading their biological viability and diminishing the functional carrying capacity of the designated critical habitat (Tian et al. 2021; Tian et al. 2022; Brinkmann et al. 2022).

The elevated maritime traffic and vessel staging interrelated with the wharf's operation significantly increase the probability of localized petroleum spills and chronic polycyclic aromatic hydrocarbon (PAH) leakage into the aquatic environment. The introduction of these PAHs precipitates acute and chronic toxicity within epibenthic prey assemblages, driving trophic disruption and diminishing the functional prey base essential to rearing anadromous species (Peterson et al. 2003). For listed salmonids and sDPS green sturgeon, this reduction in prey availability causes a direct loss of bioenergetic capacity and essential energy derived from food (MacFarlane 2010; Borin et al. 2017). Concurrently, even sublethal PAH exposure from these interdependent maritime sources induces cardiotoxicity and directly impairs the physiological fitness of rearing individuals, appreciably diminishing the conservation value of the designated critical habitat for these species (Incardona et al. 2015).

To minimize the severity of these impacts, the BA incorporates the creation of 27 acres of nature-based EWN features—such as living seawalls and intertidal rocky benches—directly into the project description. Global analyses confirm that adding structural complexity to marine artificial structures can significantly enhance local biodiversity and ecological function when compared to traditional, featureless seawalls (Strain et al. 2021). These structurally complex features provide essential micro-habitats that offer listed species vital refuge from predators and high-velocity currents, while also promoting the colonization of benthic invertebrate prey. Recognizing these functional improvements within the highly urbanized estuarine corridor, the Corps proposed integration of these 27 acres as essential minimization measures to reduce the biological intensity of the permanent habitat alteration for this consultation. However, while the proposed project includes a commitment to the 27-acre spatial target of these EWN features, the specific functional design standards and engineering specifications for these features have not yet been developed.

“Cumulative effects” are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Given the highly urbanized nature of the San Francisco waterfront, reasonably certain future non-Federal actions within the action area include ongoing commercial and recreational vessel traffic, private marine facility maintenance, urban stormwater runoff from the City and County of San Francisco, and continuous non-Federal shoreline development and redevelopment

projects. These activities will likely continue to contribute to baseline stressors such as degraded water quality (e.g., introduction of pollutants and suspended sediments), ambient underwater noise, and artificial shading of benthic habitats. While these state and private activities will exert ongoing pressures on listed anadromous species and PBFs of their designated critical habitat, NMFS is not currently aware of any specific future non-Federal activities that would significantly alter the current environmental trajectory or biological conditions of the action area beyond what is already captured in the Environmental Baseline.

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action to the environmental baseline and the cumulative effects, taking into account the status of the species and critical habitat, to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat for the conservation of the species.

ESA-listed Central Valley spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, California Central Valley steelhead, Central California Coast steelhead, and sDPS green sturgeon use the action area as an essential migratory corridor and rearing environmentNearly all outmigrating anadromous populations from the Sacramento-San Joaquin River Delta and San Francisco Bay must navigate this specific corridor to reach the Pacific Ocean. Outmigrating juvenile salmonids are shoreline-oriented, meaning they naturally hug the coastlines and rely on shallow, well-lit nearshore waters for foraging and refuge from larger predators. When they travel along the western edge of the Bay, they are forced to navigate the heavily armored, unnaturally deep, and heavily shaded environment of the San Francisco waterfront. Because they cannot easily bypass this long stretch of infrastructure without moving into deeper, more dangerous pelagic waters, the waterfront funnels them through a highly degraded, predator-heavy area. Similarly, because green sturgeon are obligate benthic foragers (i.e., bottom feeding), the severe habitat degradation of the waterfront—specifically the removal of natural mudflats, the driving of deep piles, and the creation of hard armoring detailed in the analysis—acts as a significant biological and geographic bottleneck for their foraging and migration. As described in the Environmental Baseline, these populations are already subject to significant stress from the highly degraded, urbanized nature of the estuary. The historic transition from natural tidal marshes to a rigid, engineered shoreline characterized by extensive armoring, loss of shallow-water benthic habitat, and artificial shading has fundamentally altered the biological carrying capacity of the area. Existing overwater structures create unnatural lighting gradients and ambush points for piscine and avian predators, while heavy marine traffic contributes to chronic ambient noise and persistent water quality degradation.

During project implementation, listed species will be exposed to multiple short-term construction stressors. Impact pile driving will generate intense hydroacoustic energy capable of causing physical injury, such as swim bladder rupture and internal hemorrhaging (barotrauma), as well as severe behavioral disruption. Because sound propagates highly efficiently through the water column, these expanding acoustic impact zones are expected to affect a wide area of the estuary, potentially deterring fish from using preferred migratory routes or foraging grounds.

Additionally, the isolation of work zones behind cofferdams will necessitate extensive fish rescue and relocation efforts. While intended to minimize lethal stranding, capturing trapped individuals with seines and dip nets unavoidably subjects them to handling stress, scale loss, disruption of the protective mucus layer, and osmoregulatory shock, carrying a minor but cumulative risk of delayed capture-related mortality. While the strict adherence to an in-water work window (June 1 – November 30) will successfully avoid the peak outmigration periods of juvenile salmonids, sDPS green sturgeon and those extended-rearing juvenile salmonids that remain in the estuary year-round will inevitably experience these adverse effects. Furthermore, the resuspension of benthic sediments will create localized turbidity plumes, resulting in small, temporary reductions in visual foraging efficiency, which can force juveniles to expend vital energy reserves just prior to ocean entry.

In the long term, the proposed seawall structural modifications and massive wharf installations will result in the permanent alteration and loss of approximately 9 acres of benthic and water column habitat. This constitutes an adverse effect to the physical and biological features of designated critical habitat, permanently removing natural substrate and replacing it with concrete and steel, thereby diminishing local forage production and removing shallow-water refugia, and perpetuating a rigid corridor susceptible to high predation. Additionally, post-construction effects include stormwater impacts and vessel operation, staging, and anchoring impacts. The physical impacts of vessel grounding and anchor chain scour on benthic habitats are minimized by strict mooring protocols (minimum hull clearances and midline floats). Regarding stormwater runoff, constructed parking and staging facilities are likely to result in urban stormwater contaminants entering adjacent waters, including 6PPD-q. Urban stormwater runoff is an environmental baseline stressor and categorized as a cumulative effect (BA), originating from existing city streets and tire wear.

The project’s long-term impacts are minimized by the project's proposed integration of 27 acres of structurally complex, nature-based EWN features. Rather than standard featureless concrete, these (EWN) features—such as textured living seawalls and interspersed intertidal rocky benches—are specifically engineered to enhance ecological function by restoring the microtopography and complexity that traditional armoring destroys. They provide critical micro-habitats that serve as velocity refugia from high tidal currents and physical cover from predators. Furthermore, the textured surfaces promote rapid colonization by algae and benthic macroinvertebrates, restoring the localized prey base and supporting the functional capacity of the corridor.

When considering the degraded environmental baseline, the already vulnerable status of the listed species, and the anticipated cumulative effects of ongoing state and private actions, the temporary construction-related mortality and permanent habitat alterations (as minimized by EWN features) are not expected to appreciably alter population-level trends. Although a small number of individual fish may be injured or killed as a result of hydroacoustic exposure or relocation stress, this loss will be a minute fraction of the overall populations and will not disrupt Viable Salmonid Population (VSP) parameters such as spatial structure, diversity, abundance, and productivity. Because in-water construction is strictly limited to the June 1 to November 30 work window, the project avoids the peak outmigration pulses of listed juvenile salmonids, exposing only a highly localized subset of the annual cohort to acute acoustic or relocation

stressors each year. Furthermore, the annual capture and relocation mortality maximum is 3 percent, ensuring that direct removals will not suppress the abundance or productivity VSP parameters. Additionally, because the action area functions exclusively as a migratory corridor and rearing environment, no spawning or breeding habitats will be blocked or destroyed during or post-construction. Therefore, the physical capacity for these listed populations to reproduce in their natal streams remains completely unaffected by the 32-year construction timeline and habitat conditions post-construction. For these reasons, the anticipated level of take and habitat modification will not appreciably reduce the reproduction, numbers, or distribution of the affected populations. Therefore, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Central Valley spring-run Chinook salmon, California Central Valley steelhead, Central California Coast steelhead, or Sacramento River winter-run Chinook salmon, nor is it likely to destroy or adversely modify designated critical habitat for Sacramento River winter-run Chinook salmon, Central California Coast steelhead, and sDPS green sturgeon.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

> NMFS anticipates that incidental take of Central Valley spring-run Chinook salmon, California Central Valley steelhead, Central California Coast steelhead, or Sacramento River winter-run Chinook salmon will occur in the form of capture, injury, and mortality associated with hydroacoustic impacts and fish rescue/relocation activities during construction. Additionally, take in the form of harm is anticipated from the permanent installation and reconstruction of overwater structures and seawalls, which severely degrade benthic foraging habitats, create artificial predator ambush zones, and disrupt nearshore migratory corridors. Specifically, impact pile driving will result in barotrauma, temporary and permanent

threshold shifts in hearing, and behavioral harassment that forces fish to abandon critical foraging areas within the San Francisco Bay estuary.

The estuarine environment of the action area is characterized by naturally high turbidity, strong tidal flushing, and a robust community of aquatic and avian scavengers. If a juvenile salmonid or green sturgeon is lethally injured by acoustic trauma, succumbs to delayed handling mortality, or is harmed by the effects of the overwater structures or seawalls, the carcass will likely sink, be swept away by tidal currents, or be rapidly consumed before a biological monitor could accurately observe and tally the loss. Consequently, setting a numerical take limit would provide an unenforceable and biologically meaningless threshold for reinitiation. Because it is not practicable to quantify the absolute number of individual fish that will be taken due to their dynamic estuarine movement and low detection probabilities, NMFS defines the extent of take using causal ecological surrogates, consistent with 50 CFR 402.14(i)(1)(i). Therefore, NMFS establishes the extent of incidental take using measurable physical parameters of the project footprint that share a direct, proportional relationship with the amount of harm inflicted on the species:

Hydroacoustic Take Surrogate: The installation of 660,000 square feet of wharf and the associated 1,000 linear feet of T-wall during the established in-water work window (June 1 to November 30), using piles no larger than 36 inches in diameter. This surrogate is causally linked to the take because the total area of infrastructure built dictates the number of piles required, which in turn defines the total duration and intensity of acoustic energy introduced into the marine environment. Furthermore, pile diameter directly drives the peak sound pressure levels; utilizing a pile larger than 36 inches would expand the acoustic zone of injury beyond the modeled 1,000-meter cSEL radius. If the constructed area or linear feet exceed these dimensions, or if piles larger than 36 inches are driven, the authorized extent of take will be exceeded. Incidental take is exceeded if acoustic monitoring demonstrates that the cumulative Sound Exposure Level (cSEL) thresholds of 187 dB (for fish greater than 2 grams) and 183 dB (for fish less than 2 grams) are exceeded outside of the modeled, attenuated injury zones.

Permanent Habitat Alteration Surrogate: The installation and reconstruction of up to 660,000 square feet of overwater structures (wharves, piers) and the hardening/reconstruction of up to 21,000 linear feet of seawall. This surrogate is causally linked to the take because the total footprint of shading and vertical armoring dictates the magnitude of biological function lost, the extent of predator ambush zones created, and the subsequent severity of starvation and predation risk for listed species. Take associated with these permanent habitat alterations is expected to occur almost every year during construction and annually post-construction for as long as the structures exist. While persistent, the amount of take in any single year is expected to be localized and low. If the constructed area or linear feet exceed these dimensions, the extent of incidental take will be exceeded.

To address the fish rescue and relocation activities, this Incidental Take Statement employs a bifurcated approach. While it is not practicable to quantify the less than 1-percent stranding mortality of fish that evade capture and die hidden in the mud or hyper-turbid water, it is

practicable to directly observe and quantify the mortality of fish actively captured, handled, and relocated by biological monitors.

Dewatering/Stranding Surrogate (Unobservable Take): The dewatering of cofferdams associated with up to 21,000 linear feet of seawall reconstruction. This surrogate is logically related to the unobservable take because the linear extent of the cofferdam array serves as a reliable proxy for the total volume of estuarine water physically isolated by the barriers. A larger volume of enclosed water proportionally increases the probability of entrapping listed species that evade capture. If the total linear extent of seawall reconstructed using dewatered cofferdams exceeds 21,000 linear feet, the extent of incidental take for unobservable stranding will be exceeded.

Capture and Relocation Limit (Observable Take): NMFS expects a maximum annual lethal take (mortality) of 2-percent of the total number of listed individuals successfully captured and handled during the fish rescue operations. This direct, numerical limit provides a firm regulatory ceiling that accommodates the expected 2-percent mortality rate. If biological monitors observe a capture-related annual mortality rate exceeding 2 percent of the captured listed fish species, the limit for observable incidental take is exceeded.

Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species listed above or the destruction or adverse modification of their critical habitat.

Reasonable and Prudent Measures

"Reasonable and prudent measures" refer to those actions the Director considers necessary or appropriate to minimize the impact of the incidental take on the species (50 CFR 402.02).

1. Minimize hydroacoustic impacts to listed species during in-water construction.

2. Minimize injury and mortality associated with cofferdam installation, dewatering, and fish rescue/relocation operations.

3. Minimize take in the form of predation, habitat displacement, and water quality degradation associated with permanent overwater structures, shoreline hardening, construction vessel operations, and pile removal.

4. Implement comprehensive monitoring and reporting to ensure the extent of incidental take is not exceeded, construction remains within the authorized temporal bounds of the consultation, and nature-based EWN features successfully provide the expected minimization of habitat effects.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:

    a. To attenuate sound pressure waves, the Corps must require the use of a properly functioning bubble curtain during all impact driving in open water of 18-inch diameter steel pipe piles and greater. To ensure effectiveness, the bubble curtain must adhere to the following design and operational specifications:
        i. The bubble curtain must distribute air bubbles around 100 percent of the pile perimeter for the full depth of the water column.
        ii. The lowest bubble ring must be in continuous contact with the mudline for its full circumference.
        iii. The bubble curtain system must be activated and functioning fully for at least two minutes before any impact pile driving begins.
        iv. In areas where water velocities exceed 1.6 feet per second (0.5 meters per second), the Corps must utilize a confined bubble curtain (e.g., enclosed by a fabric sleeve or casing) to prevent the bubble field from being swept away from the pile.
    b. The Corps must require the use of a sound-attenuating cushion block (e.g., a minimum 6-inch-thick wood cushion, or equivalent polymer/nylon material) placed between the pile and the impact hammer during all impact driving.
    c. The Corps must require that all impact pile driving activities be restricted to daylight hours only to provide a continuous 12-hour period each day between pile driving activities.
    d. The Corps must ensure that real-time hydroacoustic monitoring is implemented during the initial driving of 36-inch steel pipe piles to empirically verify that the bubble curtain effectively attenuates acoustic energy below the mass-stratified cSEL thresholds of 187 dB (for fish greater than 2 grams) and 183 dB (for fish less than 2 grams) outside the expected injury zones. Peak pressure impacts are expected to extend approximately 13.6 meters from the source and cSEL extending approximately 1,000 meters from the source. The RMS behavioral threshold is expected in a radius extending approximately 3,415 meters into the open water of the Bay.

2. The following terms and conditions implement reasonable and prudent measure 2:

    a. The Corps must require that a fish rescue and relocation plan is submitted, along with the qualifications of the proposed biologists designated to supervise and conduct fish

capture and relocation operations, to NMFS for review at least 60 days prior to the commencement of any in-water cofferdam installation or dewatering activities. An annual plan that includes all cofferdam and dewatering activities for the work season is required.

i. The biologist(s) working with the dewatering operation must have the necessary knowledge, skills, and abilities to ensure the safe handling of all ESA-listed fish. The biologist must continuously monitor the dewatering process. Dewatering pumps shall be screened with mesh sizes no larger than 3/32 of an inch and maintain approach velocities not exceeding 0.33 feet per second to prevent impingement or entrainment of juvenile listed species.

b. The Corps must require that the dewatering rate be incrementally reduced or temporarily halted if fish are observed exhibiting signs of distress or if the capture rate cannot keep pace with the receding water levels.

c. The Corps must require a strict hierarchy of capture methods to minimize stress: biologists shall first use knotless seines to carefully corral fish as the water level drops, followed by soft mesh dip nets for remaining individuals. Electrofishing is strictly prohibited.

d. The Corps shall require that strict handling and transport protocols are implemented:
   i. Fish must be handled only with wet hands or wet soft-mesh gloves.
   ii. Captured fish must be immediately transferred to adequately sized, clean transfer containers (e.g., dark-colored buckets or coolers) equipped with portable aerators.
   iii. Water quality within transfer containers must be continuously monitored. Water temperatures shall be maintained within 2 degrees Celsius of the ambient receiving waters, and dissolved oxygen levels must be maintained near saturation.
   iv. Fish must be held in temporary containers for the absolute minimum time necessary (no longer than 30 minutes) and kept fully shaded to reduce physiological stress. To avoid predation, the biologists will have at least two containers and segregate small, or young, juveniles from larger, or older age classes, and other potential predators.
   v. Captured listed species must be released into pre-identified, optimal receiving habitats outside the active construction zone that offer adequate flow, velocity refuge, and cover to minimize the risk of post-release avian or piscine predation.

e. The Corps must require that comprehensive data is recorded for all rescue operations, including the date, time, water temperature, capture method, species identified, fork length (if safe to measure), physical condition upon capture, and release location. Any mortalities must be immediately preserved, properly documented, and electronically reported (e.g., email) to the NMFS consulting biologist within 48 hours.

f. The Corps must require that visual sampling and mortality counts conducted during the dewatering phase include an explicit error estimation. Because standard visual verification protocols fail in the hyper-turbid conditions typical of estuarine cofferdam dewatering, establishing a visual sampling error estimation ensures that unobserved mortalities (e.g., the less than 1-percent of fish lost in the mud or turbid water) are properly accounted for in the take reporting.

3. The following terms and conditions implement reasonable and prudent measure 3:

    a. To minimize take from starvation and disrupted migration, the Corps must require the integration of Light-Penetrating Surfaces (LPS) (e.g., functional glass blocks or heavy-duty grating) into the designs of pedestrian promenades, cantilevered sidewalks, decking without buildings, and non-vehicular overwater decking to elevate under-structure ambient light levels, targeting at least 5 percent photosynthetically active radiation (PAR) at a 1-meter depth. To the maximum extent practicable, structures must be oriented in a north-south alignment, and solid structures (excluding ramps and floating docks) must be elevated a minimum of 5 feet above the Mean Higher High Water (MHHW) line.
    b. To minimize effects of displacement and provide essential refugia, the Corps must ensure that proposed EWN features minimize impacts of the seawall replacement on listed salmonids, including features such as elevated intertidal benches (e.g., rock sills or mesh-encased quarry rock) at the base of the seawall and textured seawall faces to provide shallow-water refugia and substrate complexity.
    c. The Corps must require the installation of piscivorous bird perch prevention measures (e.g., cones, spikes, or exclusion wires) on all newly installed piles and overwater structures to directly reduce predation mortality of listed juvenile salmonids.
    d. The Corps must require strict management of vessel anchoring and mooring to protect green sturgeon foraging grounds. Persistently moored vessels must maintain a minimum of 18 inches of hull clearance from the substrate during extreme low tides, and any mooring anchors placed near submerged aquatic vegetation (SAV) must utilize midline floats to prevent destructive anchor chain scour.
    e. The Corps must require the use of vibratory extraction methods rather than a direct pull or clamshell method during the removal of existing piles. When removing piles within or adjacent to sensitive SAV habitats, a silt curtain extending from the surface to the substrate must be employed to prevent the resuspension of legacy contaminants.

4. The following terms and conditions implement reasonable and prudent measure 4:

    a. The Corps must submit an annual compliance report to NMFS by March 31 of each year during project implementation. The annual compliance report shall detail the total square footage of wharf installed, the linear feet of T-wall installed, and the linear feet of seawall dewatered using cofferdams to legally verify that the defined ecological surrogates for take were not exceeded during the previous construction year. The report must also include a comprehensive summary of all fish rescue and relocation activities, including species encountered, total numbers handled, capture methods utilized, photos, and any observed mortalities or injuries.
    b. The Corps must track the overall implementation timeline of the authorized "First Actions." The Corps shall include a project status update within the annual compliance report to verify that construction remains on schedule for completion by December 31, 2062.
    c. The Corps must submit the final designs and planning documents for the 27 acres of Engineering With Nature (EWN) features to NMFS for review prior to the initiation

of construction. This review ensures that the structural complexity and placement are adequately designed to achieve the minimization of habitat displacement assumed in this biological opinion.

d. The Corps must develop and implement a standard 5- to 10-year post-construction ecological monitoring plan for the EWN features. The plan must be submitted to NMFS for review alongside the final design documents. The plan must include specific performance criteria (e.g., structural integrity, algal/macroinvertebrate colonization rates, and fish utilization) and require annual reporting to NMFS to verify that the features are successfully minimizing the impacts of permanent habitat alteration.

Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. NMFS recommends that hydroacoustic monitoring be performed at all sites that use an impact hammer to improve the breadth of information related to elevated underwater sound levels during pile driving in the San Francisco Bay. Hydroacoustic monitoring need only be conducted at the onset of each type of pile in each type of setting to develop a hydroacoustic characterization of pile size, type, bottom depth and configuration.

Reinitiation of Consultation

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the federal agency or by the Service, where discretionary federal involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

ESSENTIAL FISH HABITAT RESPONSE

Thank you also for your request for essential fish habitat (EFH) consultation. NMFS reviewed the proposed action for potential effects on EFH pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. We have concluded that the action would adversely affect EFH designated under the Coastal Pelagic Species Fishery Management Plan (FMP), the Pacific Coast Groundfish FMP, and the Pacific Coast Salmon FMP.

Magnuson-Stevens Fishery Conservation and Management Act

Section 305(b) of the MSA directs federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects may result from actions occurring within EFH or outside of it and may include direct, indirect, site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH (50 CFR 600.905(b)).

EFH Affected by the Proposed Action

The proposed project occurs within EFH for various federally managed fish species within the Coastal Pelagic Species Fishery Management Plan (FMP), the Pacific Coast Groundfish FMP, and the Pacific Coast Salmon FMP. In addition, the project occurs within, or in the vicinity of estuary HAPC, which is designated as a habitat area of particular concern (HAPC) for various federally managed fish species within the Pacific Groundfish and Pacific Salmon FMPs. HAPC are described in the regulations as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPC are not afforded any additional regulatory protection under the MSA; however, federal projects with potential adverse impacts on HAPC will be more carefully scrutinized during the consultation process.

Adverse Effects on EFH

Based on the information provided in the Biological Assessment for the San Francisco Waterfront Coastal Flood Study (Corps 2025) and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action will have the following adverse effects on EFH:

> Habitat Alteration and Loss. The expansion of seawalls and the installation of new overwater wharf structures and piles will result in the permanent destruction of approximately 9 acres of native benthic substrate and estuarine water column habitat. This constitutes a direct loss of highly productive foraging and rearing habitat for species managed under the referenced FMPs, including key forage species like Northern Anchovy and Pacific Sardine, as well as various life stages of Pacific Coast Groundfish. Replacing natural, gently sloping mudflats

and structurally complex benthic zones with featureless, vertical concrete and steel structures eliminates crucial micro-habitats that support dense invertebrate prey communities (Strain et al. 2021; Kiffney et al. 2022; Gittman et al. 2016; Seitz et al. 2006). Furthermore, the hardened, steep surfaces of traditional armoring increase reflected wave energy and alter nearshore hydrodynamics. This wave reflection scours adjacent soft-bottom habitats, coarsening the substrate and creating high-energy conditions that suppress the establishment of Submerged Aquatic Vegetation (SAV) such as eelgrass, which serves as a Habitat Area of Particular Concern (HAPC) for groundfish and critical spawning habitat for forage fish (Dethier 2016; Munsch et al. 2017; Morley et al. 2012; Dethier et al. 2016; Patrick et al., 2014). Additionally, shoreline armoring severs the vital aquatic-terrestrial link by eliminating fringing riparian vegetation, thereby depriving the aquatic food web of terrestrial insect subsidies that provide high-energy forage for outmigrating smolts and other managed species (Morley et al. 2012; Heerhartz et al. 2016; Dugan et al. 2008).

The permanent removal of established native Olympia oyster (Ostrea lurida) populations and their colonized hard substrates constitutes a direct degradation of estuary HAPC under the Groundfish and Salmon FMPs (Zabin et al. 2010). Biogenic reef-building organisms fundamentally alter nearshore hydrodynamics and water quality by actively filtering the water column and attenuating localized wave energy (Nordstrom 2014). The physical extraction, burial, or destruction of these biogenic matrices results in the absolute loss of critical interstitial void space (Goelz 2018). This interstitial space provides spatial platforms for epibenthic growth and to provide predation refugia for juvenile fishes and mobile invertebrates (Goelz 2018). Consequently, the eradication of these biogenic structures functionally degrades the nearshore trophic web, eliminates vital structural complexity needed by federally managed species, and removes localized biofiltration capacity from the San Francisco Bay ecosystem (Zabin et al. 2010; Nordstrom 2014).

Overwater Structures and Shading. The reconstruction of massive, elevated wharves and new pile-supported piers will maintain the severe, permanent functional habitat loss through continued excessive shading and structural proliferation. By intercepting photosynthetically active radiation, these dense overwater structures severely limit light penetration to the water column and benthic substrate beneath their footprint. This light limitation stunts or eliminates aquatic primary producers, including phytoplankton and macroalgae, and restricts the potential recovery of SAV, ultimately reducing the growth, density, and diversity of benthic invertebrates that serve as the fundamental prey base for MSA-managed species (Burdick and Short 1999; Glasby 1999; Haas et al. 2002; Whitcraft and Levin 2007; Zimmerman 2006). Furthermore, the wide overwater footprints create sharp, unnatural light/dark contrasts in the water column that can disorient migrating juvenile salmonids and groundfish, often forcing them into deeper, suboptimal waters to navigate around the structures. The combination of artificial shade and dense pile arrays creates highly effective holding habitats for piscivorous ambush predators, significantly increasing the mortality risk for migrating salmonids and coastal pelagic forage fish (Helfman 1981; Munsch et al. 2014; Ono and Simenstad 2014; Tabor et al. 2011). Finally, the installation of these dense pile arrays fundamentally alters localized current velocities. This hydrologic disruption can cause excessive scour around the base of the pilings, while adjacent low-flow areas experience increased sedimentation and the excessive accumulation of shell debris (from barnacles and

mollusks colonizing the new piles), further degrading benthic habitat quality and inhibiting SAV establishment (Shafer 1999; Simenstad et al. 1999; Kelty and Bliven 2003).

Recent eco-engineering studies in major urban estuaries demonstrate that the severe habitat degradation caused by traditional seawalls and overwater structures can be substantially reduced through integrated structural design (Sawyer et al. 2020). Specifically, combining light-penetrating surfaces in overhanging structures with the creation of structurally complex, shallow-water habitat (such as elevated intertidal benches) at the base of a seawall significantly improves conditions for managed species. Elevating under-pier light penetration (e.g., to 5 percent photosynthetically active radiation) in conjunction with shallow, textured substrates has been shown to effectively shift juvenile salmon behavior from shade-avoidance to active foraging, re-establishing vital nearshore migratory corridors along heavily urbanized waterfronts.

Elevated Underwater Sound Levels. Impact pile driving required for structural foundations will generate habitat conditions that include intense, highly impulsive underwater sound pressure waves. These acoustic shockwaves can result in acute, albeit temporary, and impactful sound levels in the water column for the duration of the pile driving activities (Molnar et al. 2020). The propagation of these elevated sound levels will temporarily but significantly degrade the habitat quality of a vast expanse of the estuarine environment for MSA-managed species. This acoustic masking can result in habitat conditions that disrupt essential auditory cues relied upon by pelagic and groundfish species for navigation and predator detection. The chronic noise can result in habitat conditions that result in behavioral avoidance, forcing fish to expend critical energy reserves to flee the area, thereby disrupting normal feeding behaviors, delaying essential migratory patterns, and effectively reducing the functional habitat carrying capacity of the San Francisco Bay waterfront for the duration of the construction activities.

Water Quality Degradation. In-water construction activities, particularly shoreline grading, dredging, and the installation or removal of cofferdams, will result in the severe, albeit temporary, resuspension of fine benthic sediments. This activity generates localized, highly concentrated turbidity plumes that can significantly impair the visual foraging efficiency of pelagic predators that rely on sight to capture prey. Additionally, these dense sediment plumes temporarily degrade the physical and chemical properties of the water column by drastically reducing light penetration—which stunts localized phytoplankton blooms—and by potentially remobilizing legacy urban contaminants and heavy metals sequestered within the historical waterfront substrate, further exposing MSA-managed species to sublethal toxicological stressors. Removal of old or degraded creosote piles is intended to improve long-term water quality despite temporary sediment resuspension.

EFH Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the adverse effects of the proposed action on EFH.

During the planning and design process, the Corps should describe how their proposal addresses

the specific conservation recommendations provided below. NMFS recognizes that not all conservation recommendations will be relevant in all situations. Therefore, the Corps should clearly articulate when a particular recommendation is not applicable to the proposed project.

1. To minimize the adverse effects of hydroacoustic noise, shading, vessel scour, and physical habitat disturbances and alterations to EFH, the Corps should implement all terms and conditions associated with Reasonable and Prudent Measures 3 and 4 in the Incidental Take Statement of the preceding ESA biological opinion.

2. To further reduce the adverse effects of shoreline armoring on EFH and to enhance the ecological value of the estuarine corridor, the Corps should maximize the implementation of living seawalls and other structurally complex, nature-based features throughout the project footprint. The Corps should evaluate all planned conventional seawall and bulkhead replacements and incorporate textured surfaces, intertidal rocky benches, or similar features beyond the baseline 27 acres of proposed EWN integration wherever engineering and flood risk management constraints allow.

3. Incorporate setbacks on the order of 50 feet (approximately 15 meters) to 165 feet (approximately 50 meters) from eelgrass habitat where practical to allow for greater circulation and reduced impact from boat maneuvering, grounding, and propeller damage, and to address shading impacts. Any overwater structure construction—including in-kind replacement—that occurs within 65 feet (approximately 20 meters) of eelgrass (survey mapping buffer) should be required to follow the monitoring and mitigation requirements outlined in the California Eelgrass Mitigation Policy (CEMP).

4. To minimize the loss of biologically highly productive benthic invertebrate communities, the Corps should protect native Olympia oysters (*Ostrea lurida*) established on existing hard substrates slated for removal or burial. The Corps should implement the following protocols:

    a. Pre-Construction Surveys: A qualified marine biologist should conduct a targeted survey for native oysters on all seawalls, pilings, and riprap within the project footprint no more than 60 days prior to construction.
    b. Salvage and Relocation Plan: If native oysters are identified, the Corps should develop and implement an Oyster Relocation Plan submitted for NMFS review. To the maximum extent practicable, existing colonized substrates (e.g., loose riprap or manageable debris) should be carefully extracted and relocated to adjacent, ecologically suitable subtidal or low intertidal habitats. Relocation sites must be strictly confined to elevations at or below 0 ft mean lower low water (MLLW) (targeting -2.0 to -3.0 feet MLLW) to prevent settlement and competitive overgrowth by the invasive Pacific oyster (*Magallana gigas*). Relocation sites must also avoid highly depositional mudflats to prevent lethal sedimentation overburden.
    c. Habitat Enhancement: Ensure that an applicable portion the 27 acres of Engineering With Nature (EWN) features (e.g., textured seawall panels and intertidal rocky benches) are specifically designed and placed strictly at or below

the 0-ft MLLW tidal elevation to optimally recruit and support the re-establishment of native oyster populations while excluding non-native competitors.

Fully implementing these EFH conservation recommendations would protect, by avoiding, minimizing, or offsetting impacts on designated EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species along the 7.5-mile San Francisco Waterfront project area.

Statutory Response Requirement

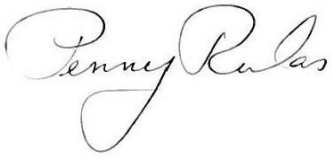
As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH conservation recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH conservation recommendations unless NMFS and the federal agency have agreed to use alternative time frames for the federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations, the federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

Supplemental Consultation

The Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR 600. 920(l)).
This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The biological opinion will be available through NOAA Institutional Repository at https://repository.library.noaa.gov/welcome. A complete record of this consultation is on file at North-Central Coast Office in Santa Rosa, California.

Please direct questions regarding this letter to Brian Meux at (707) 575-1253 or via email at brian.meux@noaa.gov.

Sincerely,



Penny Ruvelas
Assistant Regional Administrator
California Coastal Office

cc: Raven Blakeway, Corps of Engineers (raven.d.blakeway@usace.army.mil)
FRN 151422WCR2025CCD00242

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From: Blakeway, Raven D CIV (USA)
Sent: Monday, July 20, 2026 10:29 AM
To: 'Justin Ly - NOAA Federal' <justin.ly@noaa.gov>; brian.meux <brian.meux@noaa.gov>
Cc: Carraway, David W CIV USARMY CESWF (USA) <David.W.Carraway@usace.army.mil>; Morrow, Robert M CIV USARMY CESWF (USA) <Robert.Morrow@usace.army.mil>; Jensen, Tacy M CIV USARMY CESWT (USA) <Tacy.M.Jensen@usace.army.mil>; Jain, Devyani (PRT) <devyani.jain@sfport.com>
Subject: RE: [Non-DoD Source] Re: Request to initiate consultation for San Francisco Waterfront Coastal Flood Study

Good morning Justin,

In accordance with section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation Management Act, the USACE is providing formal response to the EFH conservation recommendations provided in the joint ESA-EFH consultation (WCRO-2025-03024) for the San Francisco Waterfront Coastal Flood Study. The USACE agrees to implement all four EFH recommendations as stated in the consultation.

Please let me know if you have any questions/concerns.

Cheers,

Raven Blakeway, PhD | Biologist
Regional Planning and Environmental Center
U.S. Army Corps of Engineers
Galveston Office
Mobile: 409-790-9058

From: Justin Ly - NOAA Federal <justin.ly@noaa.gov>
Sent: Wednesday, July 8, 2026 11:26 AM
To: Morrow, Robert M CIV USARMY CESWF (USA) <Robert.Morrow@usace.army.mil>
Cc: Carraway, David W CIV USARMY CESWF (USA) <David.W.Carraway@usace.army.mil>; Blakeway, Raven D CIV (USA) <Raven.D.Blakeway@usace.army.mil>; Brian Meux - NOAA Federal <brian.meux@noaa.gov>
Subject: [Non-DoD Source] Re: Request to initiate consultation for San Francisco Waterfront Coastal Flood Study

Hi Robert,

Attached is the biological opinion for the subject project. Please contact Brian or me if you or your team have any questions.

Thanks,

On Mon, Dec 29, 2025 at 9:13 AM Blakeway, Raven D CIV (USA) <Raven.D.Blakeway@usace.army.mil> wrote:

> Good morning Justin,
>
> The U.S. Army Corps of Engineers, Tulsa District (USACE), in partnership with the Port of San Francisco, is conducting the San Francisco Waterfront Coastal Flood Study (SFWCFS) as authorized under Section 110 of the Rivers and Harbors Act of 1950, Public Law (Pub. L.) 515, 64 stat. 163, Section 142 of the Water Resources Development Act (WRDA) of 1976, Pub. L. 94-587, 90 stat. 2917, 2930, as amended by Section 705 of WRDA 1986, Pub. L. 99-662, 100 stat. 4082, 4158, and Section 203 of WRDA 2020. The study's purpose is to recommend an alternative to reduce flooding risks along the waterfront by considering coastal storms, extreme high tides, and relative sea level change scenarios.
>
> A Biological Assessment (BA) and Essential Fish Habitat (EFH) Assessment was prepared to analyze the impacts of implementing the project on the surrounding action area (attached). The USACE requests formal consultation under Section 7(a)(2) of the Endangered Species Act and EFH under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for the SFWCFS. Based on the enclosed analysis, the USACE has determined the action is ***likely to adversely affect*** green sturgeon (*Acipenser medirostris*), central valley Sacramento spring-run chinook salmon (*Oncorhynchus tshawytscha*), and Sacramento winter-run chinook salmon (*O. tshawytscha*). Additionally, the USACE determined the proposed action ***may affect, but is not likely to adversely affect*** central California coast DPS steelhead (*O. mykiss*) or California central valley steelhead (*O. mykiss*). Finally, the USACE determined the proposed action is ***not likely to adversely modify*** designated critical habitat for green sturgeon and chinook salmon.
>
> If you have any questions or need additional information to conduct your review, please contact Dr. Raven Blakeway, Biologist, Environmental Branch, Regional Planning and Environmental Center, at 409-790-9058 or raven.d.blakeway@usace.army.mil.
>
> Cheers,
>
> Raven Blakeway, PhD | Biologist
>
> Regional Planning and Environmental Center
>
> U.S. Army Corps of Engineers
>
> Galveston Office

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

SUB-APPENDIX D.7 FISH AND WILDLIFE COORDINATION ACT COMPLIANCE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814-4700

In reply refer to:
ECOSphere #2022-0082557

August 27, 2025

Robert Morrow
Chief, Environmental Branch
Southwestern Regional Planning and Environmental Center, Tulsa District
U.S. Army Corps of Engineers
2488 E 81st Street
Tulsa, OK 74137

Dear Robert Morrow:

Please find enclosed our final Fish and Wildlife Coordination Act report for the U.S. Army Corps of Engineers' proposed San Francisco Waterfront Coastal Flood Study for your review and comment. We request any comments be submitted within 60 days of receipt of this report.

Please address any questions or concerns regarding this report to Lauren Estenson, Fish and Wildlife Biologist, at lauren_estenson@fws.gov or Stephanie Millsap, Assistant Field Supervisor; Watershed Planning Division, at stephanie_millsap@fws.gov.

Sincerely,

DONALD RATCLIFF
Digitally signed by DONALD RATCLIFF
Date: 2025.08.27 12:05:30 -07'00'

Donald Ratcliff
Field Supervisor

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

FINAL FISH AND WILDLIFE COORDINATION ACT REPORT FOR THE SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY

PREPARED BY:

U.S. Fish and Wildlife Service
Watershed Planning Division
San Francisco Bay-Delta Fish and Wildlife Office
Sacramento, California

PREPARED FOR:

U.S. Army Corps of Engineers
Southwestern Regional Planning and Environmental Center, Tulsa District
Tulsa, Oklahoma

August 2025

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SUMMARY

The U.S. Army Corps of Engineers' (Corps) Recommended Plan Description for the San Francisco Waterfront Coastal Flood Study primarily involves raising shoreline elements, along with seismic ground improvements, and environmental enhancements in various forms of Engineering with Nature features (EWNs), along a 7.5-mile portion of the shoreline of the City of San Francisco within San Francisco Bay. The project is divided into four reaches based on hydrology and risk. Reach 1 relies primarily on flood damage reduction measures (measures) such as floodproofing and curb walls, while reaches 2, 3, and 4 each prioritize protection at the existing shoreline with measures including raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, and levees; employing EWNs such as rocky intertidal bluff, marsh/coarse beach restoration, ecological armoring through living seawalls, and naturalized embankments and shorelines. The project would greatly reduce risks of flood events and associated event-related environmental damage. There would be a limited net area of bay fill; however, incorporation of EWNs throughout the project would help to improve habitat values overall. In our 2024 draft Fish and Wildlife Coordination Act (FWCA) report, we recommended that independent measures to be included in the project be specified in the final environmental document, and that additional coordination with resource agencies be conducted to specify the need, amount, and location(s) of compensatory mitigation for effects of bay fill. The Corps incorporated our recommendations in their May 2025 Recommended Plan Description, and also developed a compensatory mitigation plan, as part of their still-to-be-finalized Final Integrated Feasibility Report and Environmental Impact Statement. The U.S. Fish and Wildlife Service (Service) has no objection to the project proceeding provided the measures are implemented.

INTRODUCTION

This document is the Service's final detailed report on the Corps' San Francisco Waterfront Coastal Flood Study (study). It has been prepared under the authority of section 2(b) of the Fish and Wildlife Coordination Act (FWCA).

The purpose of the study is to investigate the feasibility of actions to manage tidal and fluvial flooding and sea level rise along a 7.5-mile segment of the San Francisco Waterfront from Aquatic Park to Herons Head Park in the City of San Francisco. Low-lying assets along the waterfront are at risk of damage from flooding from coastal storms and extreme high tides. This risk is expected to increase with sea level rise (SLR). The Port of San Francisco (Port) is the non-Federal sponsor acting as lead agency for the City and County of San Francisco.

After studying an array of alternatives and developing a hybridized Tentatively Selected Plan in their January 2024 Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR/EIS; Corps and Port 2024), the Corps formulated their Recommended Plan which is also the Total Net Benefits Plan (TNBP). The TNBP consists of first actions to address coastal flood risk through a suite of structural (e.g., raising the shoreline, constructing seawalls and levees, ecological armoring, etc.) and non-structural (e.g., floodproofing, retreat, building demolition, etc.) measures that function as a system and are implemented over time, based on the risk of SLR. The TNBP measures were developed to a feasibility level of design based on currently available data and information developed during plan formulation. The extent of the construction footprint in the TNBP and used as the basis for impact analysis, and methodology for construction, is anticipated to negligibly change between feasibility and the Corps' completion of Preconstruction Engineering and Design and construction phases. However, more information is needed for the Corps to understand and define site-specific design needs such as structure height, subsurface foundational needs, quantity and type of materials used, landscape and transportation design, staging areas, haul routes, timing and duration of construction, etc. Once additional site-specific data is collected (e.g., geotechnical/subsurface, topographic and utility surveys and refined interior drainage modeling, etc.), the assumptions applied to each measure during the feasibility phase will be revisited and the designs updated by the Corps as necessary.

The study had been initiated in 2018 within the Corps' San Francisco District and, after a pause in work, was resumed in 2022 within the Corps' Tulsa District. The Service intermittently attended meetings since the outset of the study. A reimbursable funding agreement finalized in early 2024 allowed us to dedicate an employee to work on a draft FWCA report and coordinate with other resource agencies. The primary information source used in the draft report was the January 2024 DIFR/EIS. The Service's draft FWCA report was completed and provided to the Corps in August 2024. Since completion of the draft FWCA report, the Corps has finalized their TNBP, including incorporating Service recommendations from the draft FWCA report. This final FWCA report will utilize the Corps' final TNBP (Corps 2025), as well as the Corps' Compensatory Mitigation Plan (Corps and Port 2025), that will be included in their Final Integrated Feasibility Report and Environmental Impact Statement.

PROJECT AREA

The project area is entirely within the City of San Francisco along the 7.5 miles of waterfront beginning near Aquatic Park to the northeast, just east of Fort Mason, and continuing east and south to just past Heron's Head Park, slightly south of Islais Creek. The project area is divided into four reaches based hydrologic separability, identifiable geographic references, specific wave action within each reach, and major differences in physical structure inventory, with the primary included elements and uses as follows:

Reach 1 (Fisherman's Wharf): Aquatic Park, Fisherman's Wharf, Piers 31-35, and North Beach neighborhood;

Reach 2 (Embarcadero): Northeast Waterfront and Financial District, most of Embarcadero Historic District;

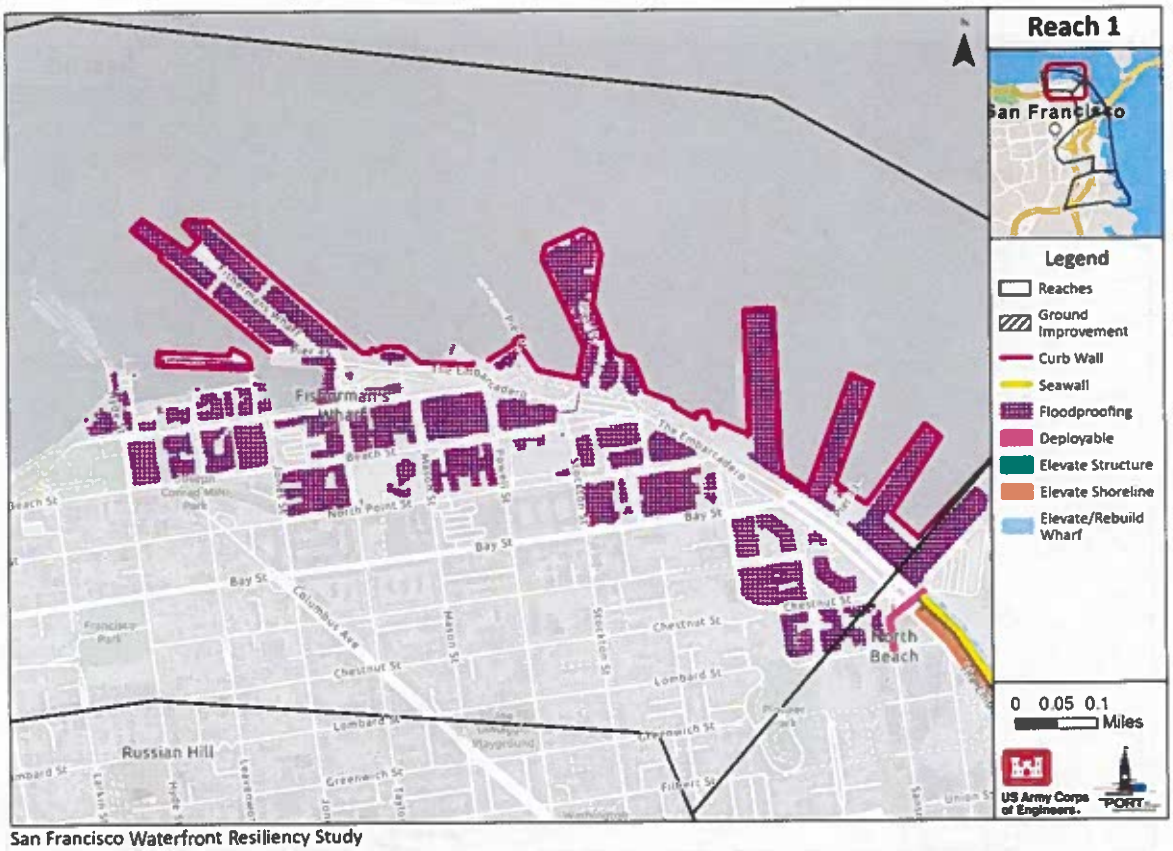
Reach 3 (Mission Creek/Mission Bay): South Beach, Mission Creek, Mission Rock, Mission Bay, Pier 70, baseball stadium, dense residential;

Reach 4 (Islais Creek/Bayview): Pier 80, Islais Creek, Cargo Way, Piers 94-96, Heron's Head Park, critical industrial, maritime, and commercial Port functions.

PROPOSED PROJECT

By reach, the proposed project would include the following measures (Figures 1-4):

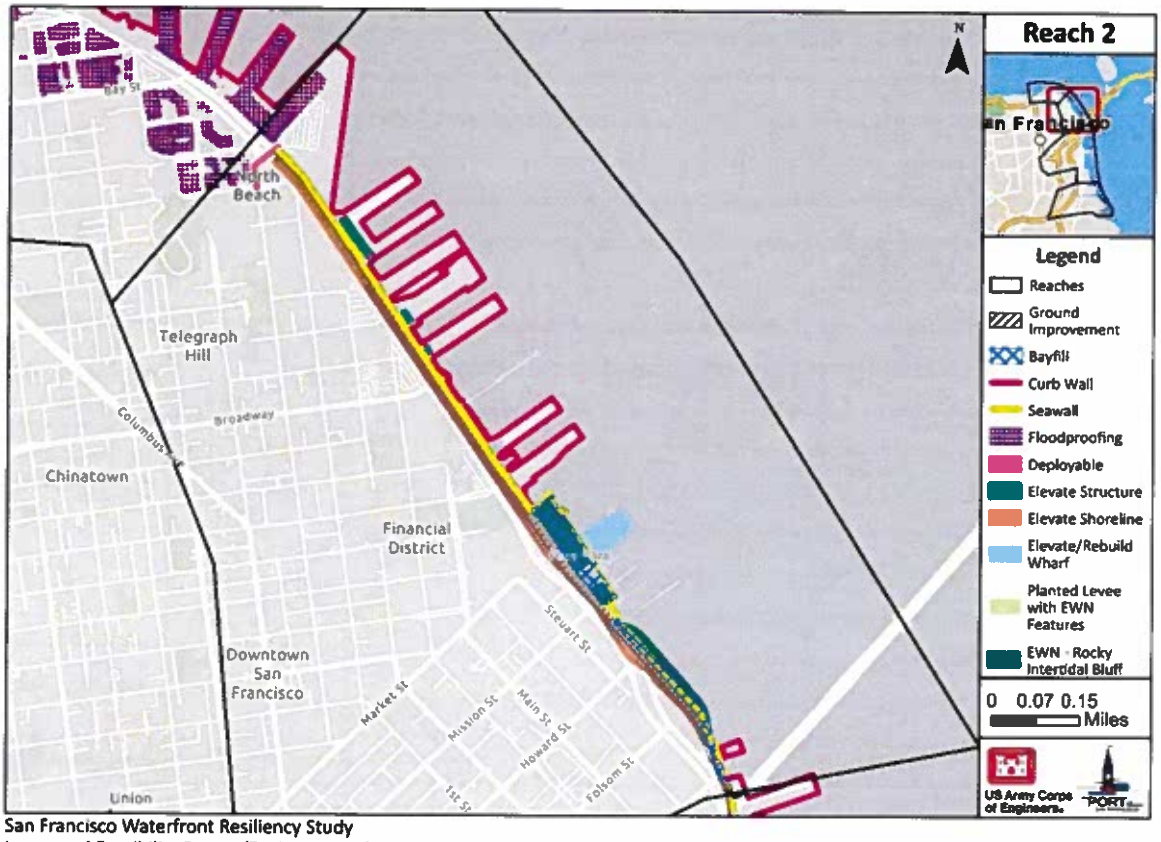
Reach 1 - There would only be non-structural measures consisting of floodproofing some buildings and infrastructure and installing curb walls to floodproof the piers.



San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Figure 1. Proposed Measures in Reach 1.

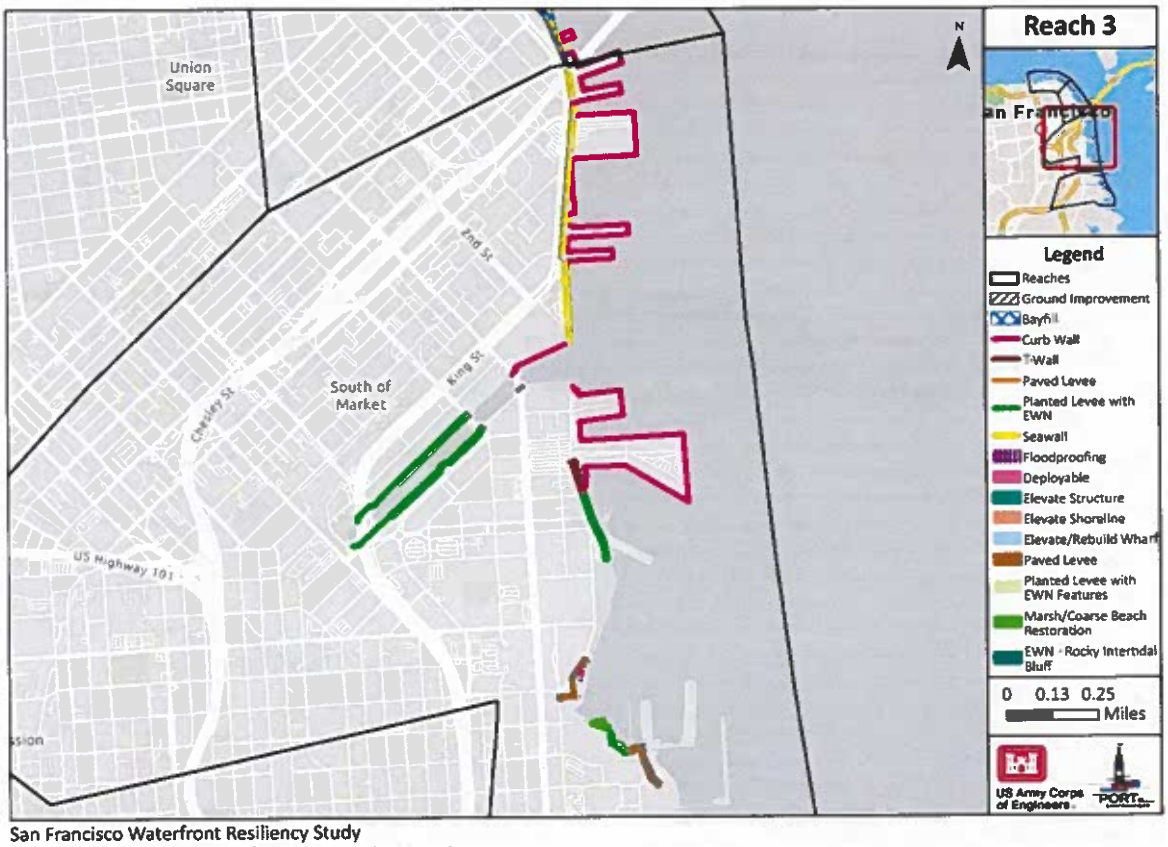
Reach 2 - Along the Embarcadero, the shoreline would be elevated in place by raising and reconstructing bulkhead walls and pile-supported wharves north of the Bay Bridge. The reconstruction of the full Embarcadero roadway and promenade would need to be redesigned and reconstructed in future project phases. The Ferry Building and bulkhead buildings would be raised in place following construction of new pile supported foundations (wharves). At Rincon Park, just south of the Ferry Building, new bulkhead seawall would be constructed approximately 60 feet into the bay to mitigate disruption to below grade transit infrastructure and the surface transit corridor in this area and rocky intertidal bluffs would also be constructed to integrate an engineered rocky tidal habitat into the shoreline elevation and bulkhead seawall rather than traditional riprap or other engineered armoring to protect the new bulkhead seawall. Piers would be floodproofed with concrete curbs around the perimeter. Ground improvements would be done to limit seismic risks. Living seawalls would be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design would incorporate textures to increase surface complexity).



San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Figure 2. Proposed Measures in Reach 2.

Reach 3 - Measures here would continue the strategy of defending community assets in place with by elevating the creek and Bay shorelines with raised and rebuilt bulkhead seawalls and wharves, levees, floodwalls, EWN features, including a planted levee and marsh/coarse beach restoration, and closure structures. Coastal defense will tie into existing and planned high ground at Bayfront, Agua Vista, and Crane Cove Parks, and at the Mission Rock and Pier 70 development areas. Partial reconstruction of the Embarcadero roadway south of the Bay Bridge will also occur to manage elevation change in this constrained urban area. Living seawalls would be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design would incorporate textures to increase surface complexity).



San Francisco Waterfront Resiliency Study
Integrated Feasibility Report/Environmental Impact Statement

Figure 3. Proposed Measures in Reach 3.

Reach 4 - Measures consist of raising the shoreline using bulkhead seawalls, levees, natural and nature-based features, floodwalls, closure structures, and tying into existing or planned high ground, near Potrero Power Station and behind the Pier 94 Wetlands. This area of the waterfront contains large parcels independent of the combined sewer system, such that the elevated shoreline will require modification to handle stormwater in a safe and effective manner. Standalone sheet pile walls would be constructed as floodwalls along portions of Islais Creek and nearby Jennings Street in the Heron's Head Park area. Living seawalls would be incorporated into the design of any new vertical, concrete and/or baycrete (a mixture of concrete and baymud) bulkhead walls or piles (i.e., anywhere new structures are being placed in the water, the design would incorporate textures to increase surface complexity).

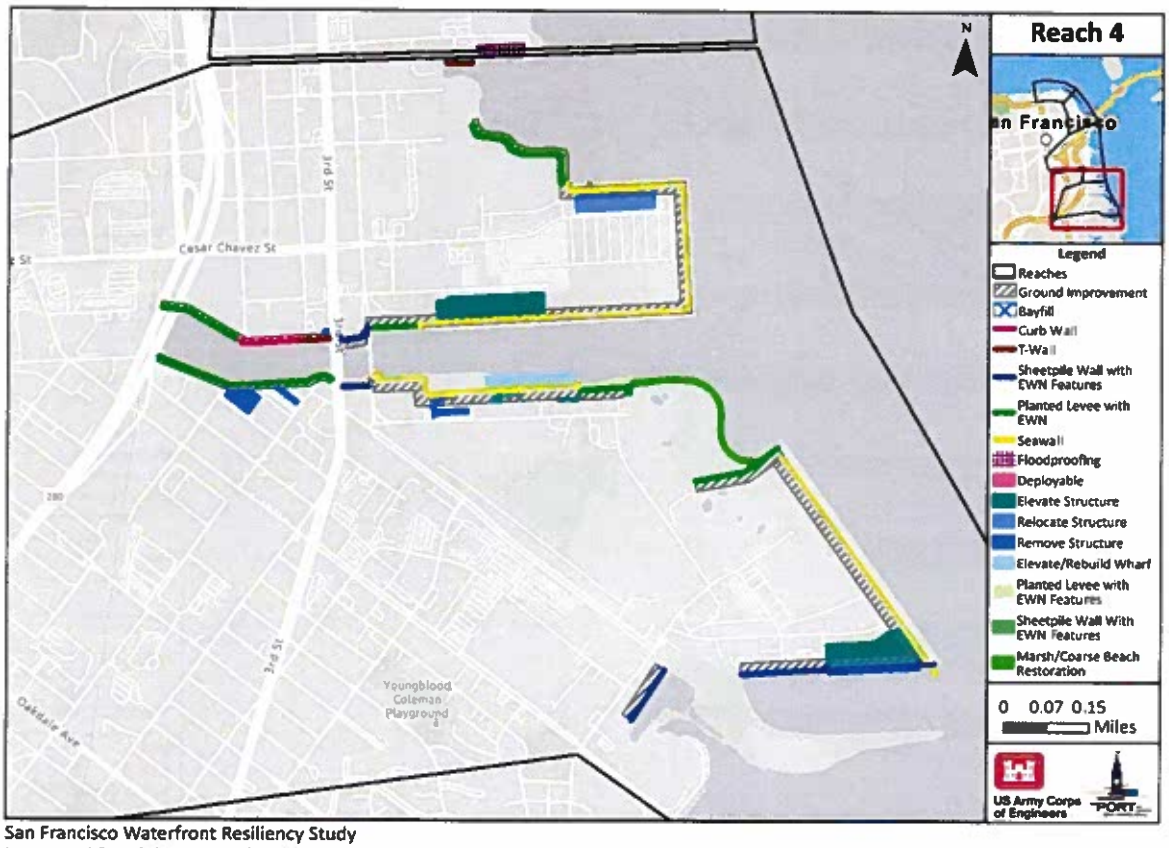


Figure 4. Proposed Measures in Reach 4.

EWNs are part of a Corps program that, in part, aims to better integrate natural and engineered systems to enhance infrastructure performance and environmental sustainability. Natural infrastructure, such as wetlands, dunes, and islands, can help absorb floodwaters, reduce wave energy, and stabilize shorelines, while also supporting fish and wildlife habitat and improving water quality. Five types of EWNs will be incorporated into the overall project design:

Planted Levees

Planted levees would be constructed in the same manner as paved levees except that the levee surface would include more native materials, native plants, and pervious type surfaces and the side slopes may have gentler slopes. The planted levees would also typically connect to terrestrial or aquatic habitat and aims to provide high quality transition zone habitat.

Use of vegetated riprap, or ecological armoring, as a direct replacement for traditional riprap would also be incorporated. This type of armoring aims to replicate the natural processes and functions of rocky, intertidal habitat through interlocking layered armored protection units or differently shaped riprap, sometimes with integrated tide pools, designed to mimic natural intertidal conditions and create microhabitats, including vegetation establishment.

Sheet Pile Walls
Where appropriate, a standalone sheet pile wall would be constructed as a floodwall, rather than a sheet pile wall in combination with another feature (e.g., levee or seawall). A sheet pile wall is a construction feature involving driving interlocking sheets of material into the ground to act as a barrier to contain water, for bank stabilization, and to prevent water from overflowing into vulnerable areas. Planted slopes and terraces would be incorporated into the design of areas with sheet pile walls to provide additional protection and benefit, similar to planted levees. The sheet pile walls would be constructed using steel and/or cast-in place concrete materials and would be constructed using land-based equipment.

Marsh/Coarse Beach Restoration
Marsh and coarse beach restoration involves the restoration of degraded existing coastal wetlands (e.g., salt, brackish, and tidal freshwater marshes), mudflats, and/or coarse beach. To restore the target habitat type at each location, where appropriate, sediment and other natural materials (cobble, gravel, larger rock size) would be introduced to the site to reach a target design elevation that will support the long-term viability of the desired habitat.

Rocky Intertidal Bluffs
Rocky Intertidal Bluffs would only be constructed at Rincon Park just south of the Ferry Building. This particular EWN integrates an engineered rocky tidal habitat into the shoreline elevation and bulkhead seawall design as a way to minimize wave runup and promote greater biodiversity along a steep shoreline rather than relying on traditional riprap or other engineered armoring to protect the new bulkhead seawall. A foundation of compacted sediment would be placed along the mudline/bay bottom and built up to achieve a target profile that slopes from the new seawall to the mudline. On top of this foundation, a combination of sand, gravel, rock, and/or pre-cast material, like ecological armoring of varying sizes, would be placed to create tidepools and bluff areas to increase surface complexity (grooves, crevices, nooks, etc.).

Living Seawalls
Living seawalls consist of structural elements combined with traditional seawalls to create varied micro-habitat conditions through surface relief and material composition. The introduction of surface complexity (e.g., surface texture, grooves, crevices, and nooks) to traditionally smooth surfaces would promote vegetation growth, provide foraging habitat, and create shelter from predation.

AVOIDANCE AND MINIMIZATION MEASURES

The TNBP describes an array of avoidance and minimization measures (AMMs) in project design and construction to avoid and minimize impacts. These include, but are not limited to, the following:

- Work avoidance, to the extent possible, within wetlands such as Pier 49 and Heron's Head;
- Minimization of fill and use of EWN measures;
- All in-water work shall be conducted within the June 1 through November 30 environmental work window;

- Prohibit construction washings into waters, use floating booms to contain debris;
- A spill prevention contingency plan;
- For in-water work, if and where required: exclusion features; a fish rescue plan; silt fences for any work near wetlands; and acoustic mitigation measures and monitoring; and
- An exhaustive list of Best Management Practices to deal with project construction related debris materials, chemicals, traffic, and noise.

EXISTING RESOURCES

The project area where work would occur is at the interface between San Francisco Bay and the City of San Francisco. The land side is almost completely urbanized with hard structures such as buildings and streets, with limited landscape vegetation. Landscape vegetation is present adjacent to buildings and within public parks including, but not limited to, Levi's Plaza, Mission Creek Garden, Mission Bay Commons Park, Warm Water Cove Park, Islais Creek Park, and India Basin Shoreline Park. Mature ornamental landscape trees and shrubs in the project area can provide cover, foraging, and nesting habitat for a variety of bird species, as well as reptiles and small mammals, especially those that are tolerant of disturbance and human presence. The water edge varies but largely consists of sea wall and structures set on top of piers. Other than this developed land, aquatic habitat types present include various forms of intertidal and subtidal habitats, as well as open water. Intertidal habitat, generally surfaces between low and high tide, include a small quantity of natural habitats such as areas of beach, mudflat, and fragments of salt marsh, as well as considerable artificial surfaces such as bulkheads, sea wall, wood pilings of piers, and riprap (placed large angular rock). A beach exists at Aquatic Park at the northwest end of the project area and a small mudflat is present at Heron's Head at the southeast end of the project area. These habitat surfaces are typically colonized by marine macroalgae, barnacles, mussels, oysters, and other attached organisms. Shorebirds, such as western sandpipers, willets, and American avocets, are known to forage in these areas at low tide.

In the project area, vegetated wetland (salt marsh) is present in the Southern Waterfront subarea, including at the Pier 94 wetlands and Heron's Head Park. The salt marsh at Heron's Head is interspersed with areas of unvegetated salt panne (water retaining depressions). Salt panne's are often seasonally inundated, and because of this, can inhibit the establishment of vegetation, leavening a barren area. The salt marshes within the project area are small, narrow, and scattered. Many of these areas have had some level of relatively recent restoration activity involving importation of sand, invasive removal, trash/debris removal, and/or native plantings to restore and enhance wetlands and upland areas, reduce coastal erosion and stabilize shorelines, and improve habitat. Heron's Head is not a natural feature, but a raised area that is part of an unfinished "Pier 98".

Subtidal habitat is also present in the project area. A small patch of subtidal habitat with eelgrass has been documented at Heron's Head. Eelgrass and other types of submerged aquatic vegetation, as well as subtidal riprap surfaces, serve several important functions, providing shelter for both juvenile fish and invertebrates; surfaces for fish like Pacific herring to lay their egg masses during spawning; foraging habitat for shorebirds at low tide and for diving birds at high tide; and habitat for migratory and wintering shorebirds. Subtidal habitat also supports the

production of shrimp, crab, and other soft benthic fauna that are potential food organisms for carnivorous fish, birds, and marine mammals.

Open water (pelagic) habitat occurs throughout the project area and supports an array of marine birds, mammals, and fish typical of this region. Birds include various gulls, cormorants, terns, and diving ducks. Mammals include the resident Pacific harbor seal, sea lion, harbor porpoises, and even whales. San Francisco Bay, of which the project area is part, has a commercial Pacific herring fishery, and supports several recreational fisheries (halibut, striper).

There is some limited use of developed urban lands by common wildlife. Seals and sea lions often rest on Pier 39, gulls are attracted to any near shore area where there may be forage in the form of food waste, and other common mammals such as skunk, raccoon, and opossum have been able to adapt to survive in urban areas (or within included landscape vegetation) as well.

FUTURE WITHOUT THE PROJECT

Without the project, the project area would be at risk of damage from flooding and seismic events, and this risk and potential damage would increase over time with SLR. A series of smaller-scale projects involving prioritized measures to reduce damage from earthquakes and near-term flood improvement could still be done to the extent non-Federal funds are available. But considerable risk would remain and failure to construct the project would result in event-caused flooding (or seismic) impacts that vary with reach. In addition to the physical damage to infrastructure and economic consequences, there would be considerable environmental impacts of the design event without the project caused by urban chemicals, sewage, and/or solid debris mobilized and introduced into adjacent bay waters. Event-related releases would be temporary, but could be significant, and might result in foreign materials being deposited in shallower portions of the bay. Preceding and following an event, there would probably be emergency measures to either protect structures, remove and replace any damaged infrastructure, provide for temporary access and transportation, perform environmental cleanup, and so on. Because of the emergency reactive nature of some actions, they may not have all the environmental protections, especially the AMMs, associated with actions that are fully designed and permitted.

This risk and the consequences of an event without the project would vary by reach; however, the extent of a 1% design event floodplain is considerable, reaching up to several thousand feet or more inland from the current bay edge. This would mean flooding of all of the Embarcadero (Reaches 1 and 2), a large portion of mixed residential in Mission Bay and associated transportation hubs (Reach 3), and much of the industrial and maritime structures and a significant water treatment plant in Reach 4. Beyond emergency measures, there would likely need to be a full treatment of the damaged project shoreline which could be similar or different than what is currently proposed depending on site conditions and economics. After that, rebuilding of damaged commercial structures could commence.

FUTURE WITH PROJECT

There would be temporal impacts during the project's construction from measures such as floodproofing and ground improvements, as well as some long-term benefits related to the

removal of abandoned, derelict, or unnecessary piers, marsh/coarse beach restoration, and incorporation of EWN features like living seawalls and rocky intertidal bluff. Table 1 provides an accounting of which measures would occur in each reach and Table 2 provides an approximate spatial extent (e.g., linear feet, acres) for the total construction footprint of each measure across the entirety of the project.

Table 1. Proposed Measures within Each Reach of the TNBP.

Measure	Reach 1	Reach 2	Reach 3	Reach 4
Floodproofing	•	•	•	
Deployable		•	•	•
Elevate Structures		•	•	•
Relocate Structures				•
Remove Structures				•
Curb Wall	•	•	•	
Elevate Shoreline		•	•	
Seawall		•	•	•
T-wall			•	•
Elevate/Rebuild Wharf		•	•	•
Paved Levee			•	
Planted Levee with EWN Features		•	•	•
Sheet Pile Wall with EWN Features				•
EWN – Marsh/Coarse Beach Restoration			•	•
EWN – Rocky Intertidal Bluff		•		
EWN – Living Seawalls		•	•	•
Bay Fill		•		
Ground Improvements		•	•	•

Table 2. Total Project Construction Footprint for Each Measure Proposed in the TNBP.

Measure	Total Project		
	Linear Feet	Area (feet^2)	Acres
Floodproofing	0	2,835,000	65
Deployable	0	50,000	1
Elevate Structures	0	750,000	17
Relocate Structures	0	175,000	4
Remove Structures	0	195,000	4
Curb Wall	51,200	0	0
Elevate Shoreline	11,500	1,030,000	24
Seawall	21,000	0	0
T-wall	1,000	0	0
Elevate/Rebuild Wharf	10,900	660,000	15
Paved Levee	1,800	80,000	2
Planted Levee with EWN Features	11,800	865,000	20
Sheet Pile Wall with EWN Features	2,900	20,000	0
EWN – Marsh/Coarse Beach Restoration	0	225,000	5
EWN – Rocky Intertidal Bluff	0	85,000	2
Living Seawalls	To Be Determined	0	0
Bay Fill	0	395,000	9
Ground Improvements	38,400	0	0

The Ferry Building Seawall, in Reach 2, would be constructed to follow the perimeter of the Ferry Building Structure. This would require approximately 4.6 acres of bay fill to back fill voids between the new and existing seawall.

The Rincon Park Seawall, also in Reach 2, would be constructed approximately 60 feet into the bay to mitigate disruption to below grade transit infrastructure and the surface transit corridor in this area. This would require approximately 4.0 acres of bay fill to fill the void between the new and existing seawall. Rocky intertidal bluffs would also be constructed at Rincon Park to minimize wave runup and promote greater biodiversity along the steep shoreline, rather than relying on traditional riprap or other engineered armoring to protect the new sea wall. Approximately 2 acres of new intertidal and subtidal habitat would be constructed in front of the waterside (bayward) of the new seawall.

Most of the seawall construction described above takes place on land because installation occurs behind (landward) of the existing seawall, which is left in place. Although close to the shoreline, all of the associated seismic ground improvement would also take place on land. This can involve various measures to mitigate liquefaction risk such as installing a subsurface array of columns filled with compacted stone or grout. Considerable construction effort would be needed for the proposed work, but it would take place wholly within urbanized lands. If successful, such measures would reduce effects of earthquakes that could damage structures and introduce solid materials into bay waters. Because of the largely land-based construction, impacts to shoreline and aquatic habitats would be minimized, limited to such things as acoustic and visual disturbance of wildlife and a modest amount of construction debris (air- or water-borne fine materials) entering the bay. The effect on wildlife would likely be limited to temporary displacement, in which wildlife move away from such disturbance, returning when construction is completed.

The effects of event-caused flooding as described for the future without project, up to the 1% design event, would be substantially avoided with the project, including event-related introduction of solid and dissolved urban pollutants and waste materials, and subsequent disturbances from emergency response and rebuilding of a damaged shoreline. There could still be physical disturbance of shoreline habitats from such an event, but environmental damage is likely to be substantially less, and recovery time shorter.

Over the longer term, habitat would be modestly enhanced in amount and quality where measures with EWN features, such as planted levees and living sea walls, are employed.

HABITAT VALUE AND COMPENSATORY MITIGATION PLAN

Habitat value is routinely quantified by calculating the average of an index-weighted area determinant of this value over time. The Service does this with Habitat Evaluation Procedures (HEP) models for particular species or habitats of interest but did not perform such an evaluation for this project. However, in its DIFR/EIS, the Corps included a similar type of analysis for impacts to subtidal habitat (i.e., Habitat Equivalency Analysis; HEA). HEA is often utilized during Natural Resource Damage Assessments conducted by NOAA or the Service to determine

how much restoration is required to compensate for habitat injuries from the release of oil or hazardous substances into the environment. HEA estimates services lost with loss of habitat, similar to the estimation of habitat value lost calculated in HEP. The loss estimate from the HEA, like HEP, can be used to estimate the area of mitigation action which would replace that loss of services.

The Corps now requires itself to use published HEP models or otherwise self-certify a different procedure for use in its planning documents; it is now seeking that certification for the use of HEA for this project. The Service does not have models that match the type of habitat affected (i.e., subtidal habitat under pier-supported buildings) but has previously used HEP-like index models to assess the effect of Corps dredging projects on subtidal habitat, such as the Oakland Harbor deepening project in this region. In those prior applications, an overall index is chosen which best represents the discounted value of the habitat. The HEA is similar, in that it makes a discounted evaluation of subtidal areas beneath piers, that is either lost (as with complete fill) or improved (as with removal of decking or piles).

For the approximately 9 acres of loss of subtidal habitat (various forms of bay fill, some complete, some partial), and assuming there would be no functioning for the period of analysis, the HEA concluded that compensation for project impacts to subtidal habitat could be provided by removing either 8.0 acres of piers (i.e., additional acres of removal beyond the 1 acre of piers removed as part of the TNBP), or approximately 15.0 acres of piles. The reasoning in the greater compensation for pile removal relates to the fact that pier removal (a pier is piles plus decking) has more restoration benefit than piles only (no decking). According to the HEA discussion, artificial structures such as piers, pilings, and similar result in lower quality subtidal habitat as a result of different, often exotic, species, reduced C:N ratio, shade cast on the bottom, and flow alteration; all of which can affect overall ecosystem functioning. Thus, removing piers or pilings will result in ecological service benefits similar to those lost due to fill.

Upon our initial review, and described in our draft FWCA report, we agreed that the HEA approach and valuations were reasonable to use for this current study, however, the actual need for offsetting mitigation measures, such as pier or pile removal, could not be fully evaluated at that time due to insufficient details about precisely what would occur (i.e., candidate locations for pier or pile removal, description of the disturbance associated with this action, SLR and shoreline retreat considerations, etc.). The Corps has now developed a compensatory mitigation plan for the project in which they evaluated four plans to mitigate for the loss of 9 acres of subtidal habitat from the project and determined that the "Alternative 2" plan best provides full mitigation. The Alternative 2 plan proposes to remove 9.1 acres of abandoned, derelict, or unnecessary piers from the San Francisco waterfront between Aquatic Park and Heron's Head. Known and available locations for pier removal under the Alternative 2 plan total 5.5 acres and would require an additional 3.6 acres of pier removal. The Corps will need to assess further pier removal options along the waterfront or outside the study area and plans to refine their compensatory mitigation plan during the Pre-Construction Engineering Design phase of the project. These additional details provided in the compensatory mitigation plan are useful; however, insufficient details about what precisely would occur remain.

DISCUSSION

Construction of the proposed project would alleviate flood and seismic related event risks that would otherwise adversely affect not only human assets and economics, but also adversely affect adjacent environmental resources. These risks are already substantial in this project area and will increase over time and with anticipated SLR. The staged nature of the project facilitates some immediate protection from these risks, as well as additional later protection as the rate of SLR becomes better known. Event-related effects on resources of not doing the project, related to uncontrolled materials entering bay waters and habitats, appear to be far greater than the construction effects of the project.

There would be limited temporary construction impacts and very limited impacts in the form of fill of subtidal waters. Upon our initial FWCA review, and reiterated here in our final FWCA review, the AMMs are sufficient to minimize impacts during construction. As for impacts, there is some bay fill of subtidal waters associated with the project, approximately 9 acres net area, including partial fill adjacent to a portion of the complete fill, for approximately 5 acres of marsh/coarse beach restoration that would function as both shoreline protection and habitat. Overall effects from bay fill are small compared to the overall remaining abundance of subtidal waters in the region. Additionally, small to moderate areas of EWNs and shoreline retreat will create some additional intertidal habitat. Although a compensatory mitigation plan for the bay fill has been developed, and the Corps has recommended the Alternative 2 action within that, known pier removal locations for pier removal totals only 5.5 acres and would require an additional 3.6 acres of pier removal in still to be determined and formally proposed locations.

CONCLUSION

The Service supports implementation of the project primarily on the basis of the benefit it provides to avoiding impacts of an event under the future without the project, and, assuming: (a) maximum reasonable inclusion of EWNs, such as planted levees and living seawalls, wherever possible during the project; and (b) the further development and refinement of the compensatory mitigation plan, and the recommended Alternative 2 action, to offset the effect of bay fill that is acceptable to State and Federal resource agencies.

RECOMMENDATIONS

The Service recommends the Corps:

1. Conduct additional coordination with State and Federal resource agencies to evaluate the need, amount, and location(s) of any pier or pile removals to offset the effect of bay fill as part of the refinement of the compensatory mitigation plan during the Pre-Construction Engineering Design phase of the project.

REFERENCES

Corps. 2025. San Francisco Waterfront Coastal Flood Study. Recommended Plan Description. Prepared by Corps Tulsa District. May 2025.

Corps and Port (U.S. Army Corps of Engineers and Port of San Francisco). 2024. San Francisco Waterfront Coastal Flood Study. Draft Integrated Feasibility Report and Environmental Impact Statement. Prepared by Corps Tulsa District. January 2024. 252 pp. + appendices.

Corps and Port. 2025. San Francisco Waterfront Coastal Flood Study. Appendix K Compensatory Mitigation Plan. Prepared by Corps Tulsa District. May 2025.

SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CALIFORNIA

SUB-APPENDIX D.8
MARINE MAMMAL PROTECTION ACT COMPLIANCE

JULY 2026

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

US Army Corps of Engineers

PORT OF SAN FRANCISCO

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, N. W.
WASHINGTON, D.C. 20314-1000

CECW-PPD 10 September 2024

MEMORANDUM FOR Planning and Policy Division, U.S. Army Corps of Engineers (CESWD-PDP), (Attn: Dr. Maria Wegner), 1100 Commerce Street, Dallas, Texas 75242

SUBJECT: San Francisco Waterfront Coastal Flood Study, Approval to Complete the Marine Mammal Protection Act (MMPA) Compliance during the Pre-Construction Engineering and Design (PED) Phase

1. This memorandum is in response to the Southwestern Division's request to complete MMPA compliance during the PED phase for subject study per CESWD-PDP memorandum received on 27 August 2024.

2. Upon review of the memorandum request, associated MMPA risk assessment and the National Marine Fisheries Service email dated 27 July 2024 that concurs with completion of MMPA in PED, I concur with Southwestern Division's request as it is compliant with Engineering Regulation 1105-2-100, Appendix C (pre-publication version dated 1 April 2019).

3. Please direct any questions to Ms. Yvonne Haberer, Office of Water Project Review, Planning and Policy Division at (202) 684-5370 or yvonne.l.haberer@usace.army.mil.

Julie Alcon

JULIE ALCON
Environmental Functional Team Leader
Office of Water Project Review
Planning and Policy Division
Directorate of Civil Works

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, TULSA DISTRICT
2488 EAST 81ST STREET
TULSA, OK 74137-4290

CESWF-PE

MEMORANDUM THRU

Planning and Policy Division, Southwestern Division, U.S. Army Corps of Engineers (CESWD-PDP), (Attn: Maria Wegner), 1100 Commerce Street, Dallas, Texas 75242

FOR Headquarters, U.S. Army Corps of Engineers, (CECW-PC), (Attn: Julie Alcon), 441 G Street NW, Washington, D.C. 20314

SUBJECT: Request to Finalize the National Environmental Policy Act (NEPA) Decision for the San Francisco Waterfront Coastal Flood Study with a Condition to Complete the Marine Mammal Protection Act (MMPA) Compliance During the Pre-Construction Engineering Design (PED) Phase

1. Reference:

   a. Engineering Regulation (ER) 1105-2-100, Appendix C, Pre-Publication version EP 1105-2-60, Environmental Evaluation and Compliance, dated April 2019

   b. Marine Mammal Protection Act, 50 CFR § 216.104(a)

2. Purpose: Request approval to finalize the NEPA decision with a condition to complete the MMPA in PED.

3. Background: The details needed to obtain an Incidental Take Authorization (ITA) under the MMPA will not be known until PED; therefore, compliance under the MMPA cannot be achieved during the feasibility study phase.

   a. The enclosed Risk Assessment demonstrates the challenges with pursuing consultation during the feasibility phase and documents the risks to delaying compliance.

   b. The National Marine Fisheries Service (NMFS) concurred with the recommendation to delay requesting an ITA until a later phase. They also provided details on the type of information needed and when an ITA should be sought.

4. Recommendation: I endorse the MMPA risk assessment and request HQUSACE concurrence to finalize the NEPA decision with a condition to complete the MMPA ITA in the next phase but prior to construction.

Encl

BRIAN K. HARPER
Director, Civil Works
Regional Planning and Environmental Center

San Francisco Waterfront Coastal Flood Study (SFWS)
San Francisco, California

Marine Mammal Protection Act Compliance
Issue Paper

ISSUE: The details needed to obtain an Incidental Take Authorization (ITA) under the Marine Mammal Protection Act (MMPA) will not be known until Pre-construction Engineering and Design (PED); therefore, compliance under the MMPA cannot be achieved during the feasibility study phase.

BACKGROUND: The purpose of the study is to investigate and identify ways to manage coastal flood risk along 7.5 miles of the San Francisco Waterfront by evaluating alternatives that meet current and future coastal flood risk management (FRM) needs. The Recommended Plan adaptively manages coastal flood risk through a suite of structural and non-structural measures that function as a system and are implemented over time, based on the risk of rising sea levels. The system is divided into four reaches based on hydrology and risk. Reach 1 relies primarily on non-structural measures such as floodproofing, retreat, and building demolition, while reaches 2, 3, and 4 each prioritize protection at the existing shoreline with several structural measures including raising the shoreline, wharfs, and buildings; constructing new seawalls, floodwalls, bulkhead walls, berms, and levees; and employing nature-based features such as rocky intertidal bluffs, coarse beaches, marsh restoration/enhancement, ecological armoring, and naturalized embankments and shorelines. Additionally, the system will be designed to comply with seismic standards and includes seismic ground improvements for all structural measures. Since the Recommended Plan is adaptive to future conditions, a plan has been developed to monitor future conditions and provide thresholds when the adaptive measures of the system should be implemented.

COMPLIANCE WITH MARINE MAMMAL PROTECTION ACT: The MMPA and its implementing regulations allows, upon request, the incidental take of small numbers of marine mammals when engaging in specified activity (other than commercial fishing). Incidental take is unintentional, but not unexpected "take." The NOAA Fisheries Office of Protected Resources authorizes the incidental take of marine mammals under the MMPA. Since marine mammals are present within the San Francisco Bay and could be impacted if the project is implemented, the MMPA is triggered, and an Incidental Take Authorization (ITA) is needed.

After review of the requirements at 50 CFR § 216.104(a) and other documentation provided on the NOAA Fisheries website regarding application for an ITA[1], the NOAA Fisheries Office must be provided with 14 very specific and detailed pieces of information that is not available during the feasibility study phase, such as information on the frequency, source level, duty cycle, duration of use within a day of operation, directionality, and other important information about source characteristics and usage of equipment. Additionally, it was found that the permit is valid for a maximum of five years, with one year of potential renewal. Construction for the SFWS is not likely to begin within five years and the take permit would expire before it could be used. EP 1105-2-60, Environmental Evaluation and Compliance, Pre-Publication version dated April 2019, states that "For feasibility studies, where PED level of detail is needed to obtain an ITA, a project risk assessment will be conducted. With Headquarters (HQUSACE)

[1] https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act and https://www.fisheries.noaa.gov/national/marine-mammal-protection/apply-incidental-take-authorization

concurrence, the NEPA decision may be finalized with a condition to complete the MMPA ITA in the next phase but prior to construction."

MARINE MAMMALS POTENTIALLY PRESENT IN STUDY AREA:

The following marine mammals have the potential to occur in San Francisco Bay

Marine Mammal	**ESA Listed**	**Impacted by Project**	**Marine Mammal Hearing Group**	**Need for MMPA Permit**
Harbor seal *Phoca vitulina richardii*	No	Yes	Phocid pinnipeds (PW) underwater	Letter of Authorization (LOA)
California sea lion *Zalophus californianus*	No	Yes	Otariid pinnipeds (OW) underwater	LOA
Harbor Porpoise *Phocoena phocoena*	No	Yes	High frequency cetaceans	LOA
Common Bottlenose Dolphin *Tursiops truncatus*	No	Yes	Mid-frequency (MF) cetaceans	LOA
California gray whale *Eschrichtius robustus* (Eastern North Pacific DPS)	No	No	Low-frequency (LF) cetaceans	No
Humpback Whale *Megoptera noveangliae* (Mexico DPS)	Yes -- Threatened	No	Low-frequency (LF) cetaceans	No

METHODS OF IMPACT:

Marine mammals are considered harassed when exposed to elevated sound levels that may lead to mortality, temporary or permanent hearing impairment (threshold shift), non-auditory physical or physiological effects, and behavioral disturbance. NMFS has developed acoustic thresholds that identify the received level of underwater and in-air sound sources which exposed marine mammals would be expected to:

- Level A Harassment: incur a permanent threshold shift (PTS) of some degree or lung or gastrointestinal tract injury
- Level B Harassment: be behaviorally disturbed or incur a temporary threshold shift (TTS)

In-water and on-land construction activities that result in noise and vibration may result in incidental take (harassment) of marine mammals present in the area at the time of construction. The most common sources of noise and vibration associated with SFWS construction activities would be continuous, intermittent, and impulsive sound pressure generated from pile driving (vibratory and impact), pile removal, and drilling as needed to construct the seawall, t-walls, sheet-pile walls, wharfs, and seismic ground improvements. Underwater sound pressure from pile driving is generated using different types and sizes of piles and hammers, and in varied substrate types. Each measure-specific configuration can produce differing underwater sound pressure levels that affect each species differently. In-water impacts are anticipated to result in Level A and B Harassment for the four species. Additionally, Level B Harassment of these activities in addition to general presence of on-land

construction personnel and equipment activities is anticipated for sea lions and seals resulting from in-air noise sources.

With the level of detail available, there is certainty that pile driving and other activities known to cause disturbances to marine mammals is likely. It is also known that construction-related noise levels would vary throughout the day, depending on the type of equipment in use at any one time and the distance to the receptors. What is unknown is the exact number and type of equipment needed to complete each action, number of days and hours each piece of equipment is in use, the construction sequencing of specific activities (i.e. multiple activities ongoing at same time), timing/seasonality of construction, etc. This information is needed to analyze and understand the sound elevation levels and the impacts to the four species potentially impacted, as well as to complete an estimate of take. From this information, the request to NOAA Fisheries for an ITA can be made when all 14 specific pieces of information, as required by regulation (50 CFR 216.104(a)) can be addressed.

RISKS: Other feasibility studies have found that when they delay MMPA compliance it often affects their ability to secure Endangered Species Act (ESA) compliance during feasibility. This concern has been discussed with NOAA Fisheries staff who are working on the Biological Opinion for the project, and he indicated that this is not a concern with the SFWS because, while marine mammals are present and likely impacted, there are no listed marine mammals that would be impacted. As a result, the MMPA and ESA process will remain independent and should have no effect on one another.

There is no known risk to obtaining compliance during PED or in construction. For any actions which could impact marine mammals, there will be long lead times during PED, which should allow sufficient duration to complete the application and secure an LOA. The duration of the process is significant (about 15 months) and will be noted in the feasibility report and EIS as a critical consideration to planning PED activities and when implementing the Adaptative Management Plan. Since marine mammals and compliance with the MMPA are a common component of any project along the San Francisco waterfront and in the Bay, the conservation measures, best practices, and potential for mitigation are generally well understood and have been included in the cost estimates for construction. When the LOA is issued, there should not be any mitigation that was not already accounted for.

DISTRICT/DIVISION RECOMMENDATION: The Tulsa District recommends completing MMPA consultation during PED when additional project details are known and a complete application for Incidental Take Authorization can be made.

From: Callie Leiphardt - NOAA Federal
To: Fisher, Melinda CIV USARMY CESWF (USA)
Cc: Dan Lawson - NOAA Federal
Subject: [Non-DoD Source] Re: San Francisco Waterfront Coastal Flood Study
Date: Monday, July 29, 2024 10:25:01 AM

Thank you, Melinda! Please see our response below:

To whom it may concern:

On July 25th, 2024 National Marine Fisheries Service (NMFS) West Coast Region (WCR) Protected Resources Division (PRD) met with the Army Corp of Engineers (Corps) to discuss the San Francisco Waterfront Coastal Flood Study Project. After receiving a project overview, we agree with the Corps assessment of not applying for a Marine Mammal Protection Act (MMPA) Incidental Take Authorization at this time.

Based on the information that has been provided thus far, and the level of planning that has been completed, the Corp does not have enough information or detail of the construction action established to adequately apply for a Letter of Authorization (LOA), and it is unlikely that NOAA Fisheries' Office of Protected Resources (OPR) would consider allocating attention or resources to it at this time ahead of other projects with more pressing time constraints. With the start of the project being 5+ years away and a LOA being effective for a maximum of 5 years, it is not feasible or necessary to apply at this time.

Once the Corp has the appropriate information and project specifics required by regulation (50 CFR § 216.104(a)), you should plan to start the LOA application process at least 9 months prior to the project start date, although preferably 15 months or more ahead if possible, as some LOAs take longer to process.

Please reach out with any questions

Best,

Callie

On Thu, Jul 25, 2024 at 12:27 PM Fisher, Melinda CIV USARMY CESWF (USA) <Melinda.Fisher@usace.army.mil> wrote:

> Good Afternoon!
>
> Thanks for taking time to meet with me this morning. Please find below several links about the project.

StoryMaps: https://storymaps.arcgis.com/stories/6f7b4530c8bc42b4a29b68b703be4f6a

General Project Overview: https://sfport.com/wrp/draft-plan

Feasibility Report and EIS: https://sfport.com/wrp/draft-report

If you have any questions, please don't hesitate to reach out.

Thanks!

Melinda

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Melinda Fisher

Team Lead, NEPA and Natural Resources Section

Regional Planning & Environmental Center (RPEC)

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