BART Seismic Retrofit Project

Berkeley Hills Tunnel to the Montgomery Street Station

ENVIRONMENTAL ASSESSMENT

U.S. Department of Transportation
Federal Highway Administration

and the

State of California Department of Transportation

In cooperation with the

San Francisco Bay Area Rapid Transit District

August 2005

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U.S. Department of Transportation
Federal Highway Administration

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In cooperation with

San Francisco Bay Area Rapid Transit District

Date 8/18/05

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SUMMARY

S.1 PURPOSE OF THIS DOCUMENT

This Environmental Assessment (EA) analyzes the potential environmental impacts associated with the proposed seismic retrofit of the San Francisco Bay Area Rapid Transit (BART) system from the west portal of the Berkeley Hills Tunnel in Oakland, California, to the Montgomery Street Station in San Francisco (Figure 1-1). This EA is prepared in accordance with the National Environmental Policy Act (NEPA) because project funding is being provided by the U.S. Department of Transportation Federal Highway Administration. This document does not address the requirements of the California Environmental Quality Act (CEQA) because the Legislature has enacted a statutory exemption from CEQA for the proposed project (Public Utility Code section 29031.1). Pursuant to this exemption, on February 10, 2005, the BART Board of Directors adopted the proposed project for purposes of CEQA. In addition, completion of NEPA compliance by means of this EA is necessary in order to qualify for federal funding.

All figures cited in this section that start with a "1" are located in Chapter 1: Purpose and Need, and the figures beginning with a "2" appear in Chapter 2: Project Alternatives.

S.2 PROJECT SUMMARY

BART is conducting a comprehensive seismic retrofit program of its system in anticipation of a potential future major earthquake. The project area is located in the cities of Oakland and San Francisco, California (Figure 1-1). There would be no increase in capacity (number of BART trains or ridership) as a result of the seismic retrofit, and substantial changes in BART service are not expected to result during or as a result of the retrofit.

The project includes seismic retrofits of several facilities: the Transbay Tube (the portion of the BART system located beneath San Francisco Bay [Figure 1-2]); San Francisco Transition Structure (Figure 2-9); Oakland Transition Structure (Figure 2-7); the aerial (elevated) guideways that carry the tracks between the west portal of the Berkeley Hills Tunnel to the Oakland Transition Structure (Figure 2-16); and, Rockridge Station, MacArthur Station, and West Oakland Station. Every BART train crossing the Bay must pass through the Transbay Tube. Although the BART system could be operated independently on either side of the Bay due to crossovers at each end that allow BART to turn trains around, an impact to the Transbay Tube rendering it inoperable would immediately cut off train access to the opposite side of the Bay.

A variety of different retrofit methods would be used, depending on the BART facility to be retrofitted, as described below. Additional details of the project and each retrofit method are provided in Chapter 2, and associated construction activities are summarized in Table S-1. The proposed seismic retrofit activities would be conducted with no substantial impact to BART service. The project would require a total of approximately 6 years to complete, although the project could potentially take longer than 6 years if limited funds required the deferral of some retrofit activities. The analysis in this document is based on the assumption that adequate funding is available and, therefore, project activities would be completed in 6 years.

Table S-1. Summary of Project-Related Construction Activities

Construction Activity	*Transbay Tube*	*San Francisco Transition Structure*	*Oakland Transition Structure*	*Aerial Guideways*	*Stations*	*Other Retrofits*
In-water Excavation/Dredging	X	X				
Dredged Material Disposal	X	X				
In-water Pile Installation	X	X				
Sediment Strengthening	X	X				
Foundation Strengthening				X	X	
Column Strengthening				X	X	
Land-based Pile Installation				X	X	
Building Frame Strengthening			X		X	X

Proposed seismic retrofits of the Transbay Tube include either micropile anchorage (installing small tension piles through the floor of the Tube to connect it to more stable clay soils below San Francisco Bay [Figure 2-2]), or vibro-replacement (compacting the sediment surrounding the Tube and reinforcing these sediments with stone columns for the length of the Tube under San Francisco Bay and onshore at the Port of Oakland [Figures 2-3 and 2-4]). In addition, stitching the Tube near both transition structures (installing clusters of large-diameter steel piles around the Tube [Figures 2-5 and 2-6]) and installing a tunnel liner sleeve at one of the seismic joints is proposed (Figure 2-8).

Proposed seismic retrofits at the San Francisco Transition Structure include either a combination of activities called the Steel Piles Retrofit Concept (Figures 2-10 and 2-11) or the Isolation Walls Retrofit Concept (Figures 2-14 and 2-15). The Pile Array Retrofit Concept consists of pile array (installing about 100 steel pipe piles beneath the Ferry Plaza Platform west of the transition structure), piles and collar anchorage (installing large-diameter steel piles around the transition structure and connecting them together with a large collar), containment structures (installing a water-resistant structure around the seismic joints), and sacrificial walls (installing concrete walls around the transition structure from the mud line up to the immediate underside of the Ferry Plaza Platform). The Isolation Walls Retrofit Concept consists of isolation and support walls (installing 2 rows of large concrete piles or reinforced concrete walls along both the north and south sides of the transition structure), pile array (installing about 26 steel pipe piles beneath the Ferry Plaza Platform west of the transition structure), and similar to the Pile Array Retrofit Concept, containment structures and sacrificial walls. To strengthen the sediments around the BART approach tunnels west of the transition structure, either retrofit concept would also include soil jet grouting (pumping a slurry mixture into the deep Bay mud around the BART approach tunnels). Part of the Ferry Plaza Platform would be temporarily removed during seismic retrofits at the San Francisco Transition Structure, but would be replaced once completed. Installation of steel pipe piles would use oscillating or rotating techniques, to the extent feasible. Seismic retrofits requiring excavation or dredging would be conducted within a temporary construction steel sheet pile wall placed from just below the mud line to the water's surface, to reduce turbidity and release of construction debris into Bay water. The above-grade portion of the Oakland Transition Structure requires strengthening the existing steel bracing with newly reinforced concrete shear walls.

Proposed seismic retrofit of the aerial guideways would typically include enlargement of the existing foundation, jacketing of the concrete columns with steel casings or collars, placement of additional shear keys at the hammerhead caps, and installation of additional piles, if needed (Figure 2-16). Installation of new piles would use impact hammer and non-impact drilling techniques (i.e., an oscillating or rotating hydraulic installation system). Some of the multi-column piers (piers that have between two to six columns instead of just one) also would require infill concrete walls between the columns. At some abutment[1] locations, concrete catchers or seat extenders would be added to increase the available seating area for the girders on the abutments.

BART stations along the project alignment are located on elevated platforms (aerial platforms), at-grade, or underground. Rockridge Station and West Oakland Station, both aerial stations, would require similar types of seismic retrofits described above for the aerial guideways to minimize structural damage and prevent potential collapse. For example, new column steel jacketing would be installed on the columns, and new concrete blocks would be placed at the top of some pier caps at Rockridge Station (Figure 2-19). At West Oakland Station, new concrete grade beams would be installed to connect all of the column footings together, and joint connections of the platform canopies would be strengthened. Installation of any necessary piles at the stations would use impact hammer and non-impact drilling techniques (i.e., an oscillating or rotating hydraulic installation system).

Proposed seismic retrofit at MacArthur Station, an at-grade station, would include adding piles and enlarging footings using similar methods to those described above. The station walls would be thickened, new footings installed, and joint connections of the platform canopies strengthened. The four underground stations associated with the project area (19th Street-Oakland, Oakland City Center/12th Street, Embarcadero, and Montgomery Street) do not require seismic retrofitting.

Proposed seismic retrofit measures for the Oakland Yard and Shop area, located on BART property (see number 38 on Figure 2-18), would include additional diagonal bracing of framing elements and strengthening of structural joints within the existing frame to minimize the effects of a potential earthquake.

S.3 IDENTIFICATION OF AGENCY ROLES

BART is the applicant for this project. The federal lead agency under NEPA is the U.S. Department of Transportation Federal Highway Administration (FHWA). Money from FHWA will pass through the Local Assistance Program of the California Department of Transportation (Caltrans) to fund the proposed seismic retrofits. This document has thus been prepared with the input of FHWA, as well as BART and Caltrans, who are acting as nonfederal co-lead agencies under NEPA. Cooperating agencies for this project include National Oceanic and Atmospheric Administration (NOAA) Fisheries, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Coast Guard, Regional Water Quality Control Board, San Francisco Bay Conservation and Development Commission, California Department of Fish and Game, State Lands Commission, City of Oakland, Port of Oakland, and Port of San Francisco.

1 An abutment is a wall supporting the end of a bridge or span and sustaining the pressure of the abutting earth.

S.4 PURPOSE OF THE PROJECT

The purpose of the project is to protect life safety[2] and the massive public capital investment represented by the permanent stationary facilities of the BART system, and to prevent prolonged interruption of BART service to the public. The portion of the BART system proposed for seismic retrofit is important to the overall transportation system in the region, and disruption could severely affect local transportation and circulation, especially across the San Francisco Bay. BART carries as many passengers during weekday rush hour as the San Francisco-Oakland Bay Bridge (BART 2004a). The proposed seismic retrofit would reduce the risk to, and improve the safety of, BART patrons and personnel during an earthquake. The project is designed to enhance the safety of passengers and personnel and to enable the BART system to return to operation within a reasonable timeframe after an earthquake. More detail on the purpose of the project is included in Chapter 1.

S.5 SUMMARY OF ENVIRONMENTAL IMPACTS

The project would result in environmental impacts only during construction. Once the proposed seismic retrofit work is completed, there would be no environmental impact. There would be construction related impacts on eleven environmental resource areas: water resources; noise; cultural resources; transportation (ground and vessel); geology/seismicity; hazardous materials; risk of upset/safety; visual resources; biological resources; air quality; and social (or community) resources. All impacts would be avoided or limited by implementation of procedures proposed as part of the project, and by mitigation measures described in this document.

Chapter 3 describes the impacts and mitigation measures for the project.

2 For the purposes of the seismic retrofit project, life safety is the level of retrofit that will provide a low risk of endangerment to human life for any event likely to affect the retrofitted structure. In general, non-collapse of a structure is considered adequate to provide life safety.

1.0 PURPOSE AND NEED

1.1 INTRODUCTION

The San Francisco Bay Area Rapid Transit (BART) District is conducting a comprehensive seismic retrofit program to strengthen the BART system in anticipation of a potential future major earthquake. The objectives of the seismic retrofit program are twofold: (1) to protect life safety[1] and the massive public capital investment represented by the permanent stationary facilities of the BART system, and (2) to prevent prolonged interruption of BART service to the public. There would be no increase in capacity (number of BART trains or ridership) as a result of the seismic retrofit.

This Environmental Assessment (EA) analyzes the potential environmental impacts associated with the BART Seismic Retrofit Project (the project), which includes seismic retrofits for the Transbay Tube, San Francisco Transition Structure, Oakland Transition Structure, the aerial (elevated) guideways that carry the tracks between the west portal of the Berkeley Hills Tunnel to the Oakland Transition Structure, and the West Oakland Station, MacArthur Station, and Rockridge Station. Every train in the BART system that crosses the San Francisco Bay (the Bay) must pass through the Transbay Tube. Although the BART system could be operated independently on either side of the Bay due to crossovers at each end that allow BART to turn trains around, an impact to the Transbay Tube rendering it inoperable would immediately cut off train access to the opposite side of the Bay.

The U.S. Department of Transportation Federal Highway Administration (FHWA) has prepared this EA in accordance with the 1969 National Environmental Policy Act (NEPA), 42 United States Code (U.S.C.) §§ 4321-4370d, as implemented by the Council on Environmental Quality (CEQ) Regulations, and U.S. Department of Transportation (DOT) *Federal Transit Administration Procedures*, 23 Code of Federal Regulations (CFR), Chapter 1, Subchapter H, Part 771, Section 771.119 (EAs) and Section 771.135 (Section 4[f] 49 U.S.C. 303). This document is not required to address the requirements of the California Environmental Quality Act (CEQA) because the Legislature has enacted a statutory exemption from CEQA for the project (Public Utility Code section 29031.1). Pursuant to this exemption, on February 10, 2005, the BART Board of Directors adopted the proposed project for purposes of CEQA. In addition, completion of NEPA compliance by means of this EA is necessary in order to qualify for federal funding.

1.2 LOCATION OF PROPOSED ACTION

The project area is located in the cities of Oakland and San Francisco (Figure 1-1). The project begins at the west portal of the Berkeley Hills Tunnel, continues southwest to Rockridge Station, south to MacArthur Station, south to 19th Street – Oakland Station and Oakland City Center/12th Street Station (both underground stations), west to West Oakland Station, west through the Transbay Tube beneath the Bay, and terminates at the Montgomery Street Station.

1 For the purposes of the seismic retrofit project, life safety is the level of retrofit that will provide a low risk of endangerment to human life for any event likely to affect the retrofitted structure. In general, non-collapse of a structure is considered adequate to provide life safety.

The total length of the project is 12.3 miles. This portion of the BART system is located in a largely urbanized area.

1.3 DESCRIPTION OF THE EXISTING BART SYSTEM

The original BART system was constructed between 1964 and 1972 using cutting-edge design and engineering techniques. The original system consisted of approximately 72 miles of track and 34 stations. Since then, new track and stations have been added to the system so that it now consists of 104 miles of track, connecting communities in Contra Costa, Alameda, San Francisco, and San Mateo counties with 43 stations. The system is a combination of aerial, underground, and surface track, which is separated from general vehicular traffic.

The portion of the BART system analyzed in this EA (the project area) consists of approximately 12.3 miles of track, of which 2.5 miles are located at-grade (surface level), 3.3 miles are on aerial structures supported by columns, and 6.5 miles are underground or underwater (the Transbay Tube is underwater for 3.6 miles). Between the west portal of the Berkeley Hills Tunnel and the northern portal of the tunnel through downtown Oakland, BART tracks are at-grade (surface level) or on a raised earthen-berm, except where they pass over streets. When passing over streets, BART tracks are located on aerial structures supported by columns. For most of this portion of the BART system, the tracks are located in the median of State Route 24.

Between the western portal of the downtown Oakland tunnel and the eastern portal of the Transbay Tube, BART tracks are on a continuous aerial guideway supported by columns. This is called the West Oakland Aerial Guideway (see Figure 2-18). The transition between the West Oakland Aerial Guideway and the Transbay Tube is called the Aerial Transition Structure (Location #37 on Figure 2-18).

The most common aerial structure along the BART system consists of a single-column reinforced concrete column bent[2] or pier on either pile-supported or spread concrete footings. There are 342 concrete column bents within this portion of the BART system. BART stations along the project alignment are located either at-grade, underground, or on elevated platforms (aerial stations). Seismic retrofits at the three stations shown in bold on Figure 1-1 - Rockridge Station, MacArthur Station, and West Oakland Station - are analyzed in this EA.

The Transbay Tube is 3.6 miles long and is buried in an underwater trench in the Bay, at a maximum depth of 132 feet below mean sea level. The eastern end of the Tube begins in the Port of Oakland, between 7th Street and Berth 32, and continues beneath the Bay to a point just east of the San Francisco Ferry Building (Figure 1-2). The Tube was constructed as a double pipe, giving it a binocular shaped cross-section. A transition structure[3] was installed at each end of the Tube, one just east of the San Francisco Ferry Building called the San Francisco Transition Structure, and one in the Port of Oakland called the Oakland Transition Structure. The San Francisco Transition Structure is located in the Bay (in water) while the Oakland Transition Structure is located on land. Four special seismic joints were constructed at the transition structures; these joints connect the Tube to the rest of the BART

2 A column bent (also known as a pier or pier bent) consists of the entire structure supporting the trackway girders, including the foundation, the column(s), and the bent cap.

3 Transition Structures are used to evacuate smoke and allow air into the Transbay Tube.

Figure 1-1. Project Vicinity Map Showing Project Area

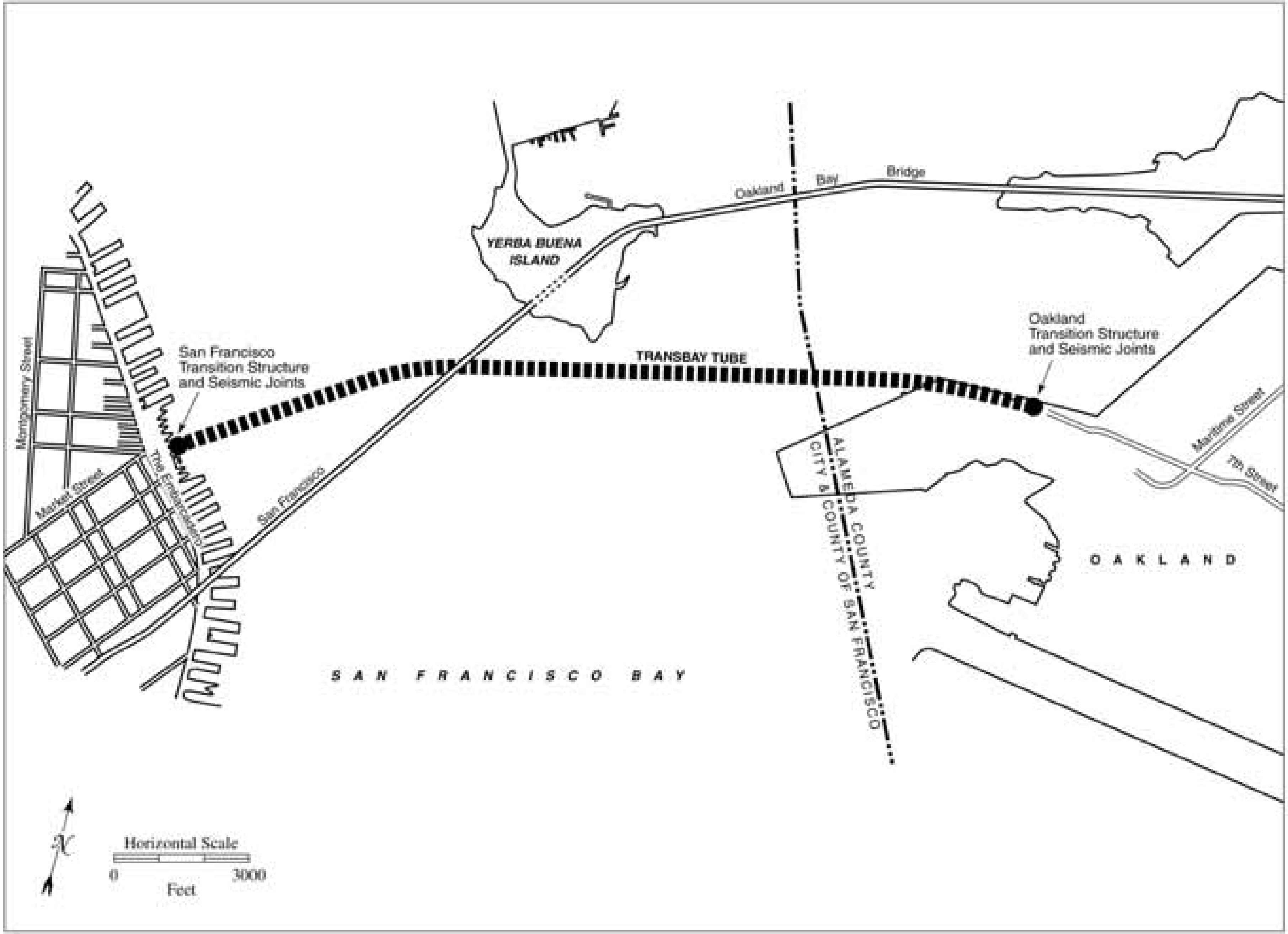

Figure 1-2. Project Vicinity Map of the Transbay Tube and Transition Structures

system and allow some movement of the system in response to seismic activity. Two seismic joints at the San Francisco end, one on either side of the transition structure, are located in the Bay just east of the Ferry Building. Two joints at the Oakland end, one on either side of the transition structure, are located on land within the Port of Oakland.

1.4 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the project is to protect life safety and the massive public capital investment represented by the permanent facilities of the BART system, and to prevent prolonged interruption of BART service to the public. Seismic retrofit studies (BART 2002a, 2002b) suggest that substantial damage to BART facilities would occur from a major earthquake. Therefore, the project is needed to reduce the risk to, and improve the safety of, BART patrons and personnel during an earthquake.

The BART system's seismic capability was tested on October 17, 1989, with the 7.1-magnitude Loma Prieta earthquake. The earthquake caused extensive damage and disruption to transportation systems throughout the San Francisco Bay Area (Bay Area). The BART system suffered only minor damage, and repairs to crucial system components were completed in time to declare the system operational by the next morning (BART 2002a). It acted as one of the only major links between San Francisco and Oakland after the earthquake until the San Francisco-Oakland Bay Bridge was restored. With the Bay Bridge out of use for a full month, the region was dependent on the BART system for transportation between San Francisco and the East Bay. BART's performance during that period resulted in an increase in daily ridership from 218,000 commuters to 350,000 (BART 2004a). BART's ability to withstand the Loma Prieta earthquake was attributed to its superior design.

While BART's original design was advanced for its time and helped the system withstand the Loma Prieta earthquake, a larger seismic event could occur in the Bay Area in the near future. Recent U.S. Geological Survey (USGS) statistical analysis indicates there is a 62 percent probability a major earthquake will affect the Bay Area before the year 2030 (USGS 2003c). Because portions of the BART system are located near or cross the Hayward, Calaveras, Concord, and San Andreas fault lines, the system could be adversely affected by a seismic event on any one of these faults. For example, the backfill surrounding the Transbay Tube is prone to the phenomenon of liquefaction[4] resulting from an earthquake. Liquefaction could cause the Tube to become buoyant, resulting in vertical movement (i.e., uplift) and potential structural failure of the Tube along the alignment. Liquefaction could also reduce or eliminate the backfill surface friction on the Tube, resulting in excessive longitudinal movement relative to the seismic joints. Excessive longitudinal movement could cause one or more of the seismic joints to break, which could cause Bay water to leak into the Tube. Since the Transbay Tube is submerged, any potential structural deficiency could threaten the safety of BART personnel and passengers and would cause a complete shutdown of the Tube. The Transbay Tube could require 2 years or more to be restored to service. A major earthquake could also damage BART stations and aerial guideways, rendering some inoperable. Temporary shoring would be

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4 Liquefaction refers to the potential for sediments covering the Transbay Tube to liquefy during an earthquake. Liquefaction is a form of seismically induced ground failure, in which saturated loose sandy sediments lose their strength, change from a solid state to a liquid state, and become unstable. Liquefaction occurs most commonly in areas with a high water table.

employed to bring some of these structures back to service quickly, but permanent repairs are estimated to require approximately 15 months to complete.

The portion of the BART system proposed for seismic retrofit is important to the overall transportation system in the region, and disruption could severely affect local transportation and circulation, especially across the San Francisco Bay. BART is estimated to carry more than 150,000 persons daily across the Bay, including more than 30,000 persons during peak hours, which is as many passengers accommodated by the San Francisco-Oakland Bay Bridge during weekday rush hour (FHWA and Caltrans 1998; BART 2004a). The Alameda-Contra Costa Transit District offers 654 daily bus trips over the Bay Bridge and has a current ridership of approximately 13,000 persons, with up to 3,000 persons during rush hour (FHWA and Caltrans 1998). The Bay Bridge is currently operating at capacity (FHWA and Caltrans 1998), and adding additional vehicles would create severe congestion and delay.

The damage to the BART system from a major earthquake would require BART riders to seek other means of transportation for an extended period. It is estimated that only 27 percent of the approximately 300,000 daily BART riders would be able to use the system immediately after the earthquake, and additional capacity would not begin to become available for approximately 6 months. Capacity would not reach 50 percent of the pre-earthquake ridership until approximately 15 months after the earthquake event. As repairs to the Transbay Tube would take over 2 years, BART would not support travel across the Bay until several years after a major earthquake event (BART 2002a, 2002b). During this time, transbay travelers would have to use alternate travel modes, potentially resulting in up to 300,000 additional trips competing for space on a damaged roadway system. The additional trips would contribute to increased delays during peak traffic hours, estimated to be 60 to 80 minutes along the State Route 24 corridor (BART 2004a).

It is not certain what other types of transportation BART riders would use, since other transportation modes would also be damaged during the earthquake, but BART studies assumed that most would attempt to drive to work. Others may be able to use non-BART public transportation or telecommute. Following the Loma Prieta earthquake, ferries remained in service; ferry service across the Bay is expected to be available in the event of a future earthquake (San Francisco Bay Water Transit Authority [WTA] 2002). However, it is unlikely that other modes of transportation, even with an expanded ferry service, could fully accommodate displaced BART riders.

With regard to economic losses, the BART *Seismic Risk Analysis* (BART 2002b) estimates that potential direct repair costs of a large earthquake on the entire existing BART system is $1.326 billion. The estimated costs for repairing the BART system between the Berkeley Hills Tunnel and Montgomery Street Station would exceed $570 million, the majority of which would be to repair the Transbay Tube. This estimate does not take into account indirect impacts, such as the cost to BART commuters of finding other transportation, the cost to non-BART commuters due to increased traffic congestion as a result of the loss of BART service, or the severe impact to the Bay Area economy due to a closure of BART. In comparison, the cost of the retrofit project is estimated to be about $447 million, and would have the added benefit of enhanced safety for passengers and personnel and would enable the BART system to return to operation within a reasonable timeframe after an earthquake.

2.0 PROJECT ALTERNATIVES

2.1 ALTERNATIVE DEVELOPMENT PROCESS

The proposed action addressed in this document is a seismic retrofit project for a portion of the existing BART system (the project). The CEQ's Regulations for Implementing the Procedural Provisions of NEPA establish a number of policies for federal agencies, including "...using the NEPA process to identify and assess the reasonable alternatives to the proposed action that will avoid or minimize adverse effects of these actions on the quality of the human environment" (40 CFR 1500.2 [e]). Thus, this document only addresses those alternatives that could reasonably avoid or minimize adverse effects of the proposed action. Because the action is an improvement of an existing facility in its current location, does not include adding new facilities, and would not increase the capacity of the system, the only alternatives considered are the proposed action and the no-action alternative. There are no other reasonable alternatives.

The CEQ NEPA implementation regulations require the analysis of the no-action alternative. In addition, analysis of the no-action alternative provides a baseline against which to compare the impacts of the proposed action. This chapter describes the basic components of the proposed action and no-action alternative, and explains why potential alternative design options were eliminated from further discussion.

2.2 PROPOSED ACTION

The project description below is based on the following two key references:

- *BART Seismic Vulnerability Study* (BART 2002a), and
- *Seismic Risk Analysis* (BART 2002b).

The *BART Seismic Vulnerability Study* is ongoing, and future work may validate or refine the engineering concepts discussed below. It may be determined at a future date that specific seismic retrofits can be eliminated or minimized without an increased risk to life safety or prolonged interruption to BART service.

BART conducted a variety of seismic studies (BART 2002a) to identify key facilities within the existing system that could be seriously affected by a large earthquake. The *BART Seismic Vulnerability Study* determined that not all facilities between the west portal of the Berkeley Hills Tunnel and Montgomery Street Station require seismic retrofit. The facilities that require seismic retrofit include the Transbay Tube; transition structures (San Francisco and Oakland); the aerial guideways between the west portal of the Berkeley Hills Tunnel and Montgomery Street Station; three stations (West Oakland, MacArthur, and Rockridge); and the Oakland Yard and Shop area.

2.2.1 Transbay Tube

The Transbay Tube is located between the Oakland and San Francisco transition structures and is 3.6 miles long (see Figure 1-2). It consists of 57 steel sections, each about 330 feet in length. The sections are welded together and reinforced with a concrete liner. The Transbay Tube was installed by dredging a trench along the Bay bottom and laying a 2-foot thick layer of gravel to the bottom of the trench (the foundation course on Figure 2-1). The Tube sections were lowered onto the gravel and additional gravel (special fill[1]) was placed at the sides of the Tube, reaching about half way up. The Tube was then covered with sand/gravel fill material (ordinary fill[2]). No compaction of either the gravel or fill layer was conducted.

Seismic retrofit studies have determined that the fill surrounding the Transbay Tube may be prone to the phenomenon of liquefaction.[3] Liquefaction could cause the Transbay Tube to become buoyant, resulting in vertical movement (i.e., uplift) and potential structural failure of the Tube along the alignment. Liquefaction could also reduce or eliminate the backfill surface friction on the Tube, resulting in excessive longitudinal movement relative to the seismic joints. Excessive longitudinal movement could cause one or more of the seismic joints to break, which could cause water to leak into the Tube. Since the Tube is submerged, any potential structural deficiency could threaten the safety of BART personnel and passengers and would cause a complete shutdown of the Tube.

Two alternative design methods, micropile anchorage and vibro-replacement, are included as part of the project to minimize the potential effects of liquefaction. Additional analysis and testing are needed to determine the technical feasibility of both methods. BART will conduct additional tests to verify feasibility and effectiveness, after which a decision will be made before the completion of final project design regarding where, and to what extent, vibro-replacement and/or micropile anchorage will be used.

The project also includes stitching the Tube and installing a tunnel liner sleeve to further strengthen the Tube's seismic joint from structural failure. These design methods, described below, would be employed regardless of whether the micropile anchorage or vibro-replacement method is chosen for implementation. The vibro-replacement method may reduce the need for pile stitching, thus reducing the environmental impact of the project. Additional seismic design methods specifically associated with the transition structures are discussed in section 2.2.2.

No disruption to BART service is anticipated during any retrofit method associated with the Transbay Tube. It is anticipated that construction staging areas for supporting work on the Transbay Tube, as well as the San Francisco Transition Structure (see section 2.2.2), would be located on the Bay waterfront and would be capable of allowing barge loading and unloading. Two potential construction staging areas include Piers 94 and 96 along the Oakland side of the Bay, within a primarily industrial area.

1 Special fill is large-diameter gravel specified by BART at the time the Transbay Tube was constructed. This fill is generally very coarse, ranging from ¼-inch size up to as large as 4-inch size. This term was created during the original construction of the BART system because this very coarse material is unusual in construction and would have had to be specially located and procured for construction of the Transbay Tube.

2 Ordinary fill is sandy material that has a finer gradation.

3 Liquefaction is a form of seismically induced ground failure, in which saturated loose sandy sediments lose their strength, change from a solid state to a liquid state, and become unstable. Liquefaction occurs most commonly in areas with a high water table.

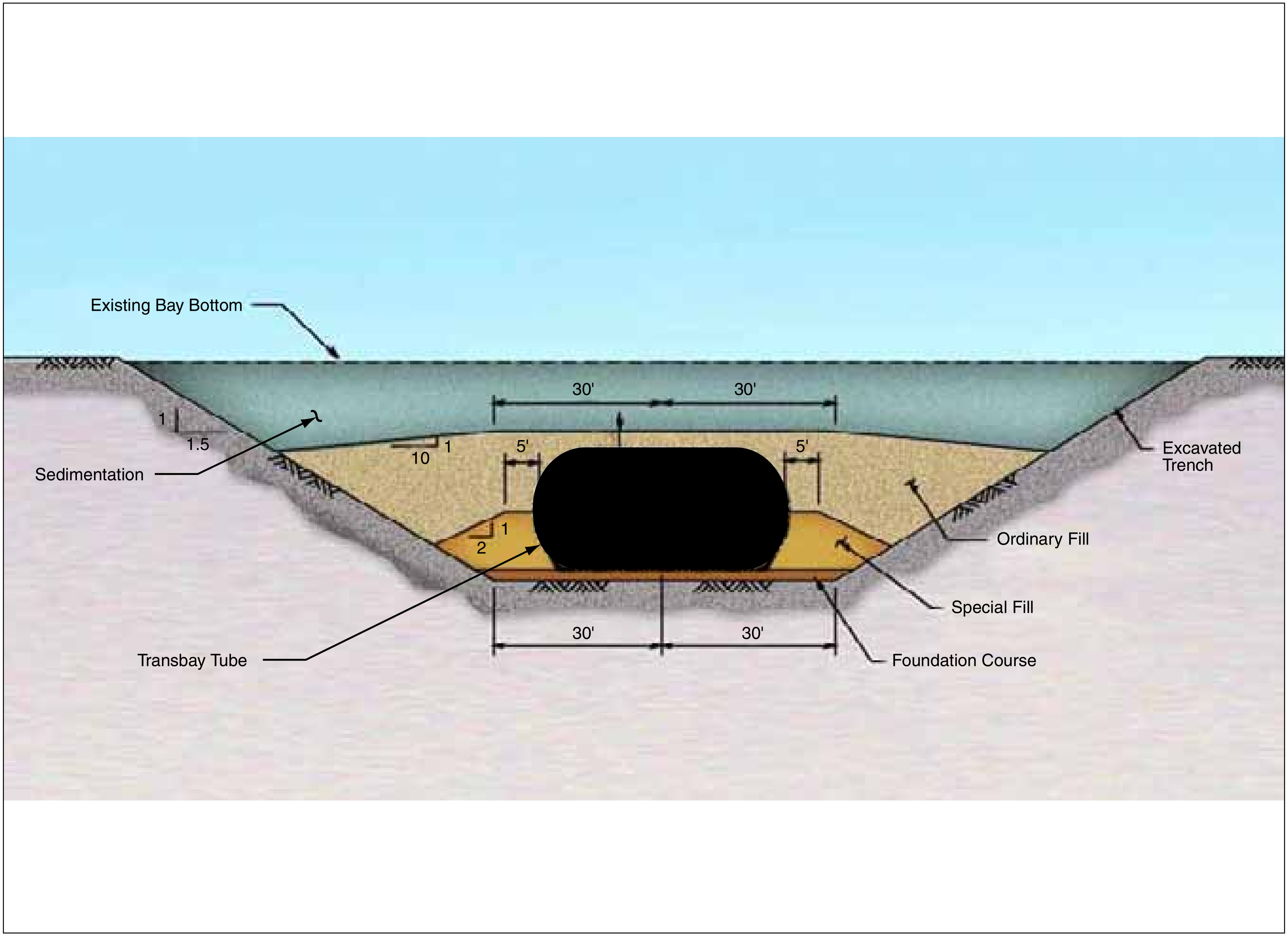

Figure 2-1. Section of Transbay Tube Showing Existing Soil Conditions

Prior to commencement of construction activities, all contractors working on or in the vicinity of the Transbay Tube will prepare Site Specific Work Plans that include emergency procedures and specific measures to prevent compromising the integrity of the Tube. All equipment and personnel necessary to perform emergency repairs on the Transbay Tube will be in the construction vicinity at all times during active construction on, or in the vicinity of, the Transbay Tube.

Micropile Anchorage (Figure 2-2)**.** Along the entire length of the Transbay Tube, small (7¾-inch diameter) tension piles, referred to as micropiles, would be installed through the floor of the Tube's existing central gallery[4] and would extend downward to more stable strata (e.g., clay below the Bay Mud) below the Tube. By anchoring the Tube to firmer soils, the upward buoyant force of an earthquake would be resisted even though the material surrounding the Tube may liquefy.

Approximately 2,200 micropiles would be installed along the length of the Tube, for an average of about 38 micropiles per 330 feet of Tube length. The length of the micropiles would depend on the depth of the more stable strata, and may extend up to 100 feet below the bottom of the gallery. To install the micropiles, holes would be drilled from the floor of the gallery and then casings installed. The micropile casings would house an embedded rod with a pressure-grouted concrete bulb at the tip (Figure 2-2).

Since the drilling would occur 40 to 60 feet below the Bay bottom, and spoils and drill muds from the holes would be taken into the gallery, no spoil or drilling mud debris would enter the water column. Spoils and drilling muds would be collected and contained during the operation, and transported through the Tube on the trackways to the East Portal of the Tube in Oakland; there they would be loaded onto approved trucks to be hauled for disposal at an approved disposal site. Three potential disposal sites include Altamont Landfill, Redwood Landfill, and Vasco Road Landfill. The estimated volume of waste solids would be 5,500 cubic yards (cy) (2.5 cy/hole x 2,200 holes), consisting of Bay sediments underlying the Tube and drill muds.

Vibro-Replacement (Figure 2-3). An alternative design method to micropile anchorage would be to conduct vibro-replacement along the full length of the Tube. The Tube backfill consists of special fill and ordinary fill, as described above. Vibro-replacement would consist of compaction of the special fill and ordinary fill, and placement of stone columns in a grid pattern about 6 feet by 6 feet on both sides of the Tube to densify the backfill around the Tube. Sediments would be densified from the existing relative density of 40 percent to a relative density of 60 to 70 percent.[5] Denser sediments surrounding the Tube would act to stabilize or anchor the Tube in the event of an earthquake. Liquefaction can only occur in loose granular soils, so densifying the material prevents this phenomenon from occurring. If there is no liquefaction, the uplift of the Tube would not occur. After the Loma Prieta earthquake, vibro-

4 The gallery is the central area between the two train tracks inside the Transbay Tube; the gallery is used as a work area and provides a space for people to walk if they need to evacuate a train located inside the Tube.

5 Every soil has a maximum density that can be achieved, regardless of how much compactive effort is applied. Relative density is the ratio between the density of the soil being considered and its maximum density.

replacement was used to install stone columns at the Matson Marine Terminal at the Port of Oakland (Geomatrix 1991, 1995a, 1995b).

Stone columns would be constructed using a vibratory probe. After the probe penetrates to the desired depth of treatment, stone fill would be deposited into the hole from the ground surface or through feed tubes to the tip of the probe as it is withdrawn. Stone columns would be placed in the surrounding backfill material and not in the sediments above the Tube, and would not extend above the existing Bay Mud surface. A total of approximately 25,000 stone columns would be placed in the backfill along the sides of the Tube. The length of the stone columns would be approximately 32 feet each. Assuming that the stone columns would be about 3 feet in diameter, a total of about 200,000 cy of stone would be placed along the Tube below the mudline. Possible sources of the stone include quarries in the San Rafael and Napa areas north of the Bay; stone would be loaded on barges near the quarries and delivered to the vibro-replacement sites by tugboats, as needed. The final pattern of the stone columns and their spacing would be determined through a vibro-replacement demonstration program. Since the stone in the stone columns would be displacing the voids in the existing uncompacted Tube backfill, no additional fill would be added to the Bay bottom.

Vibro-replacement would be performed from a barge-mounted operation simultaneously on both sides of the Tube to avoid unbalanced lateral pressures. The vibration would be limited in intensity so that it would not impact the structure of the Tube (the types of equipment used make minimal noise and vibration) and would be implemented in a sequence to minimize differential settlement along the Tube. The compaction of the special fill and ordinary fill, and placement of stone columns would be performed so that operations would occur 5 to 20 feet below the Bay Mud surface thereby minimizing, if not eliminating, any disturbance of the surface of the Bay Mud. A template may be used at the bottom of the Bay, as shown on Figure 2-3, to assist in accurate positioning of the stone columns. The template steel frame would be supported on spud piles pushed into the Bay, which would keep the template off of the Bay bottom. When relocating, the template would be lifted to extract the spud piles from the Bay bottom, and would be repositioned and supported again by the spud piles in its new location. The template would not be dragged across the bottom; the only portion of the template that would come into contact with the Bay bottom would be the supporting spud piles.

Two barge-mounted vibro-replacement operations within the Bay would operate simultaneously, both beginning in the open Bay with one barge working toward San Francisco and the other working toward Oakland. Concurrently, there would be a barge installing stitching at the San Francisco end of the Tube (see below), but it is anticipated that stitching operations would be completed before the vibro-replacement operations reached that area. In order to avoid blocking the entrance to the Port of Oakland Outer Harbor Entrance Channel with construction barges, it may be necessary to use the micropile anchorage method instead of vibro-replacement for seismic retrofitting the portion of the Tube within the Entrance Channel (see section 3.4.2 for more details).

Vibro-replacement on the land side at the Port of Oakland (Figure 2-4) would be performed in the same manner and sequence as the marine-based operation except that barges would not be

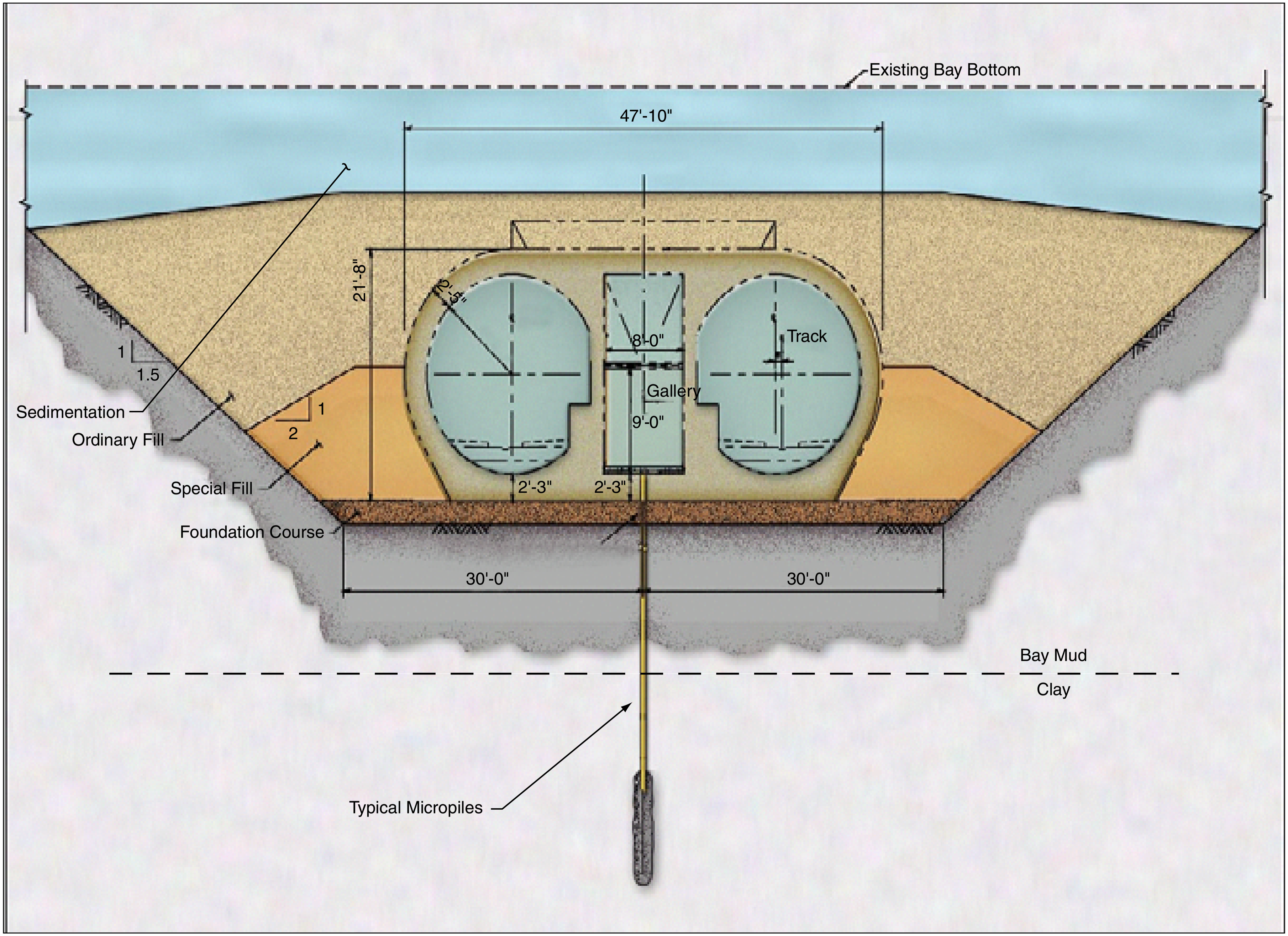

Figure 2-2. Retrofit Concept — Micropile Anchorage Along the Transbay Tube

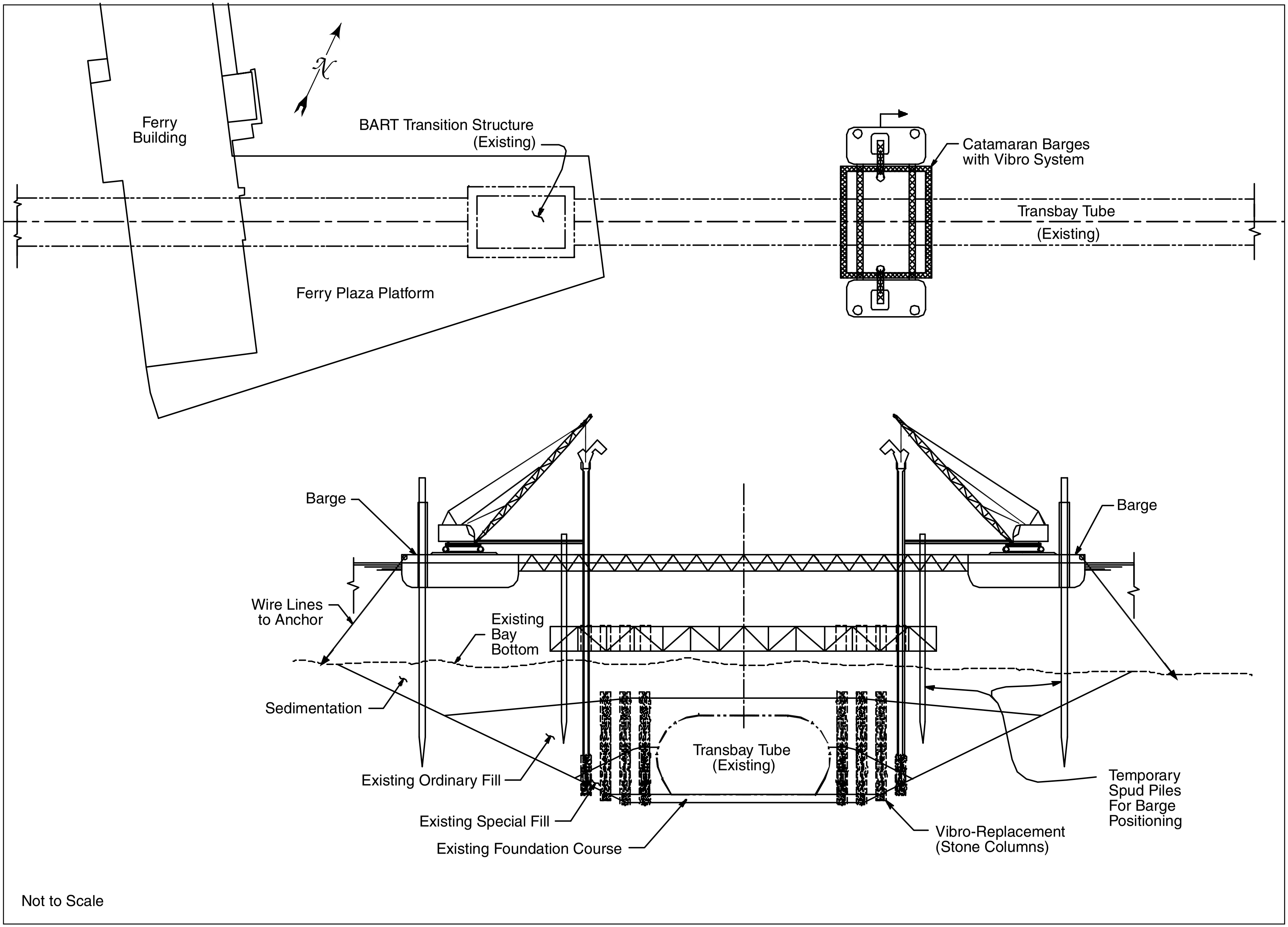

Figure 2-3. Retrofit Concept — Vibro-Replacement at the San Francisco End

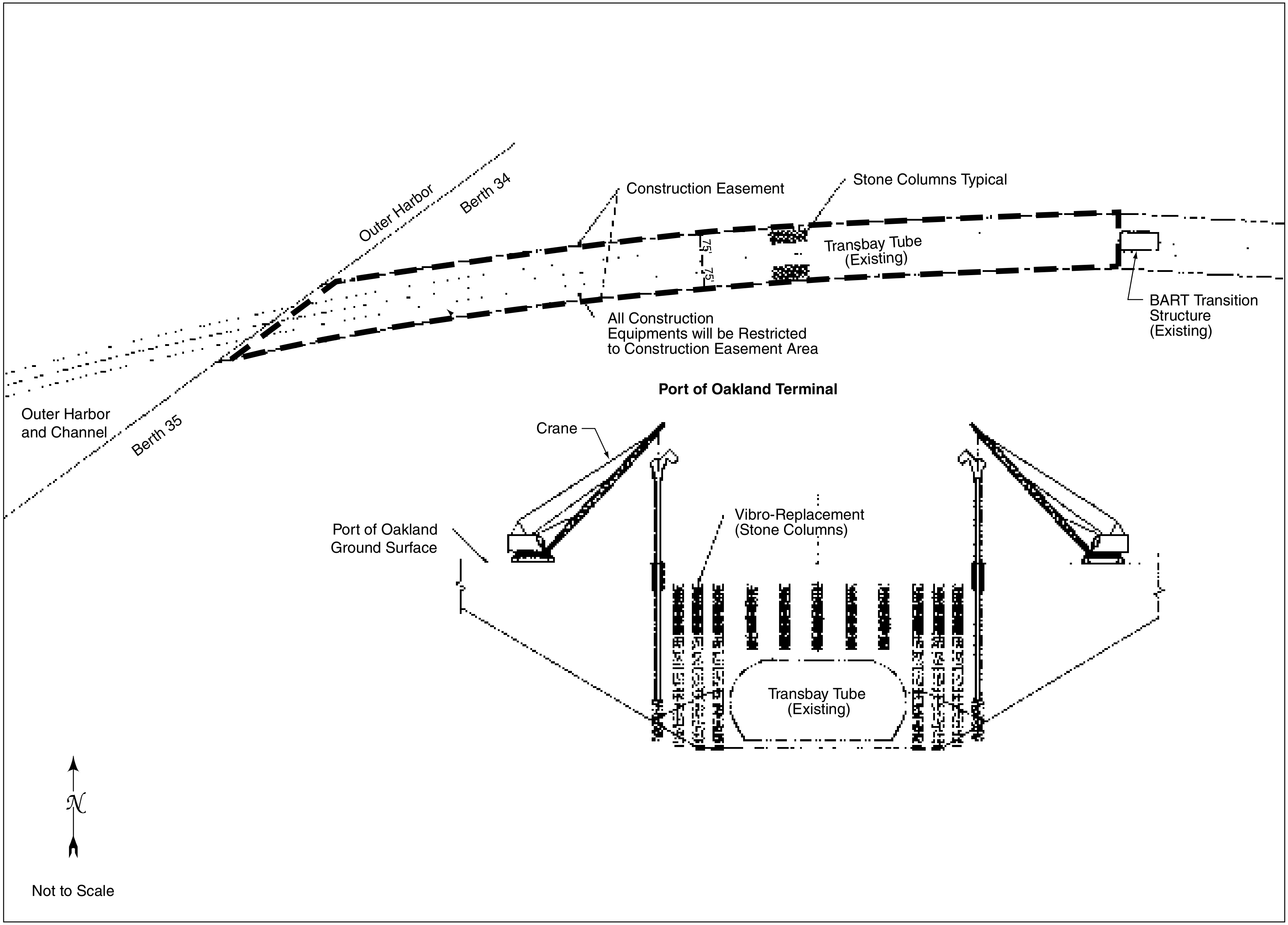

Figure 2-4. Retrofit Concept — Vibro-Replacement at the Oakland End

required. The vibro-replacement construction envelope would be contained within the BART easement[6] along the length of the Tube. The estimated length of the area occupied by equipment, actual treatment area, and pavement preparations would total 250 feet to 300 feet at any given time. The vibro-replacement construction may impact the Port of Oakland's terminal in sections measuring up to 300 feet long by 150 feet wide. This retrofit measure would be tested in a demonstration program and, if it is determined to be effective, vibro-replacement would be recommended as a viable alternative to the micropile anchorage concept to minimize the potential effect of liquefaction of the backfill surrounding the Tube. If the micropile anchorage method was employed instead of the vibro-replacement on the entire length of the Tube, then vibro-replacement techniques would still be used on the San Francisco side of the Bay to further densify materials. Backfill material that surrounds the 2,000 linear feet of the underwater Tube east of the San Francisco Transition Structure would be compacted to increase its density from the existing 40 percent to 60 to 70 percent.

Vibro-replacement activities near the San Francisco Transition Structure would require use of noise-generating construction equipment near sensitive (commercial) uses, such as the San Francisco Ferry Plaza, restaurants, and professional office buildings. To screen these uses, the construction contractor will install and maintain temporary noise control barriers around all noise-generating equipment throughout the duration of retrofit activities.

Stitching the Tube. Six clusters of four to six 8- to 12-foot diameter steel piles would be installed at 330-foot intervals over a distance of approximately 2,000 feet from each transition structure at either end of the Tube, east of the San Francisco Transition Structure and west of the Oakland Transition Structure (for a total of 12 clusters) (Figures 2-5 and 2-6). This is referred to as stitching the Tube; stitching is a term that was coined by BART to describe the work of tying down the Tube at its two ends to prevent longitudinal movement. By stitching the Tube together, the Tube would resist the push-pull effect at the seismic joint and would be prevented from breaking loose from the surrounding material. Pile clusters would be connected to the Tube through precast concrete pile caps and tremie concrete[7] around the Tube's existing dam plates[8] (Figure 2-5). Six clusters of piles and caps would be installed on the San Francisco side of the Bay, and six clusters of piles and caps would be placed on the Oakland side but would be installed on land.

Installation of each pile cluster on the San Francisco Bay side would occur from a barge and would require some dredging (dredging would also be needed for retrofits proposed at the San Francisco Transition Structure [see details below]). The dredging associated with stitching would occur at six locations (at the six clusters of piles and caps noted above) about 330 feet apart for approximately 2,000 feet directly east of the San Francisco Transition Structure. Temporary slopes created for stitching the Tube near the San Francisco Transition Structure will be constructed with shallow slopes, in accordance with recommendations by a licensed geotechnical engineer.

6 This easement is a particular type of property right that grants BART subsurface rights along the length of the Tube and rights of access from the surface for maintenance, etc.

7 Tremie concrete is concrete that is placed under water using a chute or tremie tube.

8 Dam plates are steel plates welded across the Tube near each joint that were used to connect the two Tube segments together.

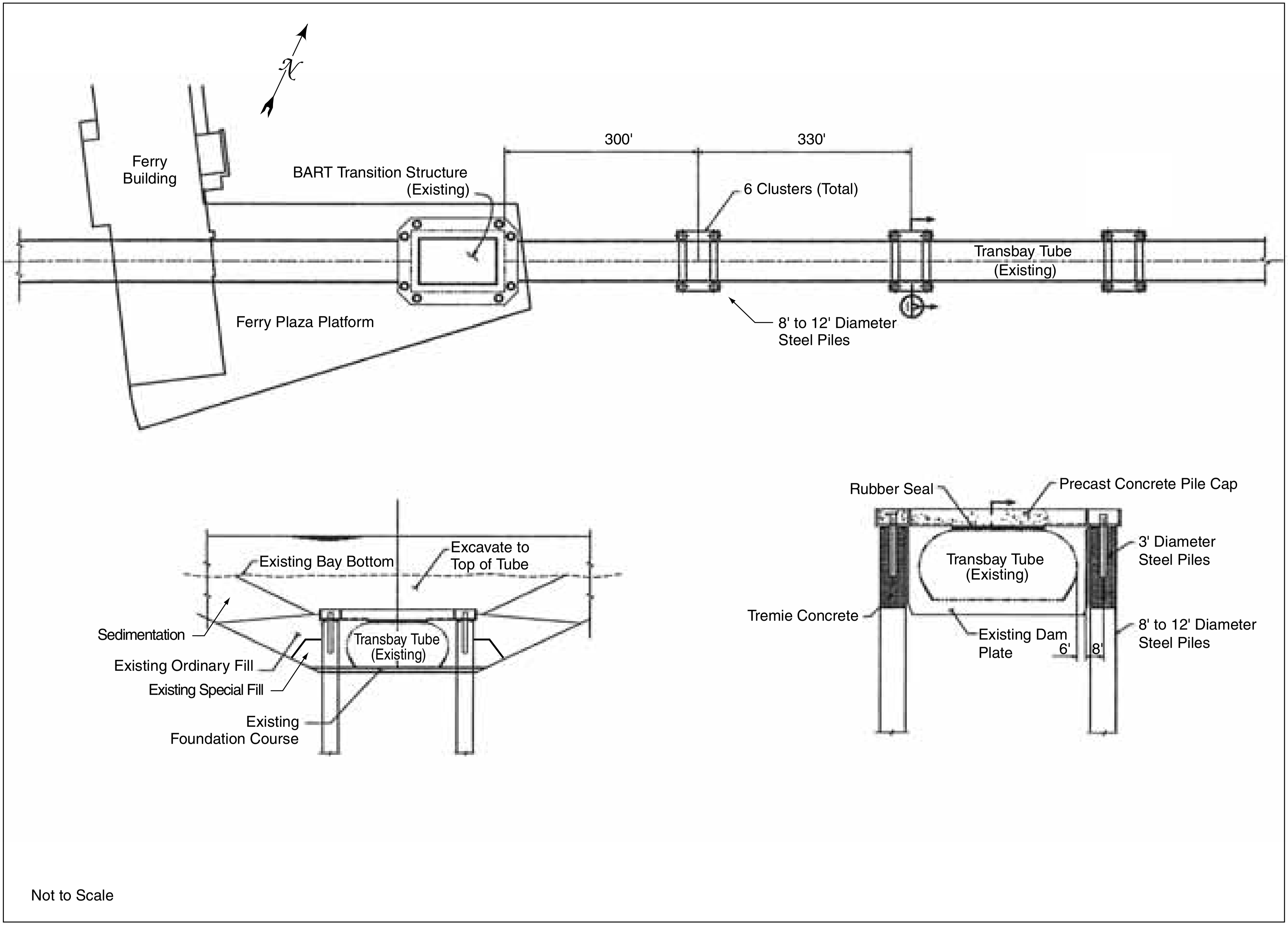

Figure 2-5. Retrofit Concept — Stitching the Tube at the San Francisco End

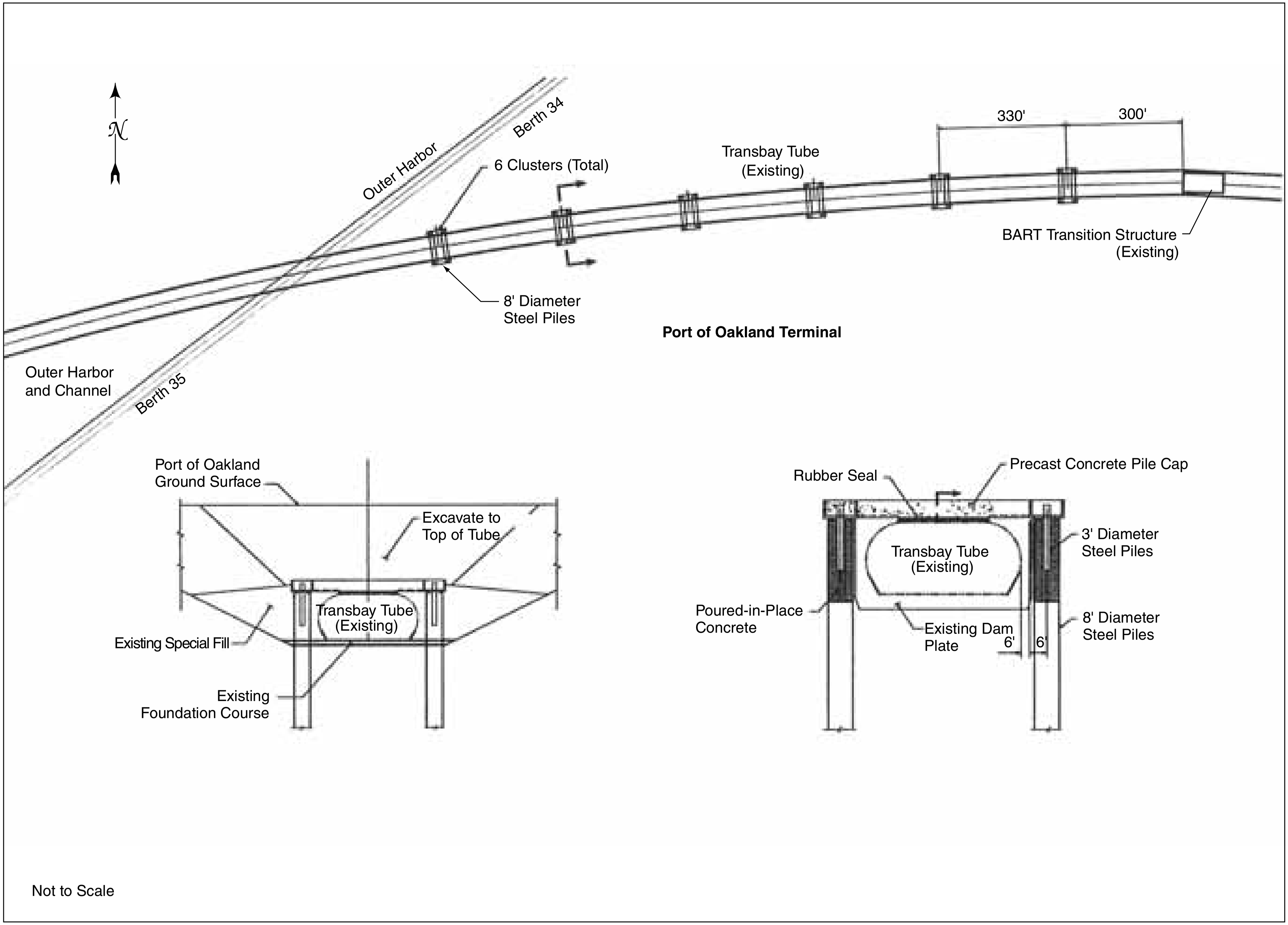

Figure 2-6. Retrofit Concept — Stitching the Tube at the Oakland End

It is anticipated that dredging at the stitching locations would take place using a clamshell bucket excavation technique, and that a silt curtain[9] would be placed around the dredging barge to limit lateral spreading of the turbidity plume. The total estimated dredge volume from the six stitching locations would be 126,100 cy. The combined estimated dredge volume from stitching activities and either of the two retrofit options at the San Francisco Transition Structure is expected to be between approximately 153,000 and 222,000 cy (see Table 2-1); the total area of Bay bottom disturbance from these combined retrofit techniques would be up to 8 acres.

After installation of the pile and pile caps, the dredged areas would be backfilled with the dredged material if the dredged material re-use option is implemented, as described in section 2.2.6.1. If the dredged material is disposed off-site, as discussed in section 2.2.6.2, then the dredged areas would be backfilled only to a minimum 5-foot depth over the Tube to replace the proper type of ordinary fill that currently exists on top of the Tube. A debris management plan will be prepared and implemented prior to construction, and will include provisions for removing any debris and smoothing the bottom (e.g., by trawling) following replacement of bottom sediments over the piling clusters.

Installation of the steel piles at the San Francisco end would utilize oscillation or rotating techniques, not an impact hammer, to the extent feasible. An impact hammer installs piles by hammering them into the ground, which generates noise as well as vibration. Oscillation-induced technology, which makes minimal noise and vibration, utilizes a hydraulic casing oscillator. The pile has a cutting edge at the bottom tip of the casing, and as the casing is rotated back and forth about 15 to 18 inches, it simultaneously pushes the pile into the ground. The rotator method is used to install piles by rotating the cutting edge of the casing in a full circle. This method also produces minimal noise and vibration effects. Currently, with the equipment that is available, both the oscillation and rotator techniques are capable of installing up to 12-foot diameter casings. It is possible that piles with a diameter greater than 12-feet may be needed for stitching, depending on soil conditions and other engineering design details. If so, the use of an impact hammer may be necessary for installing these piles if oscillation or rotating technology is not available to handle a pile of such magnitude.

For construction near the San Francisco Transition Structure, the construction contractor will be required to install and maintain temporary noise control barriers around all noise-generating construction equipment throughout the duration of retrofit activities. If conventional pile-driving (impact hammer) equipment is required for stitching the Tube, the construction contractor will, in addition to installing the noise control barriers, be required to schedule activities to avoid high public use times at the San Francisco Ferry Plaza, shroud the pile drivers with noise barrier materials, and provide advanced public notice, including a hotline for noise complaints related to surrounding uses.

9 A silt curtain (turbidity curtain) is a temporary, floating barrier that is placed around construction or dredging equipment to restrict horizontal spreading of suspended materials or turbid water masses. The silt curtain consists of a flotation boom and a flexible "skirt" of variable length that is weighted at the bottom and hangs down from the flotation boom. Several curtain designs and materials are available for different deployment conditions (e.g., currents, tides, winds).

Table 2-1. Proposed Dredge and Fill Volumes in San Francisco Bay by Project Component

Project Component/Location	*Dredge Volume (cy)*[3]	*Duration of Dredging Activity*	*Fill Volume (cy)*[3]	*Number of New Piles*
Transbay Tube				
Micropile Anchorage	-	-	-	2,200
Vibro-Replacement	-	-	-	-
Stitching the Tube[1]				
Location 1	54,000	3 weeks	54,000	4 - 6
Location 2	29,000	3 weeks	29,000	4 - 6
Location 3	16,700	3 weeks	16,700	4 - 6
Location 4	9,100	2 weeks	9,100	4 - 6
Location 5	8,500	2 weeks	8,500	4 - 6
Location 6	8,800	2 weeks	8,800	4 - 6
Seismic Joint Restoration	-	-	-	-
Total	126,100	15 weeks	126,100	2,224 – 2,236
San Francisco Transition Structure				
PILE ARRAY, PILES AND COLLAR ANCHORAGE, CONTAINMENT STRUCTURES & SACRIFICIAL WALLS (STEEL PILES RETROFIT CONCEPT)				
Pile Array	-	2 – 3 years	-	100
Piles and Collar Anchorage	10,000	2 – 3 years	500	8 – 12
Containment Structures	15,000	2 – 3 years	5,000	-
Sacrificial Walls	1,200	2 – 3 years	3,000	-
Ferry Plaza Platform[2]	-	-	-	80 - 250[4]
Total	26,200	2 – 3 years	8,500	188 - 362
ISOLATION AND SUPPORT WALLS, CONTAINMENT STRUCTURES & SACRIFICIAL WALLS (ISOLATION WALLS RETROFIT CONCEPT)				
Isolation & Support Walls	80,000	3 – 4 years	1,000	26
Containment Structures	15,000	3 – 4 years	5,000	-
Sacrificial Walls	-	3 – 4 years	1,500	-
Ferry Plaza Platform[2]	-	-	-	80 – 250[4]
Total	95,000	3 – 4 years	7,500	106 - 276
Combined Project Components				
Total Project (Steel Piles)	152,300[5]	2 – 3 years	134,600	2,412 – 2,598
Total Project (Isolation Walls)	221,100[6]	3 – 4 years	133,600	2,330 – 2,512

Notes:

1. Stitching the Tube Locations 1-6 are shown on Figure 2-20.
2. Installation of either retrofit concept at the San Francisco Transition Structure would require removing and then restoring between 65,000 and 70,000 square feet of the Ferry Plaza Platform.
3. The dredge and fill volumes are based on the proposed retrofit methods described in this chapter. The dredge and fill volumes vary between location because the amount of sediment on top of the Tube varies from location to location.
4. Depending on whether a plaza-based operation (Construction Method 2) or a marine-based operation (Construction Method 1) is used, approximately 80 to 250 piles, respectively, would be removed during platform removal; the number of replacement piles may change depending on the pile size and spacing called for in the final design.
5. To be conservative, it is estimated that dredging from all project components at the Tube and the Steel Piles Retrofit Concept at the San Francisco Transition Structure would total about 153,000 cy.
6. To be conservative, it is estimated that dredging from all project components at the Tube and the Isolation Walls Retrofit Concept at the San Francisco Transition Structure would total about 222,000 cy.

To minimize impacts to vessel traffic in the Bay, stitching construction would be phased and would be limited to a barge work area not to exceed 350 feet by 350 feet for each pile cluster. Anchoring the construction barge to the Bay bottom may go outside of these limits. Assuming that both vibro-replacement and stitching activities are done simultaneously, there could be as many as 12 construction and supply barges on the Bay at the same time. The exact number and size will be determined by the construction contractor(s) and the construction schedule.

Installation of each pile cluster on the Oakland side (Figures 2-6 and 2-7) would be a land-based operation and would involve excavating 20 to 60 feet below the ground surface to reach the top of the Tube. An area approximately 150 feet by 150 feet would be excavated for each piling group, and only one stitching area would be open at any given time. Temporary slopes created for stitching the Tube near the Oakland Transition Structure will be constructed with shallow slopes, in accordance with recommendations by a licensed geotechnical engineer. Stockpiled soils excavated during stitching would be placed in a confinement site lined with sheet plastic and surrounded by berms to prevent off-site transport by stormwater runoff. Any contaminated excavated material would be contained and hauled to an approved disposal area. Installation of the steel piles would also utilize the oscillation or rotating techniques described above, to the extent feasible.

San Francisco Seismic Joint Restoration. At the seismic joint within the Transbay Tube, just east of the San Francisco Transition Structure, a steel segmented secondary tunnel liner sleeve would be placed within the existing tunnel, with neoprene or rubber gaskets to control potential leakage (Figure 2-8). The liner would extend around both the trackway tubes and gallery. This liner would be installed in sections from within the existing Tube; therefore no ground disturbance or dredging would be required. No seismic retrofits are necessary for the seismic joints on the Oakland side of the Tube since they have more existing capacity (more ability for the joint to move without damage) than those on the San Francisco side, and have less vulnerability to seismic activities.

2.2.2 Transition Structures

Poor soil conditions adjacent to the Tube and transition structures could result in excessive Tube movement at the seismic joints, possibly resulting in failure or damage to the transition structures. Ground-shaking, liquefaction of adjacent soils, and lateral spreading of upper soil deposits (Figure 2-9) could result in excessive movement of the transition structures (i.e., rocking, sliding, base-uplifting), which could cause structural failure of the structures, seismic joints, and/or Tube. The seismic retrofit methods for the Tube described in section 2.2.1 would help to reduce the seismic-motion demands on the seismic joints as well as provide added protection from potential water leakage into the Tube. The following seismic retrofit methods would provide additional protection against structural failure of the transition structures.

2.2.2.1 San Francisco Transition Structure

Two alternative design methods consisting of a series of activities called the Steel Piles Retrofit Concept (pile array, piles and collar anchorage, containment structures, and sacrificial walls), or the Isolation Wall Retrofit Concept (isolation and support walls, containment structures, and sacrificial walls), are included as part of the project to minimize potential structural failure of the San Francisco Transition Structure. Both retrofit concepts are described in greater detail below.

Figure 2-7. Aerial Detail of Stitching the Tube and Vibro-Replacement at the Oakland End

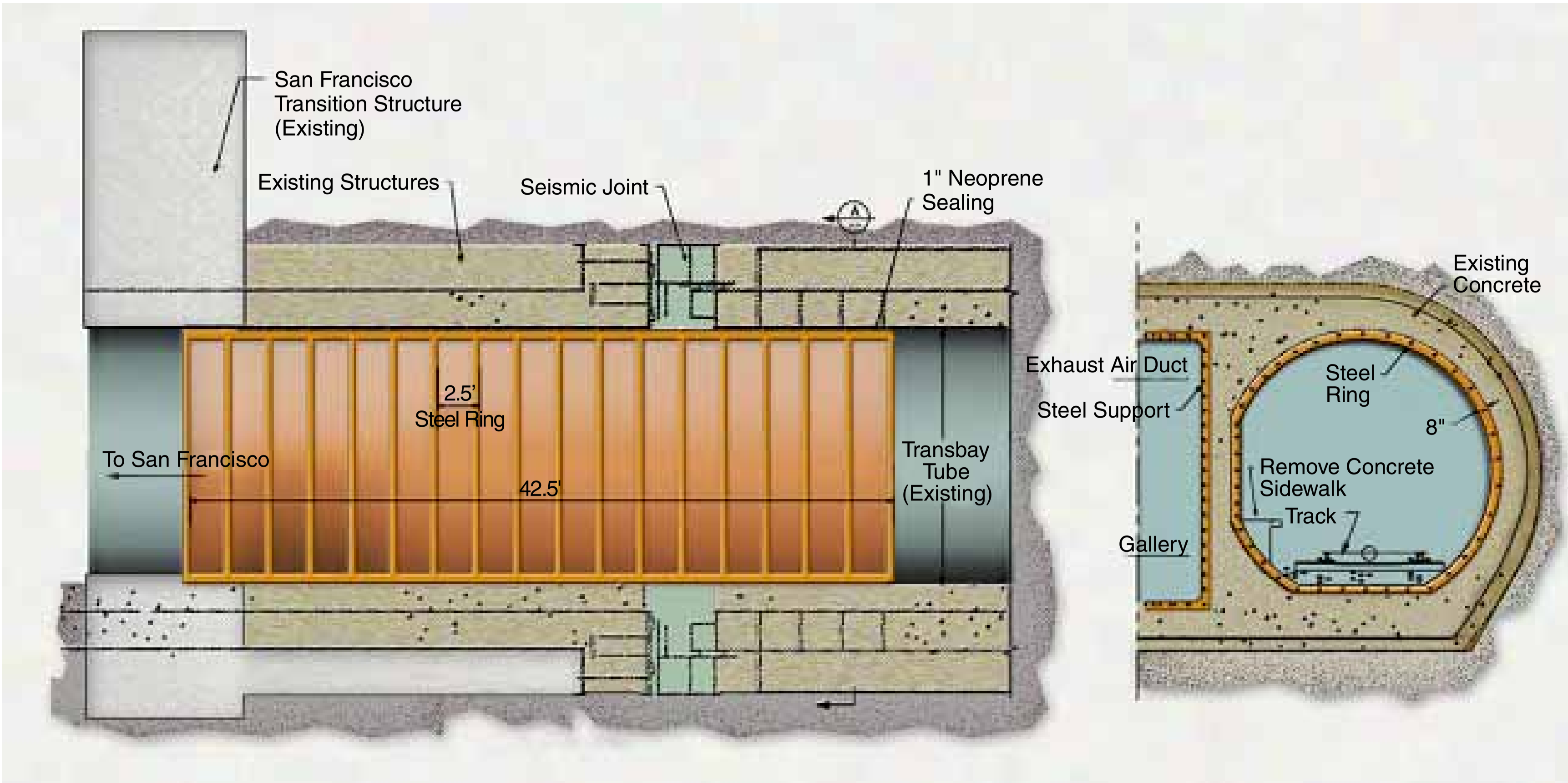

Figure 2-8. Retrofit Concept — Tunnel Liner Sleeve at the Seismic Joint

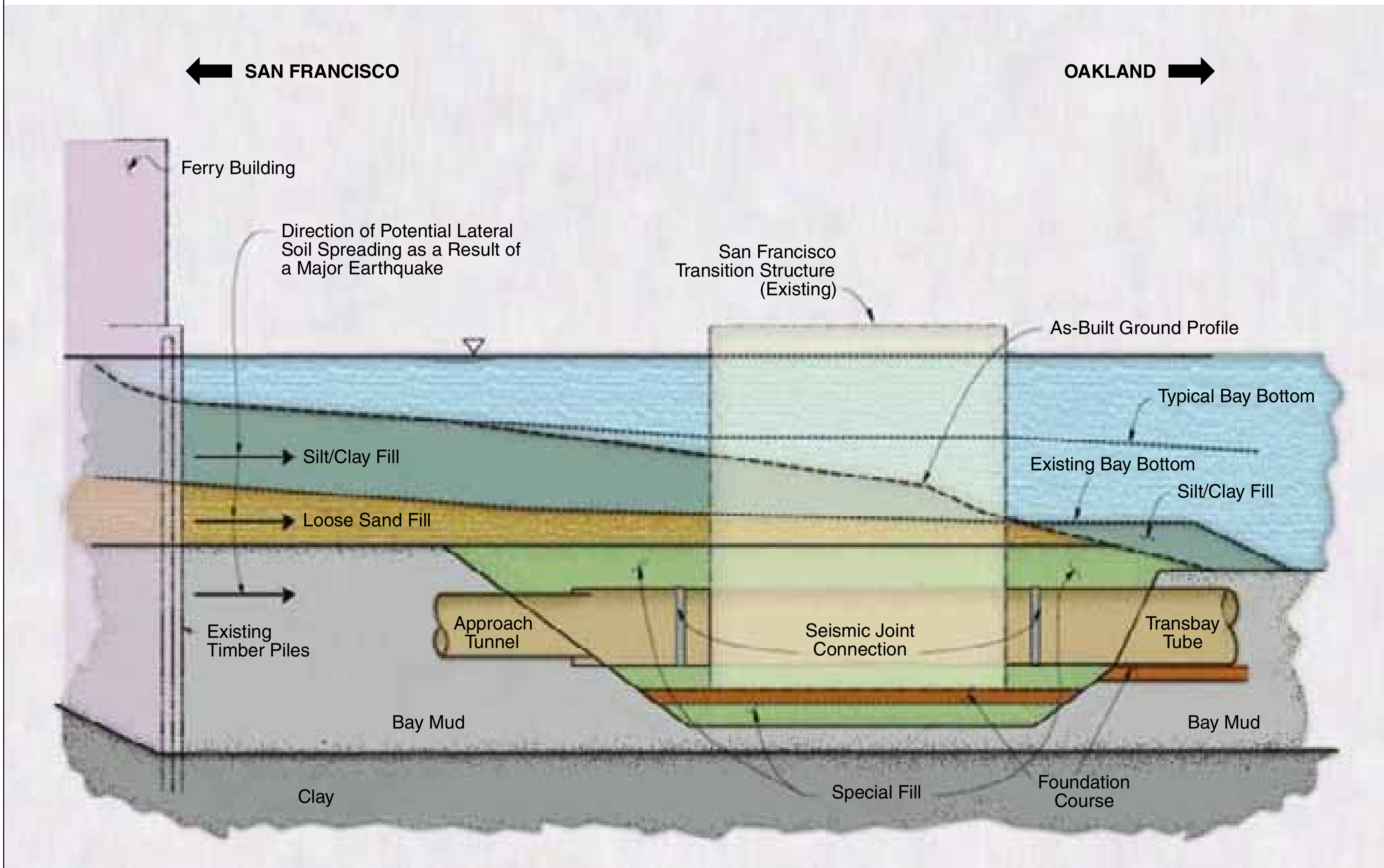

Figure 2-9. Side View of San Francisco Transition Structure Showing Existing Soil Conditions and Direction of Potential Lateral Soil Spreading

All dredging or excavation activities associated with either retrofit concept at the San Francisco Transition Structure would occur within the footprint of the Ferry Plaza Platform. During dredging, temporary construction steel sheet piling would be installed around the construction area using oscillation or rotating techniques, from just below the mud line and extending upward to the water's surface. The temporary sheet piling is intended to isolate and contain dredged materials and construction spoils from entering the surrounding Bay water, and to limit the lateral spreading of a potential turbidity plume.

For construction near the San Francisco Transition Structure, including completion of either retrofit concept, the construction contractor will be required to install and maintain temporary noise control barriers around all noise-generating construction equipment throughout the duration of retrofit activities. If conventional pile-driving (impact hammer) equipment is required, the construction contractor will, in addition to installing the noise control barriers, be required to schedule activities to avoid high public use times at the San Francisco Ferry Plaza, shroud the pile drivers with noise barrier materials, and provide advanced public notice, including a hotline for noise complaints related to surrounding uses.

Any hardscape or landscape materials removed during construction on or near the San Francisco Transition Structure, including specifically at the San Francisco Ferry Plaza, will be replaced in-kind after project completion, and will ensure the same type of vegetation or tree is replaced at a 1:1 ratio.

To avoid off-site glare onto sensitive (commercial) receptors, the construction contractor will direct light sources away from the nearby uses' lines of sight, through focusing light onto the work area and shielding the source, so as not to cause light spillover or focused, intense off-site glare.

Steel Piles Retrofit Concept

Pile Array. Between the San Francisco Ferry Building and the San Francisco Transition Structure, an array of approximately 100 (approximately 6-foot diameter) steel pipe piles would be installed beneath the existing Ferry Plaza Platform, which extends from the Ferry Building to the Transition Structure (Figures 2-10 and 2-11). The piles would anchor into more stable soils below the Bay Mud by extending up to 200 feet below mean sea level. Placement of the piles would reduce the spreading of soils downslope to the east between the Ferry Building and Transition Structure, and would reduce the impact of spreading soils on the transition structure building.

To further minimize soil movement surrounding the tunnels west of the San Francisco Transition Structure that connect the transition structure to Embarcadero Station, soil grouting would be conducted. Grouting is the injection of stable suspensions or liquid into pores, fissures or voids, or the jetting of cement mixtures at high flow rate and pressure into the soil to create soil-cement. Jet or chemical grouting of the soft Bay Mud layer surrounding the Tube tunnel would improve the soil shearing and bearing capacity of the mud, and prevent bearing and sliding failures of the soil. This grouting would be done from the Ferry Plaza Platform through temporary holes in the platform using a technology in which high pressure jets of cement or chemical grout are discharged sideways into the soft Bay Mud layer around the Tube to simultaneously excavate and then mix with the soil to create a more stable material. Discharge of the grouted soil into Bay waters above the mud line is not anticipated because of the depth where the activity would be occurring (at least 60 feet below mud line), and the jet grouting device would be surrounded by a vacuum pipe to contain and remove any excess grouted materials before they would enter the water column.

To facilitate access to, and use of, the Ferry Plaza Platform, construction would take place from either a marine-based or plaza-based operation and would be supported by construction barges. As shown in Figure 2-12, the marine-based option (Construction Method 1) would require placement of a construction barge and supply barge on the waterside of the platform. Part of the platform that currently supports pedestrian viewing[10] and ferry terminal activities would be temporarily removed in the areas of the new pile array to allow access by the construction barge. Its associated concrete support piles would be either cut off at the Bay bottom elevation or removed completely. The marine-based operation would require approximately 70,000 square feet of the existing platform to be removed along with about 250 supporting piles to allow access for the construction barges. The existing piles are relatively small pre-cast concrete piles. Since these piles were primarily designed for compression loads, it may not be easy to remove them, and they may have to be cut off at the mud line. The removed portion of the platform and supporting piles would be replaced once installation of the array of large steel piles is completed.

As shown in Figure 2-13, if a plaza-based operation (Construction Method 2) is used, a construction crane would be placed either on top of the existing platform deck or on temporary construction steel pipe piles placed through the existing platform to below the mud line, with a supply barge positioned on the south side of the platform. This would reduce the amount of platform removal necessary during construction and would reduce disruption to nearby ferry operators. The plaza-based operation would require approximately 65,000 square feet of the existing platform to be removed along with about 80 supporting piles to allow access for the construction barges. The World Trade Club, the restaurant located next to the San Francisco Transition Structure, would remain open and accessible to its members, but access at times would be provided from the second floor, not always the ground floor. Access to and from the landing dock for the Golden Gate Ferries would also be maintained.

Installation of the steel pipe piles would use oscillation or rotating techniques described in section 2.2.1, to the extent feasible. The spoils from demolition of the existing concrete and steel plaza platform would be contained and removed from the site.

Piles and Collar Anchorage. At the San Francisco Transition Structure, eight to twelve large (approximately 10-foot diameter) steel pipe piles would be installed around the transition structure building (Figures 2-10 and 2-11). The pile group would be connected with a large precast concrete or fabricated steel collar placed beneath the existing Ferry Plaza Platform down to just below the Bay Mud line, and would be positioned against the transition structure walls.

10 Pedestrians currently have access to the entire Ferry Plaza Platform, which is shown as a trapezoidal shape on Figure 2-12.

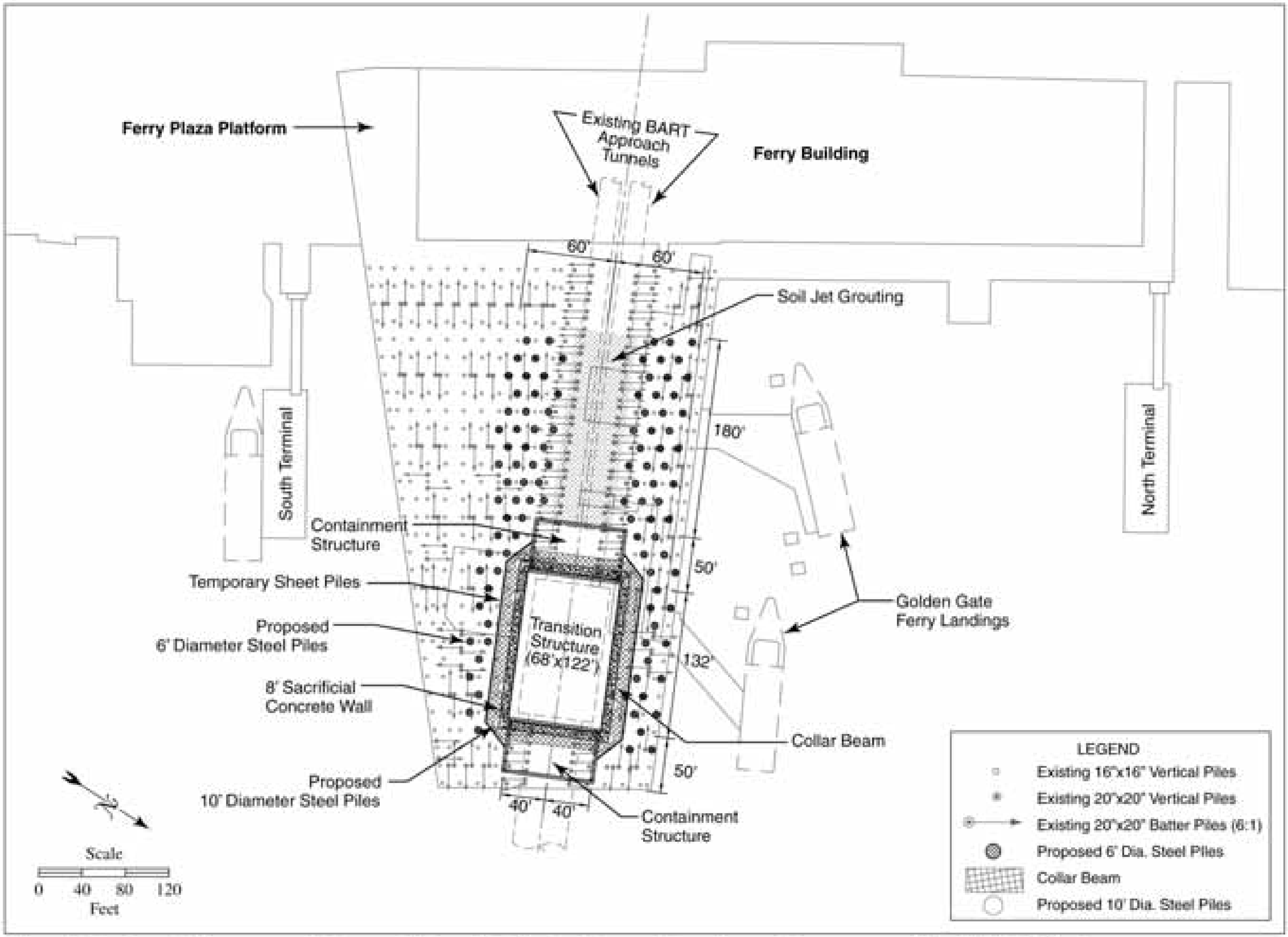

Figure 2-10. Retrofit Concept — Pile Array, Piles and Collar Anchorage, Containment Structures, and Sacrificial Walls for San Francisco Transition Structure

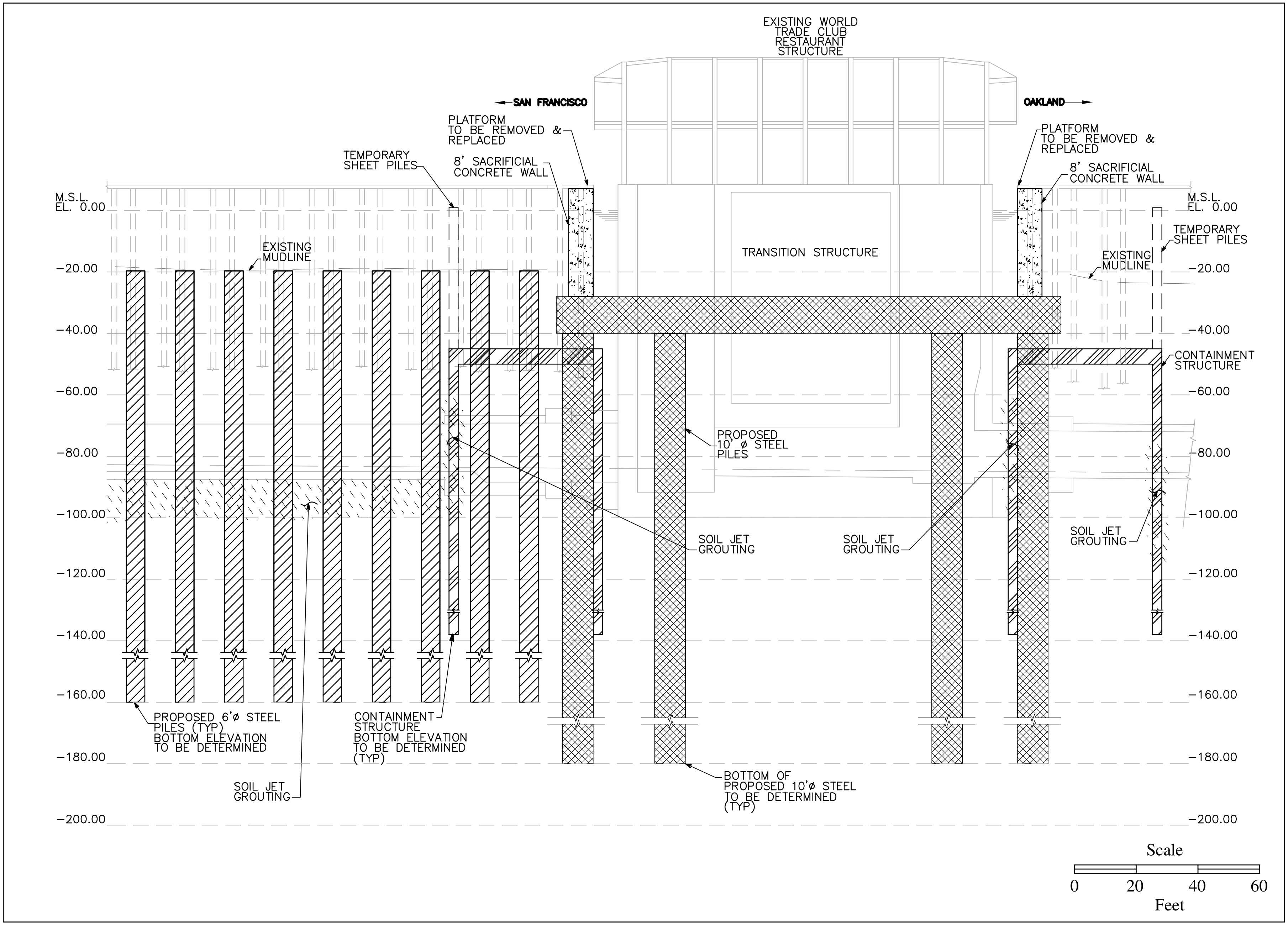

Figure 2-11. Side View of Steel Piles Retrofit Concept for the San Francisco Transition Structure

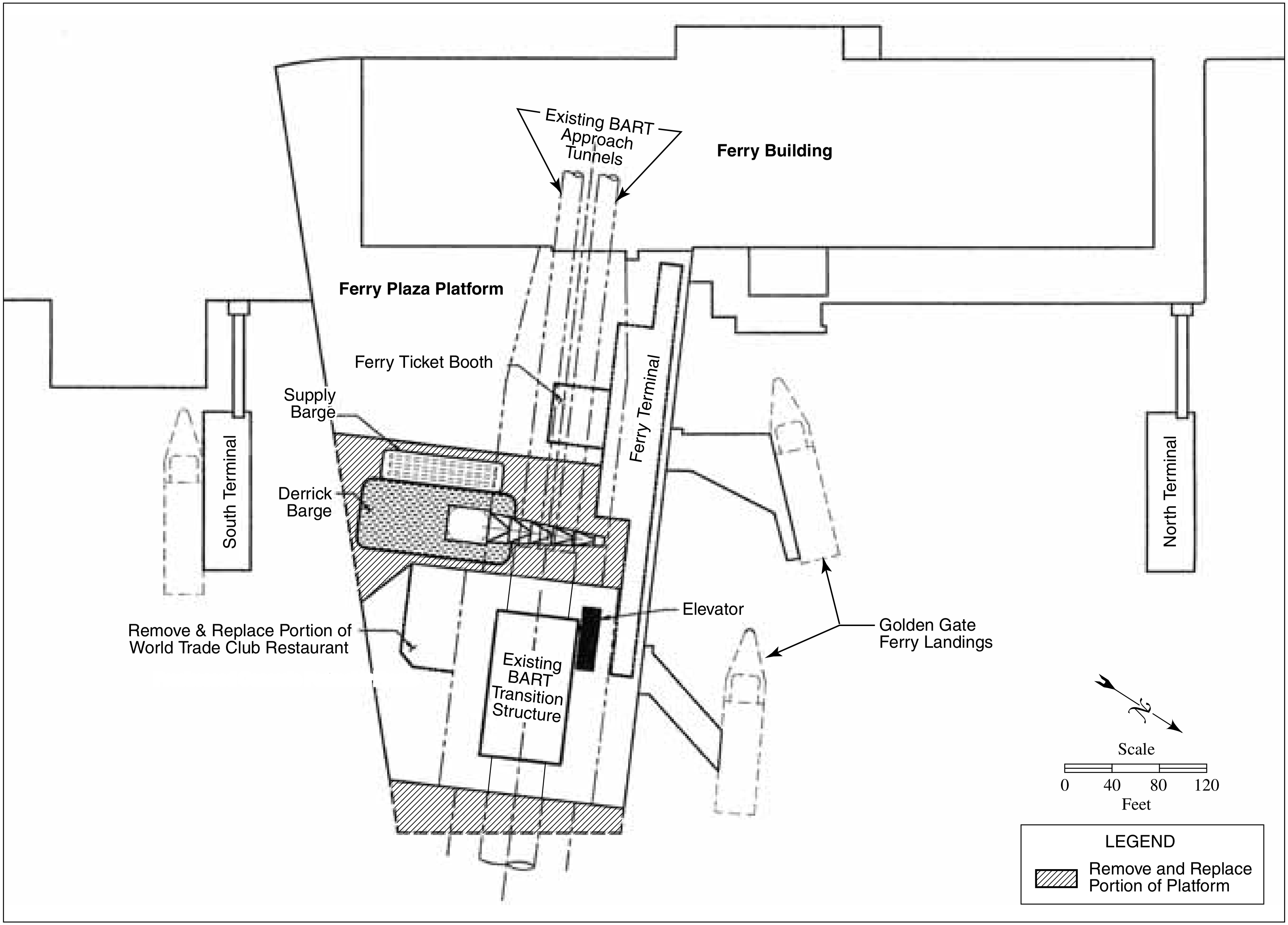

Figure 2-12. Construction Detail for Retrofits at the San Francisco Transition Structure (Construction Method 1)

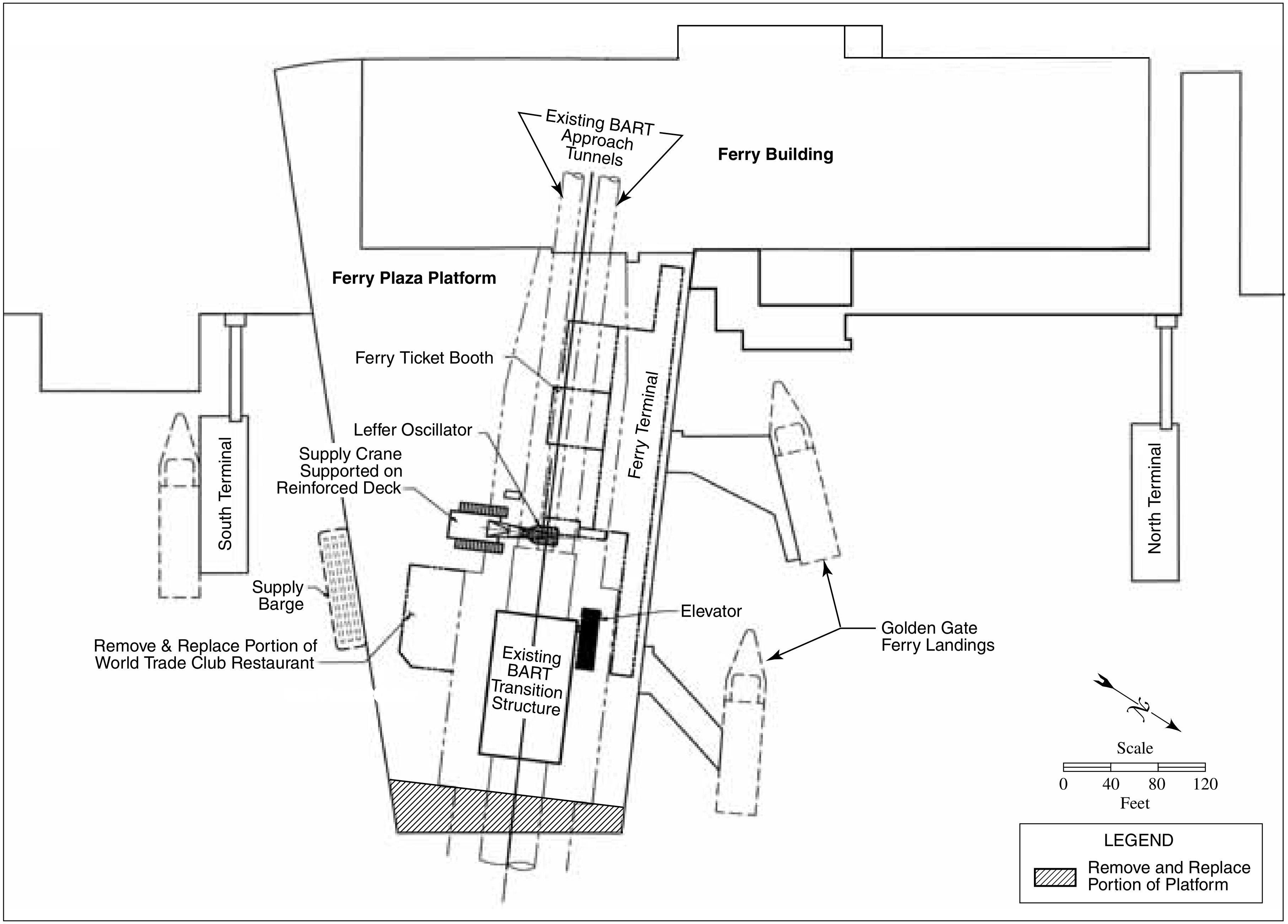

Figure 2-13. Construction Details for Retrofits at the San Francisco Transition Structure (Construction Method 2)

The piles and collar would anchor the structure to more stable soils by extending approximately 200 feet below mean sea level, and would stabilize the structure from sliding and rocking movements as well as the pressure from spreading soils. Dredging or excavation of the Bay bottom (approximately 10,000 cy) around the structure would be required (see Table 2-1). During construction, sections of the concrete deck of the Ferry Plaza Platform located around the transition structure would be removed temporarily and replaced, as described under Pile Array above (see Figures 2-12 and 2-13).

Installation of the steel pipe piles would utilize the oscillation or rotating techniques described in section 2.2.1, to the extent feasible. The concrete and steel spoils from demolition of the platform, and accidental debris spills, would be contained and removed from the site. The concrete or steel collar would be installed from a barge and from the plaza platform level, lowered to the final elevation just below the Bay Mud line.

Containment Structures. To the immediate east and west of the San Francisco Transition Structure and around the Transbay Tube seismic joints, a water resistant structure called a Containment Structure, would be installed on either end of the building to protect the Tube and tunnels from water intrusion during a seismic event (see Figures 2-10 and 2-11). The structure would consist of steel pipe piles that are overlapped to provide four continuous walls around the Tube seismic joints, extending from a point just above the joints into the deep mud below the Tube. Installation of the steel pipe piles would utilize the oscillation or rotating techniques described in section 2.2.1, to the extent feasible. Following installation of the walls, about 15,000 cy of material (primarily new Bay Mud) would be excavated and replaced by a Bentonite slurry fill, which would effectively surround the seismic joint, Tube, and tunnels and create a water-resistant seal around those structures. A concrete cap would then be placed above the Bentonite-filled structure, and Bay Mud replaced over the cap's approximately 13,500 square-foot surface. The two Containment Structures would be located directly beneath the Piles and Collar Anchorage on the east and west of the Transition Structure (beginning about 50 feet below mud line), and would extend to a depth of nearly 140 feet below the mud line.

Sacrificial Walls. Eight-foot thick concrete walls, called Sacrificial Walls, would be placed on all four sides (north, south, east and west) of the San Francisco Transition Structure to further reinforce the building from potential adverse impacts during a seismic event. Installation of the walls would require dredging or excavation of approximately 1,200 cy of material. The sacrificial walls would be located approximately 5 feet from the building's outer wall surface, and would extend from the top of the concrete or steel collar to the immediate underside of the Ferry Plaza Platform (see Figure 2-11).

Isolation Wall Retrofit Concept

Isolation and Support Walls. An alternative retrofit concept to the proposed Piles Array and Piles and Collar Anchorage at the San Francisco Transition Structure, described above, consists of elements called Isolation Walls and Support Walls. Similar to the Steel Piles Retrofit Concept, this concept also includes construction of two Containment Structures and Sacrificial Walls (see Figures 2-14 and 2-15).

The Isolation Walls would consist of two continuous walls of large (approximately 8-foot diameter) concrete piles or reinforced concrete walls placed along both sides of the Transition Structure (north and south) from just below the existing mud line, to about 160 feet below mud line. The Isolation Walls would extend westward and eastward along the Tube and tunnels, and would be connected by up to four, 6-foot diameter struts located below the mud line and perpendicular to the east-west trending walls.

The purpose of the Isolation Walls would be to minimize the impact of lateral spreading soils moving downslope to the east from the Ferry Building toward the Transition Structure and the Bay, which could cause structural failure of the Transition Structure. The distance between the two Isolation Walls is slightly greater than the width of the Transition Structure; therefore, the walls would divert some soil (on the north and south) away from the building. The Isolation Walls would also minimize the amount of soil movement occurring between the Ferry Building and the Transition Structure to the east, to only that material lying within and between the Isolation Walls.

The Isolation Walls would consist of either concrete piles that are overlapped to provide a continuous wall (called a secant pile wall), or a 6- to 8-foot wide concrete reinforced slurry wall. Construction of the secant pile wall variant would require installation of a large diameter steel caisson, excavation of materials within the caisson, and placement of concrete inside the excavated caisson as it is removed. A large concrete cap beam would then be placed directly on top of the Isolation Walls. Installation of either construction method (secant pile wall or slurry wall) would utilize the oscillation or rotating techniques described in section 2.2.1.

The Isolation Walls would be parallel to and independent of the proposed interior Support Walls, which would be placed about 8 feet away. Similar to the secant pile wall variant described above, the Support Walls would consist of concrete piles overlapped to provide a continuous wall, which is structurally connected to the outside surfaces of the Transition Structure on the north and south sides of the building. The Support Walls would be located approximately 60 feet below the mud line to about 220 feet below the mud line, and would protect the Transition Structure from sliding or tipping during a seismic event. In the 8-foot wide space between the two sets of walls (Isolation and Support Walls), Bay Mud would be backfilled to close the space. The likely source of Bay Mud would be leftover dredged materials associated with construction of both sets of walls, which would require dredging of approximately 80,000 cy of material (primarily Bay Mud soils). As described above, a temporary construction steel sheet pile would be installed around the sites prior to construction of either wall, to isolate and retain dredged materials and to reduce the extent of a potential turbidity plume entering surrounding Bay water.

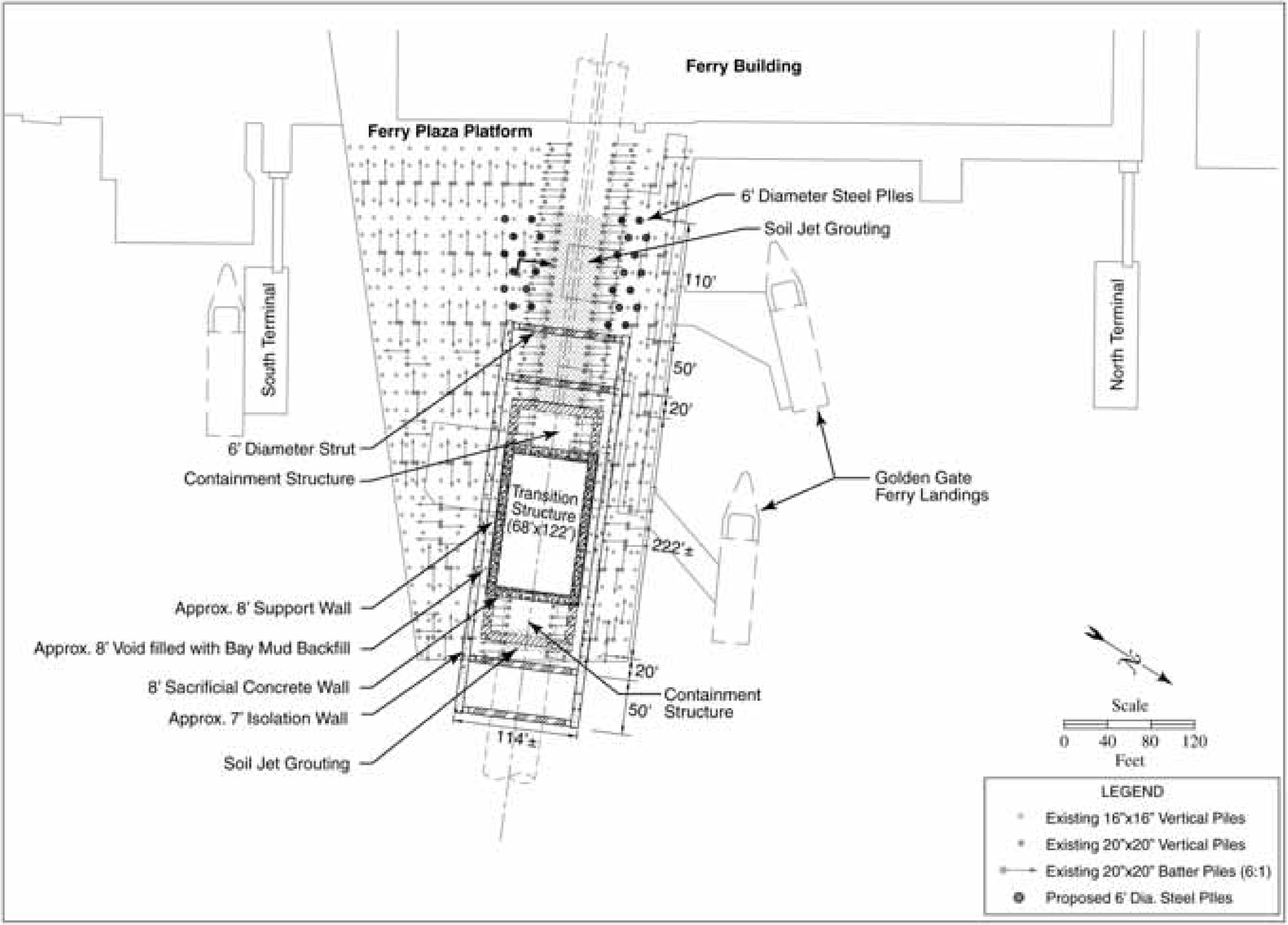

Figure 2-14. Retrofit Concept — Isolation and Support Walls, Containment Structures, and Sacrificial Wall at the San Francisco Transition Structure

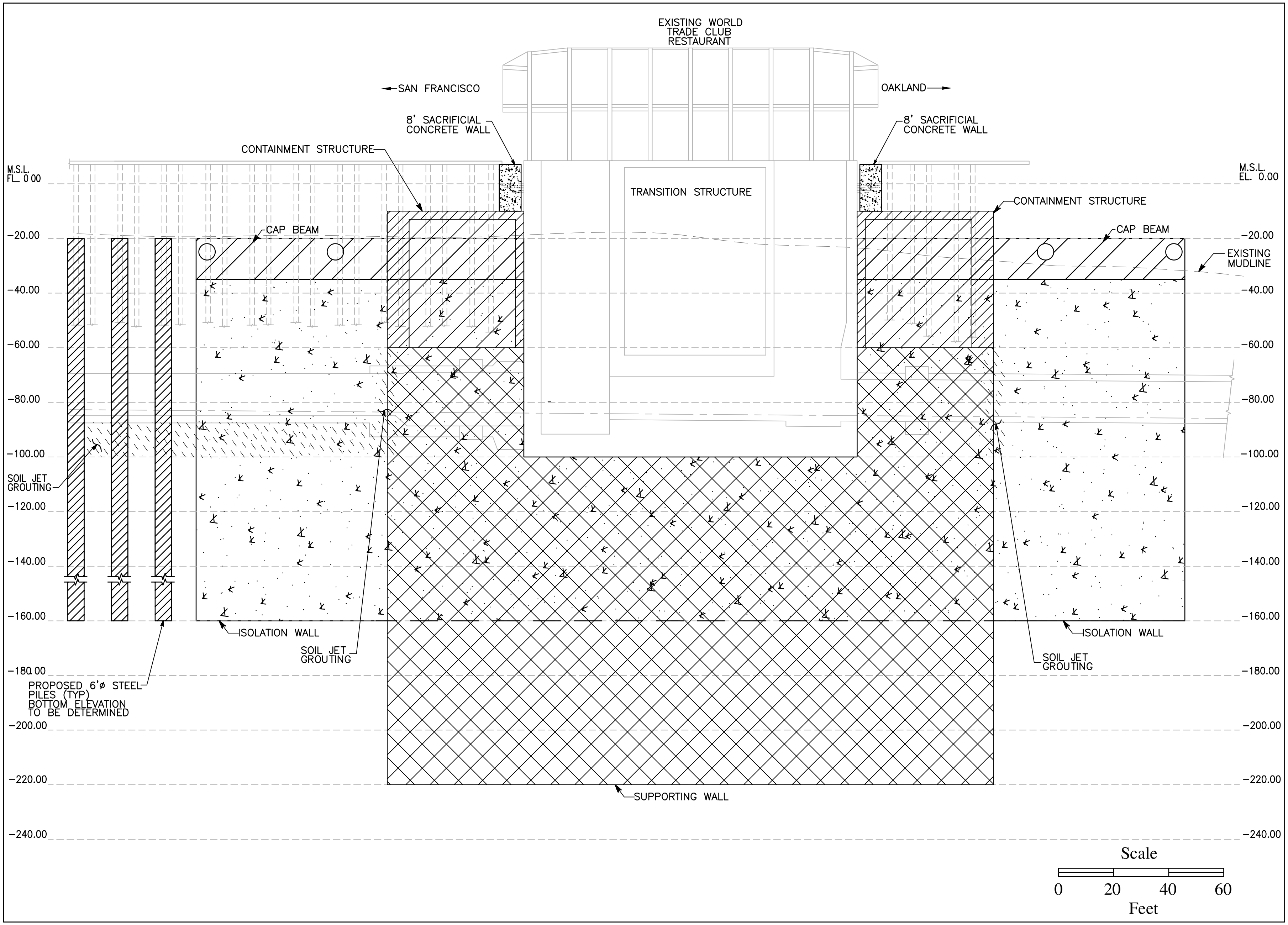

Figure 2-15. Side View of Isolation Wall Retrofit Concept at the San Francisco Transition Structure

To further stabilize the soil adjacent to the Tube west of the Transition Structure, approximately 26 steel pipe piles (6-foot diameter) would be installed north and south of the BART approach tunnels. Also, to minimize soil movement surrounding these tunnels, soil grouting would be conducted in the area surrounding the Tube (at about 60 feet below mud line) (see Figure 2-15). Jet or chemical grouting of the soft Bay Mud layer surrounding the Tube tunnel would improve the soil shearing and bearing capacity of the mud, and prevent bearing and sliding failures of the soil. This grouting would be done from the Ferry Plaza Platform, as described above for the Steel Piles Retrofit Concept. Discharge of the grouted soil into Bay waters above the mud line is not anticipated.

Containment Structures. Similar to the Containment Structures proposed as part of the Steel Piles Retrofit Concept, to the immediate east and west of the San Francisco Transition Structure and around the Tube seismic joints, a water resistant structure called a Containment Structure, would be installed on either end of the building to protect the Tube and tunnels from water intrusion during a seismic event (see Figures 2-14 and 2-15). The structure under this concept would, however, consist of concrete walls placed above the Tube seismic joints, and soil grouted walls placed in the deep mud below the Tube. Following installation of the walls, which would be located at least 50 feet below the mud line, about 15,000 cy of material (primarily new Bay Mud) would be excavated and replaced by a Bentonite slurry fill, which would effectively surround the seismic joint, Tube and tunnels and create a water-resistant seal around those structures. A concrete cap would then be placed above the Bentonite-filled structure, and Bay Mud replaced over the cap's approximately 13,500 square-foot surface. The two Containment Structures would be located directly above the Support Walls (beginning about 60 feet below mud line), and would extend up to the mud line at its highest elevation.

Sacrificial Walls. Similar to the Sacrificial Walls proposed as part of the Steel Piles Retrofit Concept, 8-foot wide concrete walls would be placed on all four sides of the Transition Structure. Under this retrofit concept, however, no dredging or excavation would be required as the walls would extend from the top of the Containment Structures on the east and west, and from the top of the Support Walls on the north of south, to the immediate underside of the Ferry Plaza Platform (see Figure 2-15).

2.2.2.2 Oakland Transition Structure

The above-grade portion of the Oakland Transition Structure, which is located on land within Port of Oakland property (Figure 1-2), requires strengthening of its steel frame. This would be accomplished by reinforcing the existing steel bracing with new reinforced concrete shear walls. The shear walls would be attached to the precast concrete panel through a grid of newly installed anchors. There would be some ground disturbance during the construction of the concrete shear walls; ground disturbance would be confined within the fenced BART easement area around the Oakland Transition Structure. There would be no public disruption during construction since the transition structure is located in a fenced-in industrial area. The staging area would be located within the fenced area around the Oakland Transition Structure. The Oakland Transition Structure is visible from 7th Street and the San Francisco Bay Trail that parallels 7th Street between Port View Park and Middle Harbor Shoreline Park.

2.2.3 Aerial Guideways

Aerial track is installed on guideways that are supported by piers. The most common aerial structure consists of a single-column reinforced concrete pier on either pile supported or spread concrete footings (see Figure 2-16 for a typical aerial structure). Existing columns have one of three different shapes: rectangular, hexagonal, or circular (Figure 2-17). On top of the column is a hammerhead-type pier cap and shear keys[11] (Figure 2-16) that support the track. Seismic studies have determined that aerial structures may suffer damage from an earthquake, such as shear key failure, pier cap damage, column damage, and/or foundation failure. Structural damage from shear key failure would most likely allow trains to continue to traverse the location at slow speeds, but more severe damage to the column or foundation could lead to structural collapse.

Proposed seismic retrofits of the aerial guideways include enlargement of the existing foundation (approximately 5 to 8 feet on each side and 2 to 3 feet on top) and placement of a top mat of rebar[12] and new vertical dowels[13] through the existing foundation. Typical seismic retrofits would also include jacketing (encasing) of the concrete columns with 3/8- to 1-inch thick steel casings or collars, and placement of additional shear keys at the hammerhead caps (Figure 2-16). The steel casing that would encircle each column to be retrofitted would range in width from 0.13 foot to 2.9 feet thick, depending on the original shape of the column; after retrofit, each column would have a round or elliptical shape. In poorer soils (soils that have less bearing capacity), installation of additional piles would also be done. At some abutment[14] locations, concrete catchers or seat extenders, would be added to increase the available seating area for the girders on the abutments. These catchers are typically reinforced concrete blocks attached to the face of the abutment using horizontal dowels.

In addition to the seismic retrofits described above, some of the multi-column piers (piers that have between two to six columns instead of just one) would require infill concrete walls between the columns. In areas where multiple piers are located within a sensitive view area, such as Forest Street near the Rockridge Station, the steel casings would be installed to the same height on each pier for a consistent look.

Ground disturbance around each pier to be retrofitted would take place within a 10-foot radius of the pier; on-site construction equipment would be placed within a 20-foot radius of each pier. See Figure 2-18 for details about the locations of proposed aerial guideway seismic retrofits.

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11 A shear key is a structural element designed to prevent differential lateral movement between two adjoining structural components.

12 In a typical concrete construction, reinforcing steel (rebar) is placed in grids of steel running in two directions. For a horizontal structure such as a pile cap, these grids are often referred to as mats. Many of the existing pile caps have bottom mats (located in the lower part of the slab), but not top mats.

13 A dowel is a straight piece of rebar inserted into existing concrete, typically to tie the older concrete into a new piece. In this case, the dowels would be placed vertically into the top of the existing foundation to tie the new concrete footing and rebar to the old, and to provide additional strength to the overall footing structure.

14 An abutment is a wall supporting the end of a bridge or span and sustaining the pressure of the abutting earth.

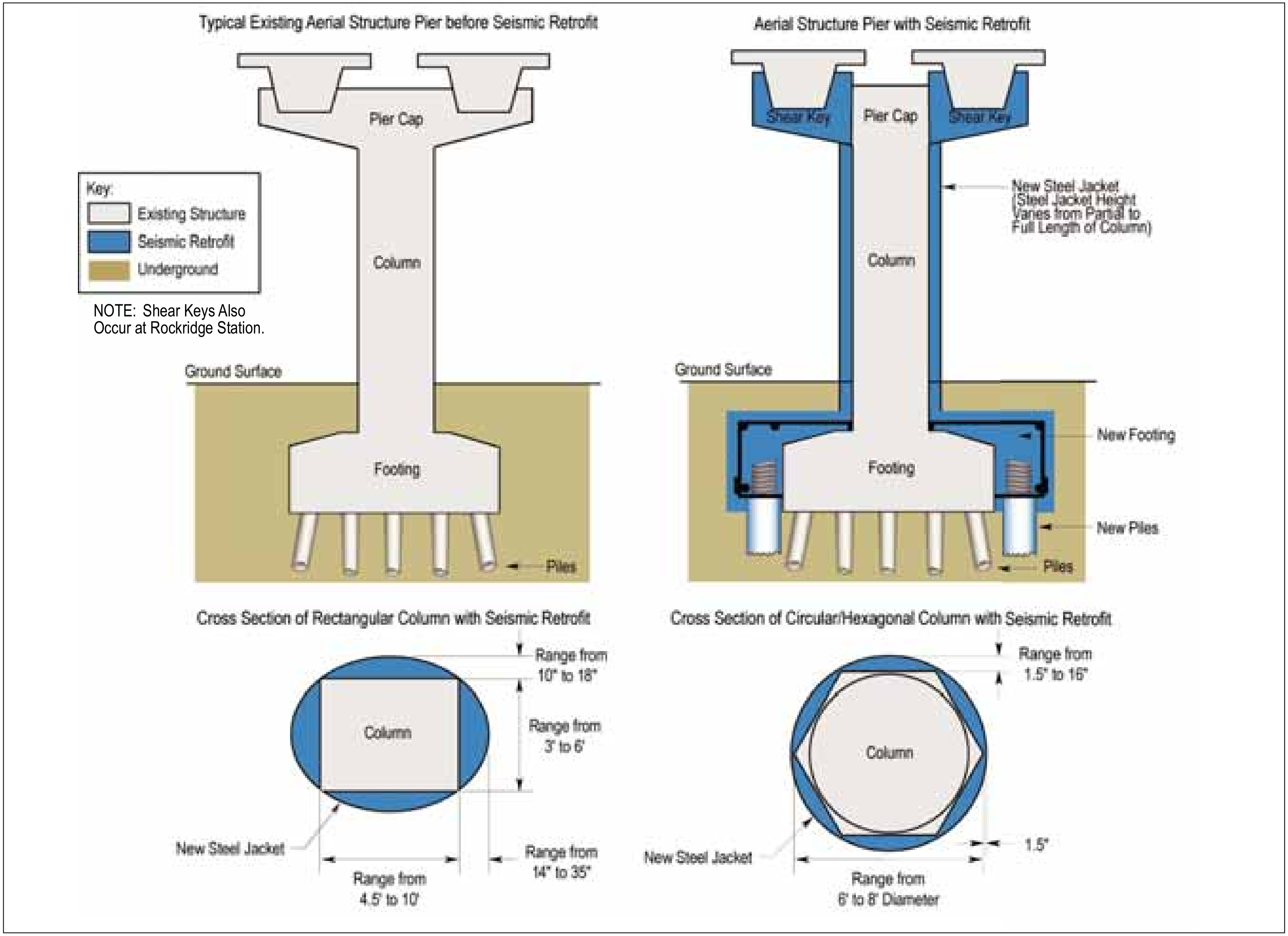

Figure 2-16. Typical Aerial Structure Pier Before and After Seismic Retrofits

Figure 2-17. View Showing Different Shapes of Existing Columns

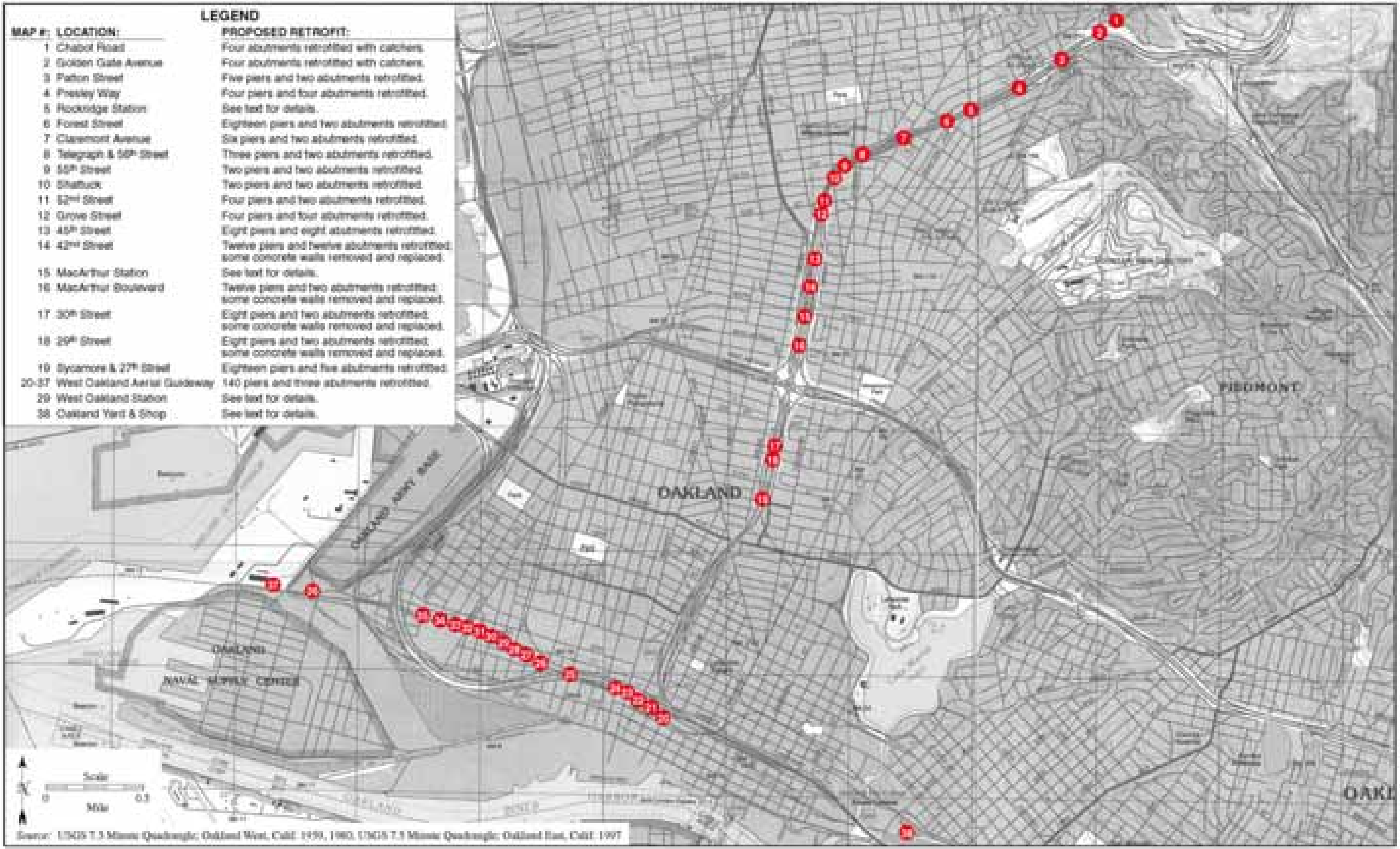

Figure 2-18. General Location of Aerial Structures and Station Retrofits

For construction near the aerial guideway retrofit locations, the construction contractor will be required to install and maintain temporary noise control barriers around all noise-generating construction equipment throughout the duration of retrofit activities. If conventional pile-driving (impact hammer) equipment is used, the construction contractor will, in addition to installing the noise control barriers, be required to schedule noisiest activities to minimize the amount of time when residents are home or schools are in operation, shroud the pile drivers with noise barrier materials, and provide advanced public notice, including a hotline for noise complaints related to surrounding uses.

Any hardscape or landscape materials removed during aerial guideway retrofits will be replaced in-kind after project completion, and will ensure the same type of vegetation or tree is replaced at a 1:1 ratio. Specifically, for construction occurring at or near Hardy Park or the Bay Trail adjacent the 7th Street right-of-way, the construction contractor will be required to restore park or trail amenities to pre-project conditions, including clean up, regrading, recompacting, repavement or relandscaping, and replacement of any damaged fencing.

For construction at locations near major surface street roadways or freeways, including at aerial guideway locations beneath the State Route 24 overpasses, the construction contractor will be required to direct light sources away from motorists' lines-of-sight, through focusing light onto the work area and shielding the source, so as not to cause light spillover or focused, intense off-site glare.

BART has identified three temporary staging areas for aerial guideway and station retrofits: (1) 5th Street and Cypress Street (near the West Oakland Station), (2) 5th Street and Brush Street (east of the West Oakland Station), and (3) 40th Street and Martin Luther King Jr. Way (near the MacArthur Station). The staging area near 5th Street and Cypress Street (Mandela Parkway) is about 300 yards (0.17 miles) south of this intersection; it is the closest staging area to the West Oakland Station and would also be used for substitute parking during construction at some locations.

This site is unpaved, has a tree and some weeds, and is surrounded by commercial buildings, primarily warehouses. The staging area at 5th Street and Brush Street would be under the BART tracks and is east of the West Oakland Station. This site is unpaved, covered with weeds, and surrounded by commercial buildings, primarily warehouses. A vacant parcel on the southeast corner of 40th Street and Martin Luther King, Jr. Way would be used as a staging area and for substitute parking during construction at some locations. This site is unpaved with weeds, and is surrounded by primarily commercial buildings, with residences across the street and within a half block of this property. BART would be responsible for the maintenance of the staging areas during project activities. No staging activities would occur within a recreation or public park area.

2.2.4 Stations

Seismic retrofits are proposed for Rockridge Station, MacArthur Station, and West Oakland Station. The four underground stations associated with the project area do not require seismic retrofitting because the predicted amount of damage caused by a potential earthquake to the underground stations is small and would not affect the ability of the system to return to operation quickly after a seismic event (BART 2002a).

Construction activities at the BART stations would temporarily displace some parking spaces at the Rockridge and West Oakland Stations, as noted below. Some sidewalks would be removed and then rebuilt. Bus stops adjacent to structures supporting BART stations would also have to be temporarily realigned or moved to nearby locations while retrofit activities occur.

For construction at the BART stations, the construction contractor would install and maintain temporary noise control barriers around all noise-generating construction equipment throughout the duration of retrofit activities. In addition, if conventional pile-driving (impact hammer) equipment is required, the construction contractor would schedule activities during non-commute periods and evenings, shroud the pile drivers with noise barrier materials, and provide advanced public notice, including a hotline for noise complaints related to surrounding uses.

Any hardscape or landscape materials removed during retrofits at the BART stations will be replaced in-kind after project completion, and will ensure the same type of vegetation or tree is replaced at a 1:1 ratio.

For construction at stations near major surface street roadways or freeways, the construction contractor will be required to direct light sources away from motorists' lines-of-sight, through focusing light onto the work area and shielding the source, so as not to cause light spillover or focused, intense off-site glare.

2.2.4.1 Rockridge Station

The Rockridge Station, an aerial station, consists of eight 2-column reinforced concrete piers supported on concrete pile foundations and is abutted on its east end by a substation structure with shear walls. The station also has elevated spans of track structures, platform slab structure, overhead canopy structure, concourse, and pedestrian structures (see Figure 2-19 for a typical aerial station). Seismic retrofit studies have determined that aerial stations would suffer earthquake damage similar to the aerial guideways, such as shear key failure, pier cap damage, column damage, and/or foundation failure. Structural damage from shear key failure would most likely allow trains to continue to traverse the location at slow speeds, but more severe damage to the column or foundation could lead to structural collapse. In addition, ground shaking may cause damage to the station canopies, stairways, and elevator shafts.

The Rockridge Station would require similar methods of seismic retrofits described above for the aerial guideways to minimize structural damage and prevent potential collapse. A top mat of rebar and new vertical dowels would be installed close to the bottom of existing footings. New column steel jacketing would be installed for all but one of the columns; all columns at the station platform are rectangular in shape. New concrete blocks would be installed at the top of the pier caps to seismically retrofit some of the shear keys. Pier retrofits would be conducted one pier at a time. Brackets also would be installed at the connection between the station platform and the main station girders. Construction would occur in phases to minimize impacts on parking.

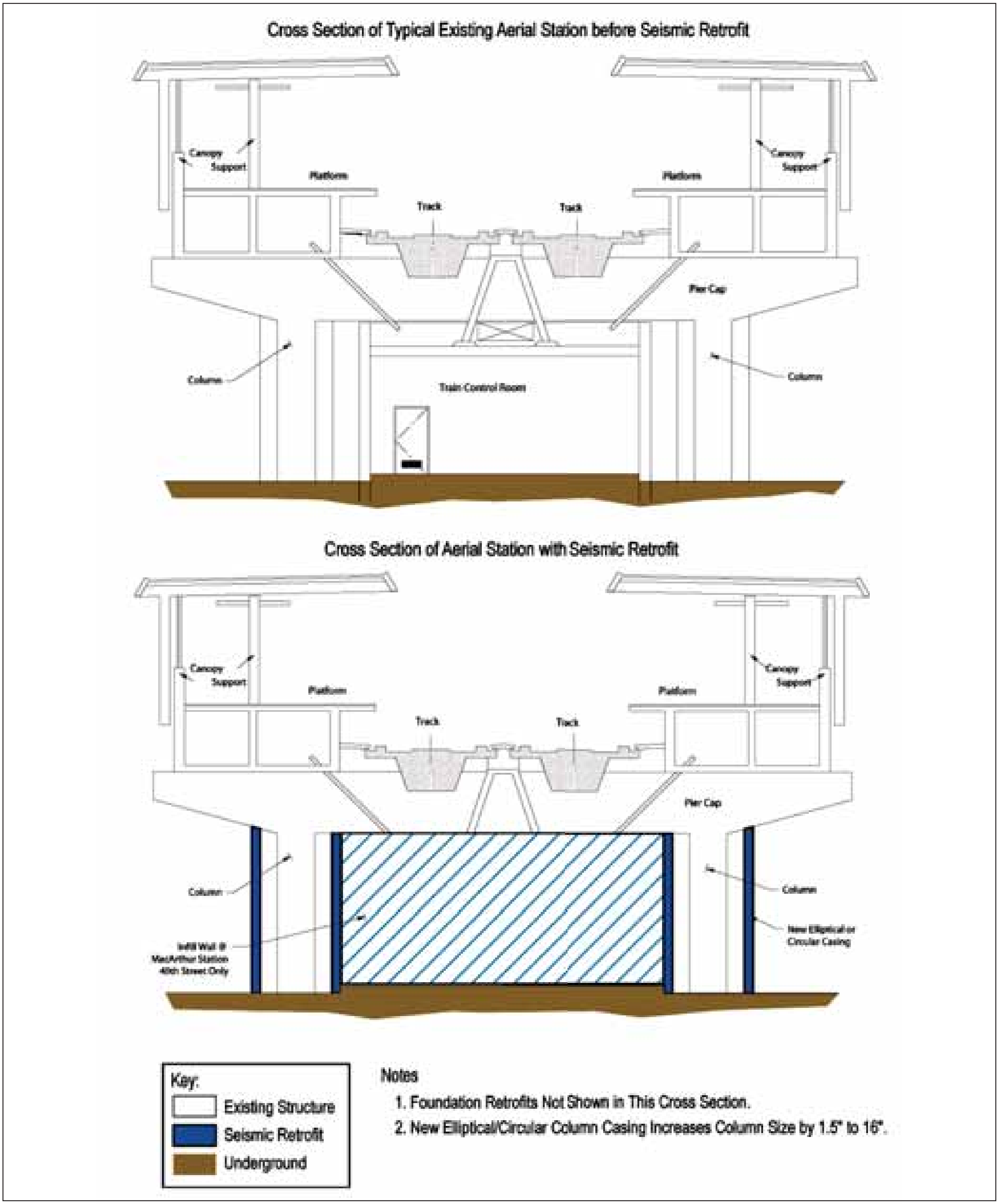

Figure 2-19. Cross-Section of a Typical Aerial Station Before and After Seismic Retrofits

Before commencement of construction activities at Rockridge Station, a protection and conservation plan for the tile mural and bronze plaque will be prepared by a qualified conservator, and implemented during and after planned retrofits to ensure that the mural and plaque remain intact during and after construction activities.

2.2.4.2 MacArthur Station

The MacArthur Station, an at-grade station, consists of two abutments and seven multi-column piers supporting a platform, track, and canopy structures. All columns and walls are on pile footings. Seismic retrofit studies have determined that sliding and dislocation of foundations and pile footings could result in partial or complete loss of operability of at-grade stations in the event of a major earthquake. In addition, ground shaking may cause damage to the walls, columns, shear keys, canopies, and entry structures.

Proposed seismic retrofits for the MacArthur Station would include adding piles and enlarging footings at some piers and along the walls of the station to minimize structural damage and prevent potential collapse. New in-fill walls would also be constructed between columns at one pier. The station walls would be thickened and new footings installed to tie the new piles into the existing walls. Work would also include strengthening the joint connections of the platform canopies. No parking would be affected by the construction activities at MacArthur Station.

Before commencement of construction activities at MacArthur Station, a protection and conservation plan for the mural painting and sculptures will be prepared by a qualified conservator, and implemented during and after planned retrofits to ensure that the mural and sculptures remain intact during and after construction.

2.2.4.3 West Oakland Station

The West Oakland Station, an aerial station, consists of eleven 2-column reinforced concrete piers supported on spread footing foundations, track girders, platform girders, platform canopy structures, train control rooms, the concourse, escalator, stairs, elevators, substation, and a parking lot (see Figure 2-19 for a typical aerial station). The West Oakland Station would be prone to the same types of earthquake damage as the Rockridge Station, such as shear key failure, pier cap damage, column damage, and/or foundation failure.

The West Oakland Station would require similar types of seismic retrofits described above for the Rockridge Station to minimize structural damage and prevent potential collapse. A top mat of rebar and new vertical dowels would be installed in cored holes close to the bottom of existing footings. New concrete blocks would be installed at the top of the pier caps to seismically retrofit the shear keys. New concrete grade beams (7 feet by 12 feet) would be installed both longitudinally and transversely to connect all of the column footings together. A special enlarged foundation would be required for two piers located adjacent to the station lobby and other station features. The individual column footings at these piers would be connected with new reinforced concrete grade beam to create one large footing. Pier retrofits would be conducted one pier at a time. Work would also include strengthening the joint connections of the platform canopies.

The construction phasing plan for the West Oakland Station generally proposes seismic retrofit work at two piers during each phase. Approximately 20 to 30 parking spaces would be closed during each phase of construction, or up to 6 percent of the total supply.

2.2.5 Other Seismic Retrofit Activities

The Oakland Yard and Shop area, located on BART property (see number 38 on Figure 2-18), is used to conduct maintenance and repair for the BART system and trains. These buildings are likely to suffer extensive damage during an earthquake. Proposed seismic retrofit measures would include additional diagonal bracing of framing elements and strengthening of structural joints within the existing frame to minimize the effects of a potential earthquake. The staging area would be located within the existing paved areas surrounding the Oakland Yard and Shop.

No ground disturbance would be required, and there would be no effect on BART passengers during construction since these buildings are located on restricted BART property.

Seismic retrofit activities would be conducted with minimal impact to BART service. During all seismic retrofit activities, construction contractors will use energy efficient equipment, avoid unnecessary idling of construction equipment, maintain equipment in good working conditions, and encourage car pooling of construction workers. Construction equipment will not block BART trains or substantially interfere with BART employees or riders. In areas where operations could be impacted, work will be done during non-operational hours (generally 12:30 to 4:00 A.M. weekdays, but this varies by location, and non-operational hours are longer on weekends). BART operates from 4 A.M. to midnight on weekdays, 6 A.M. to midnight on Saturdays, and 8 A.M. to midnight on Sundays.

Any utilities (including pipelines, electrical cables, telephone cables, fiber optic lines, etc.) located in the project area that may interfere with seismic retrofit activities will be either protected in place or relocated at the commencement of the work. Utility relocation will be conducted as part of the project. BART will consult with potentially affected utility companies to identify the utilities that may be affected and to ensure continuation of service. The contractor will be required to install all re-routed utility lines and conduct tie-in activities during off-peak service periods approved by the affected utility provider. All relocations of wastewater piping shall utilize pumps and diverted flows to maintain full service capabilities.

Prior to commencement of construction, the construction contractor will be required to prepare and implement a construction phasing plan and traffic management plan to manage and maintain traffic operations, parking, pedestrian and bicycle safety, etc. throughout the duration of retrofit activities at any aerial guideway location or BART station, including for any required utility relocation work. The plan would be developed with the direct participation of BART, the City of Oakland, AC Transit, and Caltrans. In addition, the property owners of all businesses adjacent to the construction areas will be consulted.

Construction contractors will be required to prepare Site Specific Work Plans or BART will implement operational changes issued by the System Safety Department, delineating emergency procedures for evacuation of BART trains. Contract specifications will also include specific procedures for maintaining the security of the BART right-of-way, provisions for maintenance of communication and ventilation control systems and/or provisions for back-up systems during all retrofit activities, and provisions of BART's System Safety Plan and Emergency Response Plan. Contractors will be required to adhere to standard BART procedures that require background checks on all contractors. The Operations Control Center will be notified at the start and end of any major construction activities. Additionally, BART will coordinate with the City of Oakland and San Francisco Fire Departments throughout all retrofit activities.

In addition, contractors will be required to prepare a Health and Safety Plan, for each retrofit location, and Soils Management Plan prior to commencement of construction activities. In the event that contaminants are encountered during excavation activities, all construction contractors will be required to adhere to the prevention procedures stipulated in these plans, including compliance with Cal-OSHA 40-hour training requirements. For all land-based construction activities, the contractors will also be required to implement the BAAQMD Enhanced Control Measures, as well as BART Standard Specifications - Section 01570, Part 1.08, during dry conditions for dust control.

2.2.6 Dredged Material Reuse/Disposal Options

This section describes the reuse/disposal options, both within the project and offsite, for the dredged material that would be generated by the project. Dredging would be required for a variety of retrofit activities proposed at the Transbay Tube and the San Francisco Transition Structure, including: (1) stitching the Tube at the San Francisco end (section 2.2.1), (2) the pile and collar anchorage associated with the Steel Piles Retrofit Concept (section 2.2.2), (3) the Containment Structures associated with both retrofit concepts (section 2.2.2), (4) the Isolation and Support Walls associated with the Isolation Walls Retrofit Concept (section 2.2.2), and (5) the Sacrificial Walls associated with the Steel Piles Retrofit Concept (section 2.2.2). The total amount of dredged material generated from the project would range from approximately 153,000 to 222,000 cy, depending on if the Steel Piles Retrofit Concept or the Isolation Walls Retrofit Concept, respectively, is implemented at the San Francisco Transition Structure. Proposed dredge and fill volumes, the expected duration of dredging for each dredge location, and the number of new piles that would be installed are summarized in Table 2-1. A more detailed discussion of activities associated with the dredged material disposal options, including a conceptual construction sequence and additional information on each reuse/disposal option, is included in Appendix A.

A wide range of dredge disposal options was examined for this project. Section 2.2.6.1 assumes that project dredged material will test suitable for in-Bay disposal, and describes the possibility of reusing some of the dredged material during stitching the Tube at the San Francisco end, with the remainder of the material from retrofits at the San Francisco Transition Structure being disposed offsite at one of the in-Bay or upland reuse/disposal sites. These potential in-Bay or upland reuse/disposal sites are discussed in detail in section 2.2.6.2, along with two potential landfill sites that could be used for disposal of the most contaminated material. Section 2.2.6.2 also assumes that no material is reused within the project stitching operations, and that the total project dredged material may be disposed at one of the eight offsite reuse/disposal locations. That is, section 2.2.6.2 presents a worst-case analysis in which the maximum 222,000 cy of dredged material associated with the combined stitching operation and Isolation Walls Retrofit Concept could go to any of the reuse/disposal sites listed in Table 2-2, including a landfill site.

2.2.6.1 Dredged Material Reuse within the Project

If the dredged material meets the requirements for in-Bay disposal[15], some of the project dredged material (up to 126,100 cy) could be reused within the stitching operation by backfilling the stitching holes after the installation of the pile and pile caps (Figure 2-20). This would minimize effects on transportation and air quality since the total amount of material would not require transport to an offsite facility for disposal. Dredged material would be stored on barges until the stitching holes are ready for backfilling. Even after reuse within the stitching operations, however, dredged material associated with the Steel Piles Retrofit Concept (approximately 26,900 cy) or the Isolation Walls Retrofit Concept (95,900 cy) would require offsite disposal at one of the permitted in-Bay or upland reuse/disposal sites (described in section 2.2.6.2). Because dredged material would have to meet the requirements for in-Bay disposal under this scenario, any leftover dredged material would also be expected to meet the requirements for disposal at any in-Bay, ocean, or upland reuse/disposal sites.

In addition, during dredging associated with stitching, some of the existing ordinary backfill (a special mix of sand and gravel) located directly over the Tube would need to be removed to allow the frame for the stitching piles to sit directly on top of the Tube structure. Consequently, some additional ordinary fill material (approximately 11,000 cy) would have to be imported because it is not possible to segregate the ordinary backfill from the regular Bay Mud sediments that overlay the Tube while dredging is occurring. Filling the holes with the imported ordinary backfill would potentially displace up to 11,000 cy of available area that would otherwise be filled by the 126,100 cy of project dredged material, and could exceed the capacity of the six holes. Although it is impossible to closely balance cut and fill volumes during dredging operations due to sediment settling and other factors, such as ocean current, the possibility remains that up to 11,000 cy of dredged material may require offsite disposal following completion of dredging activities at the six stitching locations. If any dredged material exceeds the capacity of the six stitching holes as a result of being displaced by the ordinary fill, it will be disposed offsite at one of the permitted in-Bay, ocean, or upland reuse/disposal sites (described in section 2.2.6.2), along with the additional 26,900 to 95,900 cy of dredged material associated with retrofits at the San Francisco Transition Structure under the Steel Piles Retrofit Concept or the Isolation Walls Retrofit Concept, respectively. Transport of the total combined 37,900 to 106,900 cy of dredged material, including the stitching reuse material potentially displaced by the ordinary fill (up to 11,000 cy) and either the Steel Piles Retrofit Concept or the Isolation Walls Retrofit Concept, respectively, would require a maximum of 11 to 31 barge trips (each containing approximately 3,500 cy of material).

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15 Dredged material meets the requirements for in-Bay disposal if the material is dispersive in nature and tested suitable pursuant to the Inland Testing Manual (EPA and USACE 1998). See also Appendix A (Dredged Material Reuse/Disposal Options) and section 3.1.2.3 (Water Resources).

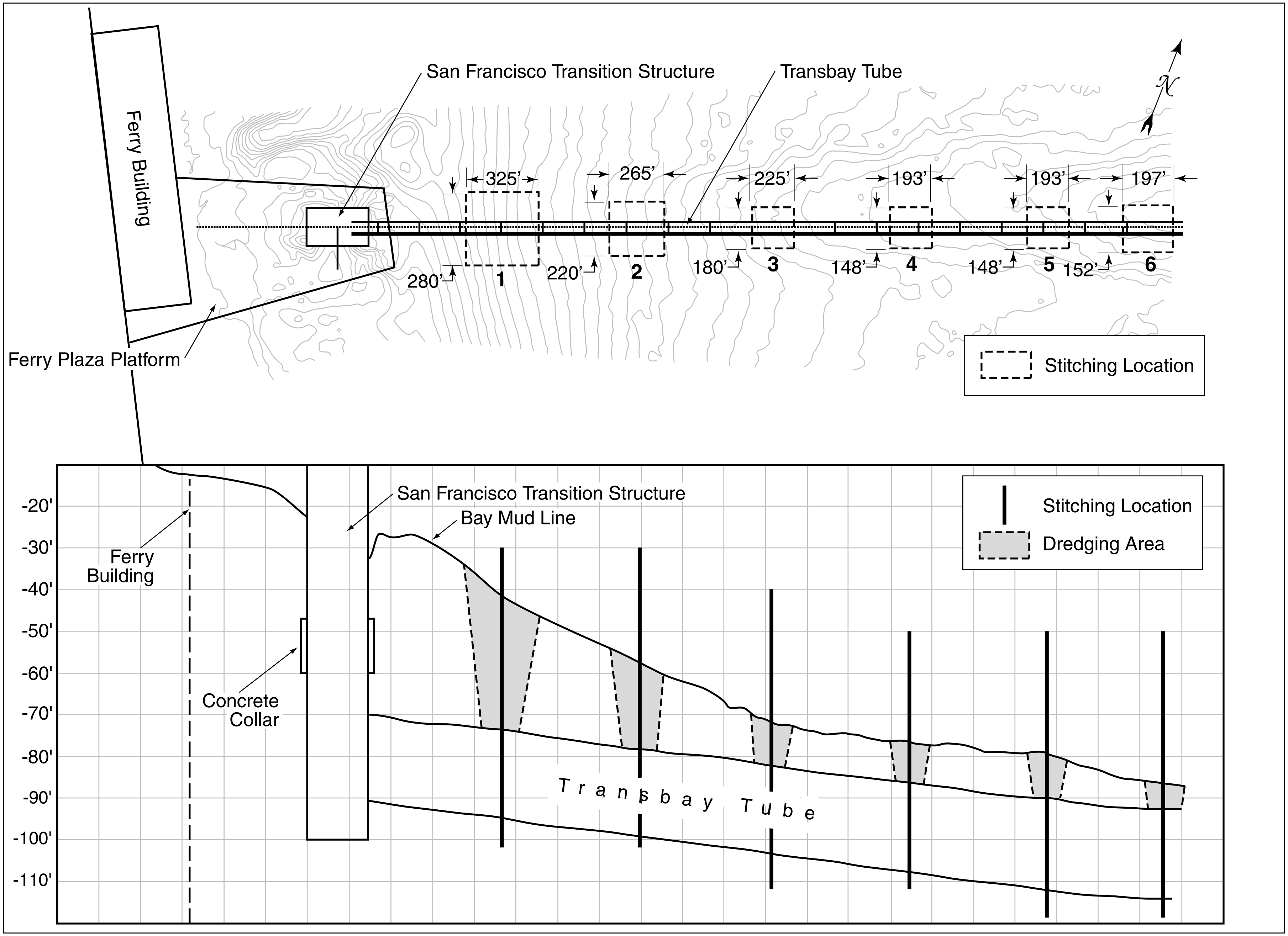

Figure 2-20. San Francisco Stitching Site Holes

2.2.6.2 Dredged Material Reuse/Disposal Options outside the Project

Eight offsite reuse/disposal options not involving reuse within the project are evaluated; these are listed in Table 2-2 and shown in Figure 2-21. These reuse/disposal options represent a variety of beneficial uses of the dredged material, including wetland restoration at Hamilton or Montezuma Wetlands, levee maintenance on Winter Island, and fill for the proposed Alameda Point Golf Course. For other options, the dredged material would be disposed in the Bay (Alcatraz), in the ocean (San Francisco Deep Ocean Disposal Site [SF-DODS]), or in a landfill (Altamont, Vasco Road). As shown in Table 2-2, all of the sites have the volume capacity to accommodate the entire maximum 153,000 to 222,000 cy of dredged material from the project associated with stitching activities and either the Steel Piles Retrofit Concept or the Isolation Walls Retrofit Concept, respectively, assuming the dredged material meets the site's acceptance criteria with regard to sediment quality. Although the Altamont Landfill's capacity is 125,000 cy per year, the landfill could reasonably accommodate the total dredged material over the project lifetime, assuming 2 to 4 years of construction.

Disposal of dredged material at an ocean site (e.g., SF-DODS) is possible if the dredged material is tested in accordance with the Ocean Testing Manual. For in-Bay disposal (e.g., Alcatraz), maintenance dredging is given priority; material that is dispersive in nature and tested suitable pursuant to the Inland Testing Manual would be potentially eligible for this disposal option. The feasibility of in-Bay disposal also depends on the dredging volume and timing. In-Bay disposal site capacities will decline over the next few years to ensure compliance with the Long-Term Management Strategy (LTMS) plan to reduce in-Bay disposal (U.S. Army Corps of Engineers [USACE] et al. 1998). Disposal of the dredged material at an ocean or in-Bay site would require 44 to 64 barge trips (each with approximately 3,500 cy capacity) to transport the maximum 153,000 to 222,000 cy of dredged material associated with the combined stitching activities and either the Steel Piles Retrofit Concept or the Isolation Walls Retrofit Concept, respectively.

For the upland and landfill sites, the dredged material would need to be dewatered before reuse/disposal. The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) does not permit dredged material to be dewatered into San Francisco Bay. For disposal sites where dewatering is needed, it must be done on land. To transport the dredged material to a dewatering site, it is assumed that a 5,000-cy barge would have an effective material loading capacity of 70 percent, because approximately 30 percent of the capacity would be taken up by water and material bulking, which is the volume of the material that expands upon excavation. This 30 percent reduction in barge capacity would also accommodate the need to not load the barges beyond the extent to which they can fully contain the dredged material during transport to the disposal site. Therefore, each barge would only load 3,500 cy of material, and 44 to 64 barge trips would be required to transport the maximum 153,000 to 222,000 cy of dredged material associated with the combined stitching activities and either the Steel Piles Retrofit Concept or the Isolation Walls Retrofit Concept, respectively, to an upland reuse/disposal site or to a dewatering site for landfill disposal. Some of the upland reuse/disposal sites have their own dewatering/sediment rehandling facilities, while others do not. Table 2-3 summarizes the locations where dredged material would be dewatered/rehandled, depending on the disposal site.

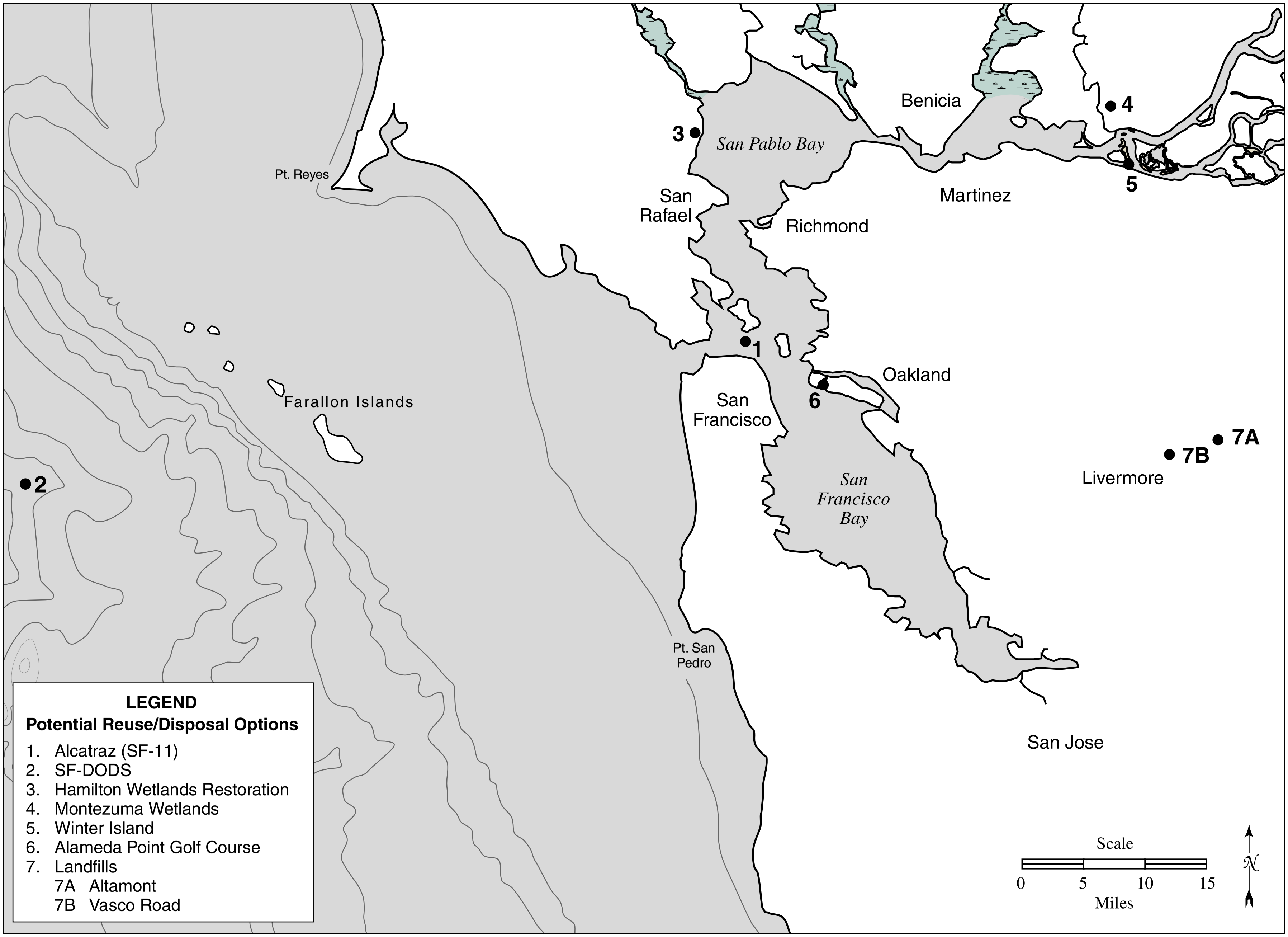

Figure 2-21. Potential Dredged Material Disposal Site Options

Table 2-2. Dredged Material Reuse/Disposal Options for the BART Seismic Retrofit Project (not Involving Reuse within the Project)

Disposal Site	*Disposal Capacity for the Years 2005 through 2011*[1]	*Qualitative Description of Type of Material Accepted*
IN-BAY		
Alcatraz (SF-11)	1.65 – 0.9 million cubic yards (mcy) per year	Clean material passing testing under the Inland Testing Manual (USACE et al. 1998)
OCEAN		
SF-DODS	4.8 mcy per year	Clean material passing testing under the Ocean Testing Manual (USACE et al. 1998)
UPLAND		
Hamilton Wetland Restoration (including Bel Marin Keys) — Novato, CA	10.6 mcy total	Clean "cover" material (CCC 2003)
Montezuma Wetland Restoration — Solano County, CA	17 - 20 mcy total	Both "cover" and "non-cover" material (Solano County 2001)
Winter Island — Contra Costa County, CA	800,000 cy total	Material suitable for levee rehabilitation (fewer chemical restrictions than wetland use) (USFWS 2000)
Alameda Point Golf Course	2 mcy total[2]	Revised DEIR for golf course issued in March 2005; project approval expected by Jan 2006. San Francisco Bay Conservation and Development Commission & Regional Water Quality Control Board to establish sediment quality criteria for this site; fill to be covered by more than 3 feet of clean sand (City of Alameda 2004).
LANDFILLS		
Altamont Landfill (Class II & III facility) — Livermore, CA	125,000 cy per year	Nonhazardous, non-petroleum contaminated Class III waste, per CCR Title 22 and 40 CFR (Alameda County 2000, 2003).
Vasco Road Landfill (Class III facility) — Livermore, CA	300,000 cy per year	

Notes:
1. The timeframe 2005 through 2011 is the expected construction period for the BART seismic retrofit project. Designated capacities for in-Bay disposal sites are expected to decline over the period 2005 through 2011, along with the decrease in in-Bay disposal allowed under the Bay Area's LTMS for dredged material disposal.
2. The Alameda Point Golf Course Project would be able to accept up to 2 mcy, but only until 2008.

Table 2-3. Potential Dredged Material Dewatering/Rehandling Locations

Disposal Site	*Dewatering/Rehandling Location*
Hamilton Wetland Restoration	Hamilton Wetland Restoration[1]
Montezuma Wetland Restoration	Montezuma Wetland Restoration[1]
Winter Island	Winter Island[2]
Alameda Point Golf Course	Alameda Point Golf Course[1]
East Bay Landfills	Port of Oakland Berth 10 Rehandling Facility

Notes:
1. Project has or will have a dedicated sediment rehandling facility.
2. Winter Island does not have a sediment rehandling facility but the dredged material could be placed inside berms that would allow the excess water to drain into the ground.

Disposal at the Altamont or Vasco Road Landfills could be used for the most contaminated sediment. To be acceptable at either landfill, the dredged material must meet a less than 50 percent moisture limit criterion and have no free liquids. The dredged material would first be dried at the Port of Oakland's Berth 10 rehandling facility. This facility would be made accessible to BART until the Port's new Berth 29 is constructed, which is not expected to occur until after the BART project has been completed. The Port would lease this rehandling facility to BART; BART would have to operate the facility under the conditions specified in the Port's existing permit, including all dewatering requirements, as SFBRWQCB does not allow for any waste discharge offsite. BART would be allowed to offload only 15,000 to 20,000 cy of dredged material over a 2-month period. The project could do this repeatedly every 2 months for as long as it took to dry the maximum combined 153,000 to 222,000 cy of project dredged material, should all material be destined for landfill disposal. Sediment would then be trucked to a landfill in small (12-cy capacity) dump trucks. Dredged material hauling from the Port of Oakland to landfill disposal sites will only occur outside of peak hours (6 AM to 10 AM and 3 PM to 7 PM).

Based on the Port’s dewatering requirements, it would take approximately 15 to 20 months to dry the total 153,000 cy of dredged material associated with the combined stitching operation and Steel Piles Retrofit Concept before it could be transported to a landfill site. Transport of this material would require 12,750 total truck trips whether spread over the estimated 3 year construction period, or occurring in successive trips immediately after the material is dried (15 to 20 months). This would equate to approximately 12 daily truck trips (if spread evenly over the 3 year period) or approximately 21 to 28 daily truck trips (if trips occur consecutively during the 15 to 20 month dewatering period).

Dewatering the total 222,000 cy of dredged material associated with the combined stitching operation and Isolation Walls Retrofit Concept would take approximately 22 to 30 months. Transport of this material would require 18,500 total truck trips whether spread over the estimated 4 year construction period, or occurring in successive trips immediately after the material is dried (22 to 30 months). This would equate to approximately 13 daily truck trips (if spread evenly over the 4 year period) or approximately 21 to 28 daily truck trips (if trips occur consecutively during the 22 to 30 month dewatering period).

A dredging operation plan, for barges traveling to upland and in-Bay sites, will be implemented as part of the dredging permit approval process, and will include conditions for spill control measures, proper dredged material handling, use of hydraulic fuel, loading requirements, etc. Additionally, because dredged material will be 80% dry, and only 20% liquid at the time of transport by truck, an accidental spill during transport would not result in uncontrolled release of dredged material.

Since sediment testing results for the sediments that would be dredged for the project are not available, it is not known at this time if some portion of the total dredged volume would be suitable for certain reuse/disposal options (e.g., in-Bay, ocean, or wetland restoration) while other portions would require a different disposal solution (e.g., landfill). However, it should be noted that in 2004, 95 percent of all material dredged in the San Francisco Bay was deemed suitable for aquatic disposal (Bay Planning Coalition 2005), which is consistent with historic values that indicate the proportion of dredged material recommended as unsuitable for unconfined aquatic disposal is typically less than 5 percent (Dredged Material Management Office [DMMO] 2002). The unsuitable material is usually from maintenance dredging projects. Based on this information, it is expected that most, if not all, project dredged material will be determined suitable for in-Bay, ocean or beneficial upland reuse disposal. It is not expected that a large portion of the project dredged material would require a different disposal solution (e.g., landfill), and it could be that the total volume of dredged material would be suitable for one reuse/disposal site. However, this document still presents a worst-case analysis in which the maximum 222,000 cy of dredged material associated with the combined stitching operation and Isolation Walls Retrofit Concept could go to any of the reuse/disposal sites listed in Table 2-2, including a landfill site.

2.2.7 Schedule

The approximate construction schedule for the project is outlined below (see Figure 2-22).

- Transbay Tube and Transition Structures
  - Transbay Tube micropile anchorage or vibro-replacement — 2 years
  - Vibro-replacement on land (Oakland end) — 1 year
  - Stitching on the San Francisco end — 1½ years
  - Stitching on the Oakland end — 1 year
  - San Francisco Transition Structure — 2 to 4 years
  - Oakland Transition Structure — ½ year
  - San Francisco Seismic Joint Restoration — 1½ years
- Aerial Guideways — 4 years
- Stations — 6 years
- Oakland Yard and Shop Area — 1¼ years

2.3 NO-ACTION ALTERNATIVE

Under the no-action alternative, the proposed seismic retrofit of the BART system between the Berkeley Hills Tunnel and Montgomery Street Station would not occur. The use of the BART system would continue as it currently exists, but without the benefit of added protection against seismic activity.

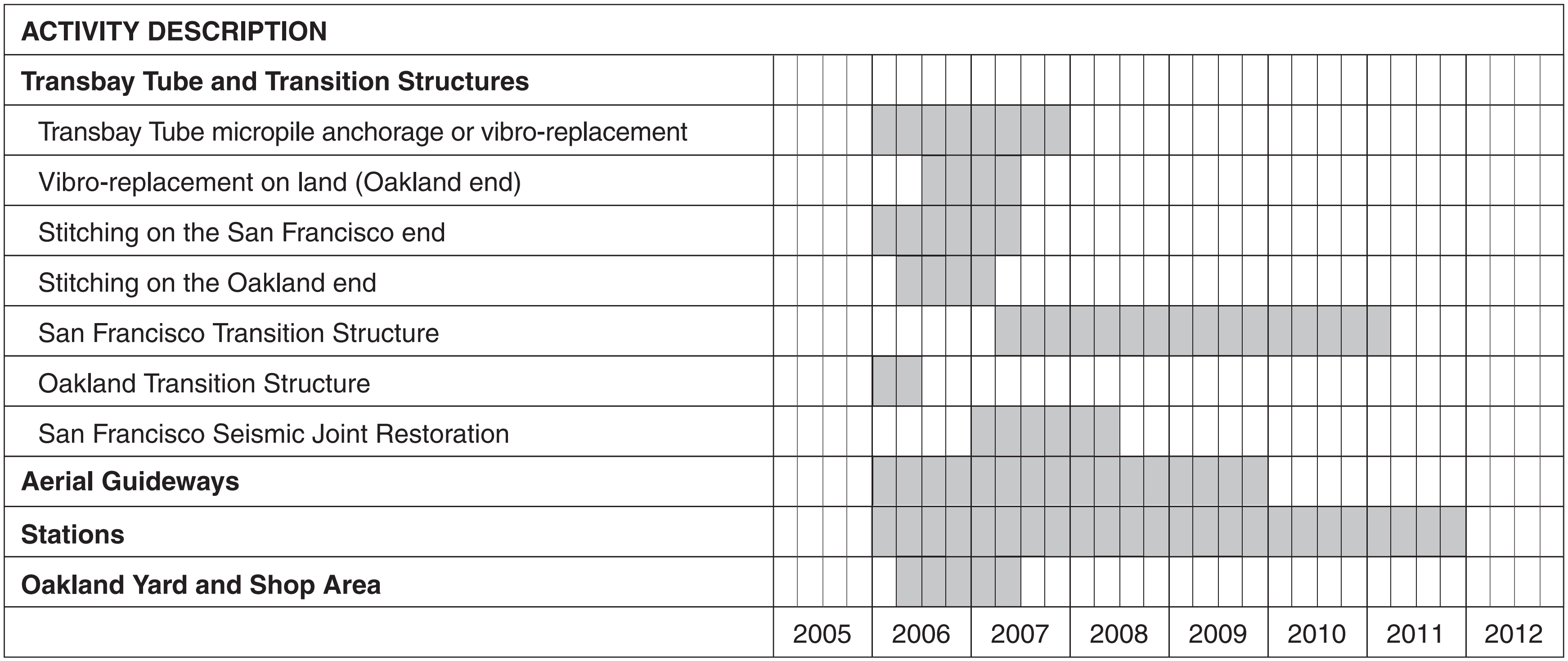

Figure 2-22. BART Seismic Retrofit Project Construction Schedule

Implementation of the no-action alternative would not meet the purpose and need of the proposed action, which is to provide seismic retrofitting to the BART system to protect life safety and the massive public capital investment represented by the BART system and to prevent prolonged interruption of BART service to the public.

NEPA requires that the no-action alternative be analyzed; it also provides a measure of the baseline conditions against which the impacts of the project can be compared. Analysis of potential impacts associated with the no-action alternative is discussed in section 3.12 (No-Action Alternative).

2.4 DESIGN VARIATIONS CONSIDERED BUT ELIMINATED FROM FURTHER EVALUATION

Several seismic retrofit design variations were considered for the Transbay Tube, transition structures, and aerial guideways, but were eliminated from further evaluation for the reasons discussed below. The following discussion is based on the *BART Seismic Vulnerability Study* (BART 2002a).

2.4.1 Transbay Tube

Alternative design variations examined as an alternative to the micropile anchorage technique to minimize the potential effects of liquefaction include exterior Tube tie-downs, heavy riprap over the existing fills, and chemical or jet grouting of the backfill. These alternatives were eliminated from further evaluation because of excessive cost, difficulty in confirming their effectiveness, and they would cause greater environmental concerns. The following three design variations were considered as alternatives to stitching the Tube.

1. Chemical or jet grouting was considered for anchoring the Tube's end to improve the friction between the Tube and soil. This alternative was determined to be less reliable and more expensive, and was eliminated from further evaluation.
2. Installing a new seismic joint in the first section of the Tube east of San Francisco (east of the existing seismic joint on the eastern side of the San Francisco Transition Structure) was considered as an alternative to accommodate potential large movements at the seismic joint. The new joint would be constructed to have sufficiently large seismic movement capacity to accommodate the predicted seismic motion demand at the end segment of the Tube. This alternative was found not to be viable due to high costs and risks to the BART system during construction, and was eliminated from further evaluation.

Internal battered micropile tube tie-downs were considered but rejected due to the lack of sufficient horizontal tension load capacity that could be generated in the micropiles, together with the complexities of construction in the tight quarters of the Tube gallery.

The installation of a permanent cofferdam[16] structure was considered as an alternative, interim safety measure prior to installation of all seismic retrofit measures and as a long-term

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16 A cofferdam is a watertight, temporary structure used to keep out water during construction.

redundant protection of the Tube. The cofferdam would surround the San Francisco Transition Structure and existing seismic joints, and would minimize the volume of Bay water entering the Tube if water leaks developed at the seismic joints following excessive joint movement. This concept was not feasible because sealing the cofferdam as it crossed the Tube on the Bay side would be very difficult to accomplish, and there would be a potential for damage to the Tube and adjacent structures. Also, the cofferdam structure could potentially alter the hydrological effects of the transition structure on the Bay and would potentially become a long-term maintenance problem because of standing water inside the cofferdam. Therefore, this alternative was eliminated from further evaluation.

2.4.2 Transition Structures

At the San Francisco Transition Structure, the following four design variations were considered as an alternative to the Pile Array Anchorage method to prevent soil liquefaction and reduce the spreading of soils downslope between the Ferry Building and transition structure. Similar alternative design methods were considered for the Oakland Transition Structure, but were rejected for the same reasons.

1. Installation of a sheet pile barrier wall was eliminated from further evaluation since it was determined that it would not be able to restrain the imposed load from the spreading soil.
2. Adding additional larger-diameter piles to the platform was eliminated from further evaluation since the platform, with the added piles, could not be relied upon to provide a restraint to the spreading soil.
3. Adding large diameter piles with a steel frame was considered but rejected due to the relatively constant corrosion protection maintenance effort that would be required for the steel frame in the salty Bay water.
4. At the San Francisco Transition Structure, one design variation was considered as an alternative to the Piles and Collar Anchorage method alone to stabilize the transition structure from sliding and rocking movements as well as the pressure from spreading soils. Jet or chemical grouting of the 20-foot thick soft Bay Mud layer under the base of the transition structure was considered to improve the soil shearing and bearing capacity of the mud and to prevent bearing and sliding failures of the soil. This grouting would be done from the Ferry Plaza Platform using directional drilling techniques through temporary holes in the platform, and from within the transition structure through the base slab. This alternative was determined to be less reliable on its own, as well as more expensive; therefore, it was eliminated from further evaluation.

2.4.3 Aerial Guideways

The installation of additional piles at the foundations of all aerial piers, regardless of soil conditions, was considered. This alternative would ensure that no damage would occur to the pile foundations during an earthquake, but would increase the risk of a catastrophic failure in the columns. BART elected to accept some foundation damage to reduce the risk of column collapse (and associated risks to life safety) by proposing to add additional pile foundations only where required; therefore, this alternative was eliminated from further evaluation.

3.0 EXISTING ENVIRONMENT, IMPACTS, AND MITIGATION

Technical studies were prepared for a number of resource areas evaluated in this EA; these studies provide an in-depth analysis of potential impacts associated with the project. Mitigation measures for the project identified in this EA are also based on the findings and recommendations of these specialized technical studies. The following technical studies were prepared for the project:

- Water Quality and Hydrology Technical Study;
- Location Hydraulic Study;
- Noise Technical Study;
- Cultural Resources technical studies, including:
  - Archaeological Survey Report,
  - Historic Property Survey Report,
  - Historical Resources Evaluation Report, and
  - Finding of Effect;
- Traffic Technical Study;
- Vessel Transportation Technical Study;
- Phase I Environmental Review and Phase II Field Investigation Report;
- Visual Resources Technical Study;
- Biological Resources technical studies, including:
  - Biological Assessment, and
  - Natural Environment Study; and
- Environmental Justice Technical Study.

These studies are available for review at BART's Seismic Retrofit/Earthquake Safety Program offices located at 300 Lakeside Drive, 17th floor, in Oakland, California, during regular business hours (9 A.M. to 5 P.M. Monday through Friday).

The following resource areas were determined to have no impacts and, therefore, are not discussed further in this EA: Land Use; Utility Service Systems; and Energy. Land Use impacts are not anticipated because the proposed action is improvement of an existing facility in its current location, and does not include adding new facilities or increasing the capacity of the BART system. In addition, BART will undertake utility protection and/or relocation work as part of the project to ensure continuation of utility service as described in section 2.2.5. Accordingly, no impacts to Utility Service Systems are anticipated. For energy-related impacts, energy conservation measures have been incorporated into the project as described in section 2.2.5. The only energy consumed by the project will be from construction equipment during the construction period, no wasteful energy consumption will occur, and there will be no consumption of energy after the retrofit activities are completed.

A detailed discussion of the regulatory environment governing this project is provided in Appendix C of this EA. If a project activity requires a permit or other regulatory action (e.g., stormwater discharge requires a National Pollutant Discharge Elimination System (NPDES) permit under Section 402 of the Clean Water Act), the applicable regulatory requirement is also identified in the impact discussion.

Analysis of the impacts associated with the reuse or disposal of dredged material generated by the project is provided under each resource area in Chapter 3 of the EA. The EA analyzes two feasible scenarios for reuse or disposal of project dredged material, including (1) dredged material reuse *within* the project (see Appendix A, section A.1), provided results from standardized testing demonstrate the material is suitable for in-Bay disposal, and (2) dredged material reuse/disposal options *outside* of the project (see Appendix A, section A.2). Reuse or disposal of dredged material outside the project would occur at existing, permitted facilities or designated sites. Disposal-related impacts on resources at each of the in-water and upland sites have been evaluated previously in the site designation environmental documentation (e.g., Environmental Impact Statement [EIS] or permit applications specific to each disposal facility and reuse site). Because the reuse and disposal sites considered for this project are already designated/permitted, use of the sites for disposal of dredged material from the project would comply with the site use and other permit conditions. The following resource areas would potentially be impacted by transporting dredged material to the reuse/disposal sites, and thus are addressed in greater detail in Chapter 3 of the EA:

- Water Resources;
- Noise;
- Transportation;
- Visual Resources;
- Biological Resources; and
- Air Quality.

The following resource areas would not be impacted by the transport of dredged material to the reuse/disposal sites, so a detailed discussion is not provided:

- Cultural Resources;
- Geology/Seismicity;
- Hazardous Materials;
- Risk of Upset/Safety (safety related to vessel transportation is addressed in section 3.4, [Transportation]); and
- Social Impacts.

3.1 WATER RESOURCES

A Water Quality and Hydrology Technical Study (BART et al. 2005a) was prepared to assess potential impacts to water resources located in the project area. Resource areas evaluated in this technical study include the following: hydrology and circulation; water quality; sediment quality; flooding potential; and groundwater hydrology. The environmental analysis determined that impacts on water resources would be short term (for the duration of the construction activity) and localized (BART et al. 2005a). A Location Hydraulic Study (BART et al. 2005e) was also prepared to assess the potential hydraulic impacts associated with the project. This study provides a detailed analysis of project work that lies within the base (100-year) floodplain, including the 100-year high tidal floodplain (100-year tidal floodplain). The study concludes that project impacts to hydrology and floodplain risks would be negligible.

3.1.1 Existing Setting

The existing setting for water resources is summarized below and described in greater detail in the Water Quality and Hydrology Technical Study (BART et al. 2005a) and Location Hydraulic Study (BART et al. 2005e).

3.1.1.1 San Francisco Bay Water Resources

The project would potentially affect water resources predominantly within the central portions of San Francisco Bay, between San Francisco and Oakland in the vicinity of the San Francisco-Oakland Bay Bridge (Bay Bridge) and Yerba Buena Island, and portions of urban areas within west Oakland along the existing BART system.

Hydrology and Circulation

Freshwater inflows, tidal flows, and their interactions largely determine variations in the hydrology of the Bay. These processes enhance exchange between shallows and channels during the tidal cycle and contribute significantly to landward mixing of ocean water and seaward mixing of river water. The 100-year tidal elevations are shown in Table 3.1-1 for gages near the Transbay Tube. To estimate the 100-year tidal elevation during construction, an adjustment for the general rise in sea level is made. The 100-year tide elevations from the National Oceanic and Atmospheric Administration (NOAA) and the Federal Emergency Management Administration (FEMA) in Table 3.1-1 include consideration of such phenomena as El Niño and tsunami effects.

There has been a general rise in ocean levels over the last 100 years according to USGS and NOAA records. At the Fort Point sea level station near the south landing of the Golden Gate Bridge, sea levels have increased an average of 8 inches from 1900 to 1999 (USGS 1999). This rate of sea level rise can be used to adjust the USACE and FEMA estimates of the 100-year tide from the 1980s values shown in Table 3.1-1 for the gages near the project, up to the first year of anticipated project construction. Assuming project construction begins in 2005, and using the rate of change for sea level from Fort Point, sea levels would increase by 1.6 inches (0.1 foot) by the year 2005. The 100-year tide adjusted for the year 2005 is 0.1 foot of sea level rise added to the highest of the USACE and FEMA values shown in Table 3.1-1.

Table 3.1-1. Comparison of High Tidal Elevations near the BART Transbay Tube

Location	*Port of Oakland Berth 32/33* [a]	*Yerba Buena Island* [b]	*Pier 22 San Francisco Bay* [c]
1984 USACE 100-Year Tide *	6.3	6.3	6.5
1986 FEMA 100-Year Tide **	6.5	6.5	NA
Maximum Historical Tide [d] Date	4.9 12/27/74	5.7 1/9/78	4.8 12/27/74
2005 Adjusted 100-Year Tide [e]	6.6	6.6	6.6

Notes:
All the elevations are based on the National Geodetic Vertical Datum (NGVD).
* USACE (1984)
** FEMA (1986)
a. Station Identification: 941 4779
b. Station Identification: 941 4782
c. Station Identification: 941 4317
d. Based on available data up to 1983 (NOAA 2003).
e. Based on Fort Point sea level rise estimates (USGS 1999) of 0.1 foot by year 2005, added to the higher of the 100-year tidal estimates shown for the USACE and FEMA in the rows above.

Water Quality

The main surface water body in the project area is the San Francisco Bay, which connects to the Pacific Ocean through the Golden Gate Channel. The San Francisco Bay is an estuary, in which river water mixes with and measurably dilutes seawater. Surface runoff from the Bay Bridge and Interstate 80 and urban runoff from adjacent streets, industrial sites, and open areas flows directly or indirectly into the Bay. Other input sources to the Bay include discharges from municipal wastewater treatment plants, discharges from dredging operations, discharges from other industrial processes, and atmospheric deposition.

San Francisco Bay is an impaired water body, meaning it does not meet its designated uses because of excess pollutants, under Clean Water Act (CWA) Section 303(d), and total maximum daily load (TMDL) assessments have been planned or initiated for a number of pollutants/stressors. The 2003 CWA Section 303(d) list of water quality limited segments identifies the following pollutants/stressors for San Francisco Bay Central (Calwater Watershed 20312010) and San Francisco Bay Lower (Calwater Watershed 20410010): chlordane, dichloro-diphenyl-trichloroethane (DDT), diazinon, dieldrin, dioxin compounds, exotic species, furan compounds, mercury, nickel, polychlorinated biphenyls (PCBs) and dioxin-like PCBs, and selenium.

Since 1993, surface water quality throughout the San Francisco Bay has been evaluated by the Regional Monitoring Program (RMP), under the direction of the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). Data from the RMP are used to characterize water and sediment quality in the project area. The Yerba Buena Island station is located in the project area; see Table 3.1-2.

Table 3.1-2. Trace Pollutants in San Francisco Bay Sediments at RMP Station BC11 (near Yerba Buena Island) during the Year 2000

Pollutant	Bay Sediment (milligrams per kilogram [mg/kg])	Effects Levels (mg/kg)	
	BC11	*ER-L**	*ER-M**
Arsenic	8.2	8.2	70
Cadmium	0.27	1.2	9.6
Chromium	NA	81	370
Copper	40	34	270
Lead	20	46.7	218
Mercury	0.20	0.15	0.71
Nickel	74	20.9	51.6
Selenium	0.24	-	-
Silver	0.19	1.0	3.7
Zinc	105	150	410
Total PAHs	1.4	4.022	44.792
Total PCBs	0.025	0.0227	0.18
Total DDTs	0.003	0.00158	0.0461
Total Chlordanes	ND	0.0005	0.006

* ER-L = effects range-low
ER-M = effects range-medium
Source: San Francisco Estuary Institute (SFEI) 2000.

The Central Bay portion of San Francisco Bay generally has the lowest TSS concentrations; however, wind-driven wave action and tidal currents, as well as dredged material disposal and sand mining operations, can cause elevations in suspended solids concentrations throughout the water column. Average concentrations of TSS (based on optical measurements) of 23 milligrams per liter (mg/L) and 32 mg/L were reported at depths of 23 feet and 3 feet above the bottom, respectively, at a site near Pier 24 (on the west side of the Bay Bridge in the vicinity of the project area) (Buchanan and Ganju 2002).

Metals in the Water Column. Ten trace metals in the aquatic system are monitored on a regular basis by the RMP. These trace metals include arsenic, cadmium, chromium, copper, mercury, nickel, lead, selenium, silver, and zinc. Measured concentrations of these metals in the project vicinity were below the respective criteria during 2000 as well as during previous years of the RMP.

Organic Pollutants in the Water Column. The RMP measures three general types of trace organic contaminants: polycyclic aromatic hydrocarbons (PAHs), PCBs, and pesticides. During 2000, Bay waters near the BART project contained PCB concentrations that exceeded water quality criteria, whereas concentrations of other trace pollutants were below criteria. Elevated PCB concentrations occur throughout large portions of the Bay, and the potential source of PCBs in the central San Francisco Bay watershed, identified in the 2002 CWA Section 303(d) list, is "unknown nonpoint source."

Sediment Quality

Sediments within the main channel areas of the San Francisco Bay consist primarily of coarse-grained sands, reflecting the strong currents that restrict deposition and accumulation of finer-grained particles. Along the eastern shoreline of the Bay, sediments are predominantly mud

(Nichols and Patamat 1988). Characteristics of surface sediments may vary seasonally, in response to changes in river flow, transport loads, and wave-induced resuspension of sediments from shallow portions of the Bay (USACE et al. 1998).

While pollutant loading to the San Francisco Bay from point and non-point sources has declined dramatically over the past two decades, and surface sediment contamination may be declining from historical highs, Bay sediments are still an important source and site of accumulation of pollutants. Concentrations of trace metals and organics in Bay sediments are monitored by the state's Bay Protection and Toxic Cleanup Program (BPTCP) (SFBRWQCB 1995) and RMP (SFEI 1998). Sediment metal and trace organic concentrations in bottom sediments at RMP Station BC11 (a station near Yerba Buena Island Station BC10) during 2000 are listed in Table 3.1-2.

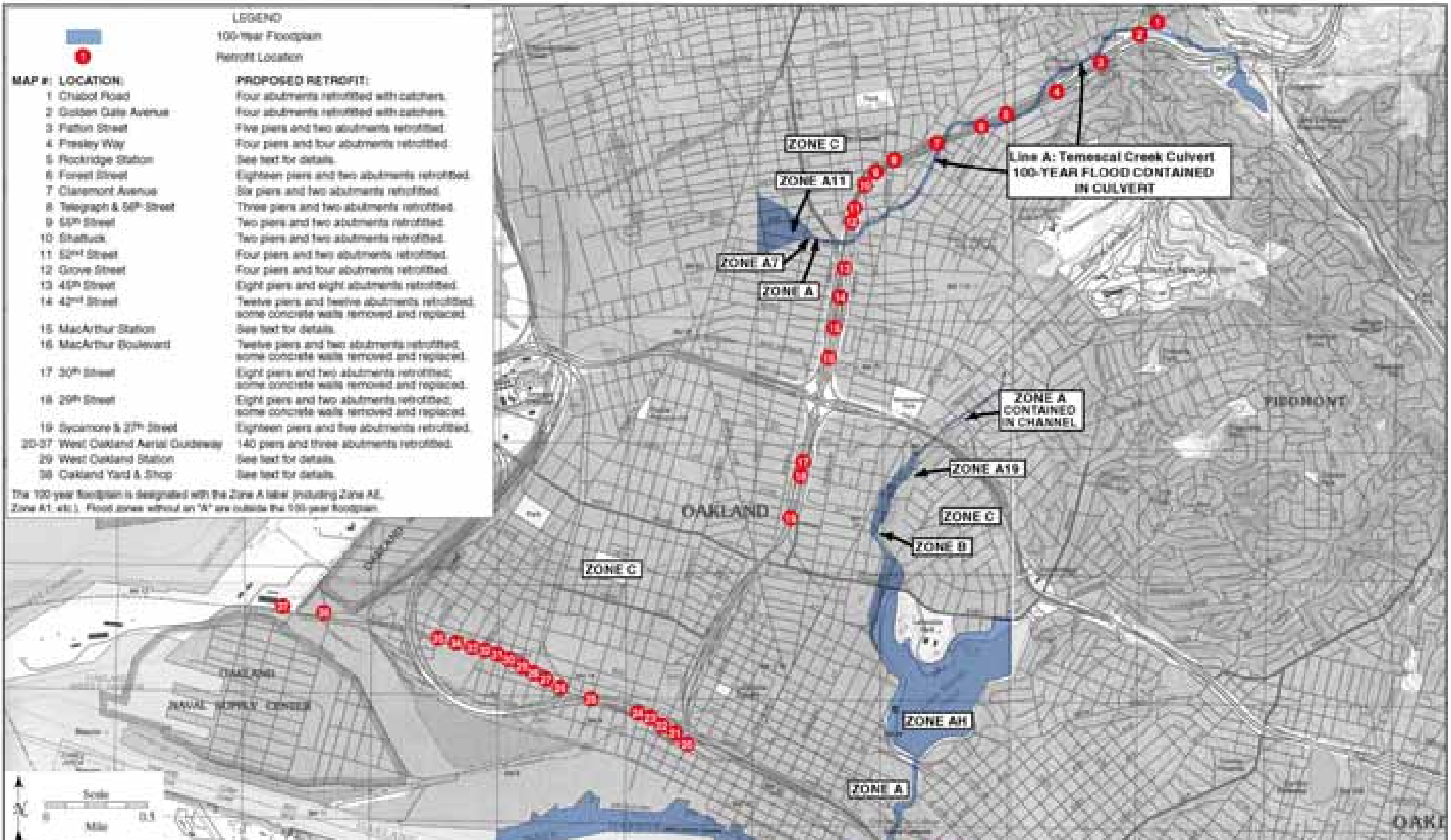
3.1.1.2 Upland Water Resources

Much of the upland portion of the project area is highly developed for urban and industrial uses. The only substantial surface water feature in the vicinity of the project is Lake Merritt in Oakland, which is an urban wildlife refuge, representing a unique resource that provides public exposure to wildlife habitat (Goals Project 1999). The lake is approximately 1 kilometer (km) east of the BART route. Other upland, surface water features within the project area are small and highly modified. Municipal stormwater permits apply to the urbanized portions of the project area.

Most of the historical tidal flats and marshes along the eastern shoreline of the San Francisco Bay have been filled and developed (Goals Project 1999). Compared to the tidal wetlands located in the Emeryville Crescent, shoreline portions of the project area do not provide extensive habitat for wildlife and are characterized by limited functions and values due to human disturbance and lack of wetland species diversity.

Flooding Potential

The floodplain consists of the land-based, 100-year surface runoff floodplain, and the 100-year tidal zone. There are no encroachments of the project on the 100-year floodplain for surface runoff. Figure 3.1-1 illustrates the composite FEMA maps for this area of the project. The BART retrofit locations are shown in red, the floodplain areas are shown in blue. The 100-year floodplain is shown in blue and designated with the Zone A label (including Zone AE, Zone A1, etc). Flood zones without an "A" are outside the 100-year floodplain, and therefore not of concern for this study. The "Line A" Temescal Creek culvert (see Figure 3.1-1) crosses the BART alignment five times between project location 1 and project location 13, but there is a low risk for interference with any of the proposed retrofit locations shown on Figure 3.1-1.



Source: FIRM (Flood Insurance Rate Map): City of Oakland, Calif.; Panel 20 of 45, Community-Panel Number 065048 0020 B
USGS 7.5 Minute Quadrangle: Oakland West, Calif. 1959, 1980; and Oakland East, Calif. 1997

Figure 3.1-1. FEMA Flood Zones Relative to the General Location of Aerial Structures and Station Retrofits

Groundwater Hydrology

Groundwater in the upland portion of the project area is part of the Santa Clara Valley aquifer, and is contained primarily in coarse-grained, lens-shaped deposits of sand and gravel that alternate with beds of fine-grained clay and silt with minimal permeability (Planert and Williams 1995). Groundwater quality near the margins of the Bay may be affected by saltwater intrusion and, locally, by industrial contamination from spills and historical waste discharge practices.

Groundwater elevations at sites along the aerial portion of the BART route are listed in Table 3.1-3. The table compares the groundwater elevations, shown as feet above mean sea level (msl), with the excavation depths proposed for the BART retrofit project. The depths to groundwater are greater than the proposed excavation depths at all sites except for those along the West Oakland Viaduct and the West Oakland Station (the last two rows of the table) near the shoreline of the Bay.

Table 3.1-3. Groundwater Elevations Near Aerial Guideways and Other Facilities

Map #[1]	*Location*	*Proposed Excavation Depths (feet above mean sea level [msl])*	*Groundwater Elevation (feet above msl)*
1	Chabot Road	274	254
2	Golden Gate Avenue	266.5	243
3	Patton Street	252.3	196
4	Presley Way	219	184
6	Forest Street	182.5	150 - 160
7	Claremont Avenue	157.2	114, 129
8	Telegraph & 56th Street	133.5	110, 120
9	55th Street	130.7	103
10	Shattuck	125	<54
11	52nd Street	120.47	84
12	Grove Street	107	80 - 94
13	45th Street	91.0	75
14	42nd Street	Not Available	75, 60
16	MacArthur Boulevard	75.99	53, 58
17	30th Street	47.71	22, 24
18	29th Street	46.75	23, 25
19	Sycamore & 27th Street	31.0	17 – 20
20-28, 30-37	West Oakland Viaduct	-0.2 – 5.5	10
29	West Oakland Station	3	10

Notes:

1. Map # corresponds to Figure 3.1-1.

Source: BART (2001).

3.1.2 Proposed Action

3.1.2.1 Factors for Evaluating Impacts

Impacts on water resources would occur if the project would:

- Violate any water quality standards or waste discharge requirement;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Expose people or structures to a substantial risk of loss, injury, or death involving flooding, as a result of the failure of a levee or dam;
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows;
- Place structures in areas that would encroach on the 100-year tidal floodplain;
- Increase the potential for inundation by seiche, tsunami, or mudflow;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or increase the rate or amount of surface runoff so as to cause substantial flooding, erosion, or siltation on- or off-site; or
- Otherwise substantially degrade water quality.

3.1.2.2 Impacts and Mitigation

Transbay Tube

Micropile Anchorage. Because drilling would affect only subsurface sediment layers (i.e., those beneath the Tube and below the bottom of the Bay), drilling would not resuspend or otherwise disturb bottom sediments, and none of the cuttings or wastes from the micropile holes would be discharged to the Bay. This project activity would not alter surface flow patterns in wetlands, affect runoff patterns in adjacent upland areas, result in stormwater discharges to the Bay, or increase the potential for local flooding. Consequently, no impacts on water quality or sediment quality in the Bay would result.

Vibro-Replacement. This process would be performed from barges and would not require dredging, although some minor disturbances to the bottom of the Bay would occur from deployment of spuds (temporary anchors) from the barge, spud piles from the template frame, and the vibratory probe. Resuspension of bottom sediments would cause localized increases in suspended solids concentrations and corresponding increases in turbidity. However, the amount of bottom sediments potentially disturbed by vibro-replacement would be small, and suspended sediments would be expected to disperse with local currents or settle rapidly to the bottom. Therefore, as minor elevated suspended particle concentrations would occur only in the immediate vicinity of the vibro-replacement sites the impact on water quality would be negligible.

Stitching the Tube. Water quality impacts would result primarily from dredging, dredged material disposal and/or backfilling with the dredged material (if testing results demonstrate the material is suitable for aquatic disposal), and installation of pilings and piling caps at the San Francisco end of the Tube. Minor disturbances of surface sediments would also result from mooring the dredge and/or dredge barge.

Elevated suspended sediment concentrations associated with dredging and the transfer of dredged material to a barge would result in a surface turbidity plume near the dredge, with accompanying decreases in light transmittance (i.e., water clarity). Following completion of dredging, the suspended sediment/turbidity plume is expected to disperse within hours due to mixing, dilution, and settling of dredged solids (USACE et al. 1998). Dispersion of a surface turbidity plume would be restricted by placing a silt curtain around the dredging operation. Thus, water quality impacts related to elevated suspended solids concentrations and turbidity levels from dredging operations are expected to be temporary and localized.

Contaminants released during resuspension and leakage/spillage from dredging may re-attach to suspended particles, which would eventually settle to the bottom. Thus, dredging operations would temporarily move some sediment-associated contaminants into the water column, but they would not represent a new source or increased loadings of 303(d)-listed pollutants and are not expected to cause permanent changes in water quality (BART et al. 2005a).

Barge anchoring and piling installation would also cause localized and temporary disturbances to bottom sediments, although these sediments are expected to settle rapidly and within 100 meters or less of their origin. This would have a negligible impact on water quality.

Stitching at the Oakland end of the Tube would not require dredging or dredged material disposal, would not generate any waste materials that would be released into the Bay, and would not impact Bay water or sediment quality.

San Francisco Seismic Joint Restoration. Placement of a tunnel liner sleeve between the seismic joint on the San Francisco end of the Tube would occur entirely from inside the Tube, would not require dredging or result in any waste discharge to the Bay, and would not impact water or sediment quality.

Transition Structures

San Francisco Transition Structure. Disturbances to water quality would accompany dredging, barge anchoring, piling installation, and placement of the pilings cap, and would consist of temporary and localized resuspension of bottom sediments, similar to those described above for stitching. Slight increases in suspended sediment concentrations would persist until particles settled to the bottom and/or were dispersed by tidal currents, a negligible impact.

Impacts to water and sediment quality from retrofits at the transition structure associated with either the Steel Piles Retrofit Concept or Isolation Walls Retrofit Concept would generally be similar, although some differences are expected due to differences in total dredging requirements, piling installation, and wall construction. For both concepts, disturbances to water and sediment quality would consist of temporary and localized resuspension of bottom sediments, similar to those described above for stitching. Slight increases in suspended sediment concentrations would persist until particles settled to the bottom. Dispersion of suspended sediments and turbidity plumes would be restricted by the temporary sheet pile walls that will surround the dredging operations. Some loss of grouting/slurry material may occur during retrofit activities. However, these materials would be confined to the Bay bottom, and not dispersed outside of the temporary sheet pile walls, which will also facilitate cleanup and disposal. Therefore, as dredging and installation of new retrofits would be confined to the immediate construction area within the Ferry Plaza Platform, impacts to sediment and water quality would be negligible.

Steel Piles Retrofit Concept. The removal and eventual replacement of 250 existing pier pilings at the Ferry Building, along with placement of 100, 6-foot diameter piles between the Ferry Building and Transition Structure, will cause short-term and localized resuspension of bottom sediments. Installation of piles around the transition structure would use an oscillation or rotating technique that would minimize physical disturbances of the bottom sediments. Dredging of approximately 26,200 cy of bottom sediments, as well as replacement of bay sediments over the top of the containment structure, would occur inside of the temporary containment sheet pile walls that would restrict horizontal dispersion of resuspended bottom sediments and leakage from the dredge bucket. Similarly, jet or chemical grouting would be conducted below the mud line and within an area enclosed with temporary sheet walls that would restrict the horizontal dispersion of any grout materials that could migrate through the mud line. Subsequently, should grout materials migrate through the mud line, they would be recovered from the bay bottom, and therefore, any resulting changes to sediment quality would be temporary and localized, a negligible impact. Soil jet grouting would alter the properties of the subsurface sediments, but would not affect the quality or characteristics of the surface sediment. The duration of these changes to water and sediment quality is expected to be 2-3 years.

Isolation Walls Retrofit Concept. Dredging required for implementation of this retrofit concept (approximately 95,000 cy) would be more extensive than for the Steel Piles Retrofit Concept. Excavation and backfilling would, however, occur inside an area confined by temporary sheet pile walls that would restrict dispersion of sediments and turbidity water plumes outside of the immediate construction area. The temporary walls also would restrict dispersion of any grouting or slurry materials used for soil jet grouting and to prevent collapse of trenches, respectively. Following construction, water quality would return to pre-construction conditions as resuspended sediments settle to the bottom. Any grout and slurry materials that accumulate on the bay bottom would be collected and disposed. Therefore, changes to water and sediment quality would be temporary and localized, a negligible impact. Soil jet grouting would alter the properties of the subsurface sediments, but would not affect the quality or characteristics of the surface sediment. The duration of these changes to water and sediment quality is expected to be 3-4 years.

Oakland Transition Structure. Retrofit of the Oakland Transition Structure would have no impact on water resources.

Aerial Guideways

Proposed retrofits to the aerial guideways for the Oakland portion of the BART system would not generate or release wastes to water bodies. Retrofit of the aerial guideways would not place any new structures within flood-prone areas, alter surface flows, or increase the potential for flooding or inundation. Excavation of footings would generate piles of soil, which would be placed in confinement areas (e.g., bermed and lined ponds) that are not subject to runoff and dispersal to surface waters. At all but the West Oakland Aerial Guideway and West Oakland Station, groundwater elevations are below proposed excavation depths. Retrofit activities at all locations except for the two identified above, would not generate any dewatering wastes.

Groundwater may be encountered in the vicinity of the West Oakland Aerial Guideway and West Oakland Station. Discharges of dewatering effluent, if needed, would require an NPDES permit or waste discharge requirement (WDR) from the SFBRWQCB, as regulated by Section 402 of the CWA and the Porter-Cologne Water Quality Control Act (see Appendix C, section C.1). The aerial guideway retrofit sites, including adjacent staging areas, would be covered under the general stormwater permit, which would identify best management practices (BMPs) and other requirements to limit potential impacts on water quality from stormwater runoff during the retrofit operation. Because these operations would implement BMPs and comply with the Stormwater Pollution Prevention Plan (SWPPP), discharges would be in accordance with permit or WDR conditions.

Stations

Retrofit activities for the three BART stations would consist largely of reinforcement of existing structures. These proposed changes, and related construction activities, would not generate or release wastes to water bodies. In addition, retrofit of the stations would not place any new structures within flood-prone areas, alter surface flows, increase the potential for flooding or inundation, or place waste materials in areas subject to runoff and dispersal to surface waters. The station sites, including adjacent staging areas, would be covered under the general stormwater permit, which would identify BMPs and other requirements to limit potential impacts on water quality from stormwater runoff during the retrofit operation.

A Location Hydraulic Study (BART et al. 2005e) was prepared to assess the potential hydraulic impacts associated with the project within the base (100-year) floodplain, including the 100-year high tidal floodplain (100-year tidal floodplain). A Summary Floodplain Encroachment Report has also been prepared for the project, which is required for projects that have minimal floodplain risks.

The Location Hydraulic Study shows that the base floodplain would not be affected by the project (see Table 3.1-4). Proposed retrofit activities are located within close proximity to the 100-year floodplain of Temescal Creek; the 100-year floodplain is contained within the Temescal Creek culvert. The Temescal Creek culvert crosses the project alignment five times between Location 1 and Location 13, but does not interfere with any of the proposed retrofit locations (see Figure 3.1-1). Because the project does not encroach on either the 100-year floodplain or the 100-year tidal floodplain, there is no risk associated with the proposed retrofit activities. Since the project is a retrofit of existing structures and within the footprint of the existing BART line, project implementation would not affect natural and beneficial floodplain values or floodplain development. As the project would have no effect on natural or beneficial floodplain values, non-routine measures are not required to minimize floodplain impacts or preserve the natural and beneficial floodplain values. Implementation of routine construction techniques and BMPs, including avoiding existing drainage facilities, avoiding disturbing or impeding flow in the Temescal Creek culvert, and limiting storage or use of equipment to non-floodplain areas will ensure avoidance of any short-term impacts on the floodplain.

Table 3.1-4. Summary of Base Floodplain Risks and Impacts

Type of Risk or Impact		Project
I.	Are risks associated with the action?	No
II.	Are there impacts on natural and beneficial floodplain values?	No
III.	Will the action support probable incompatible floodplain development?	No
IV.	Are non-routine measures required to minimize floodplain impacts associated with the action?	No
V.	Are non-routine measures required to restore and preserve the natural and beneficial floodplain values impacted by the action?	No
VI.	Is the action a significant floodplain encroachment?	No
VII.	Is the action a significant longitudinal encroachment?	No

3.1.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

Dredged Material Reuse within the Project

Reuse of dredged material within the project would cause temporary and localized impacts on water quality due to elevated suspended sediment concentrations following placement of dredged material at each of the stitching holes (described in section 2.2.6.1). These changes would be similar to those expected from placement of ordinary backfill over the Tube, except that elevated suspended sediment concentrations may persist for a slightly longer period due to the greater volume of material and greater proportion of smaller sized particles with relatively lower settling rates. Turbidity plumes formed during placement of dredged material at the stitching holes would not be expected to extend beyond a few hundred meters from the site due to the presence of silt curtains surrounding the site, and the plumes would disperse within several hours after placement operations end, a negligible impact on water quality.

This conclusion is predicated on results from standardized testing of the dredged material demonstrating that the material does not contain elevated concentrations of chemical contaminants or cause significant toxicity or contaminant bioaccumulation in representative marine organisms, and is therefore, considered suitable for in-water disposal. If results from sediment testing show that the material is unsuitable for in-water disposal, reuse of the material as fill within the project would not be permitted. In this case, no project-related impacts to water quality would occur from reuse of dredged material as fill.

Placing the dredged material in the stitching holes would not cause any noticeable changes in the texture or quality of bottom sediments within the project area. This is because dredged sediments would be replaced in the reverse order in which they were removed (e.g., surface sediments would be removed first and replaced last), thereby maintaining similar sediment characteristics. During reuse of dredged material within the stitching operation, an additional 11,000 cy of "ordinary backfill" (a special mix of sand and gravel) would need to be imported to replace existing ordinary backfill directly over the Tube; all imported ordinary backfill would be placed into the six stitching holes, potentially displacing up to 11,000 cy of dredged material planned for reuse. Any displaced dredged material (totaling up to 11,000 cy) that does not fit neatly into the stitching holes would be disposed offsite along with up to 95,900 cy of leftover dredged material associated with seismic retrofits at the San Francisco Transition Structure.

Impacts on sediment quality under this option would be negligible. Reuse of dredged material within the project would have no impact on upland surface water or groundwater quality.

Dredged Material Reuse/Disposal Options outside the Project

Impacts on water resources from transporting dredged material to aquatic disposal sites would occur only if materials were spilled or leaked during transit. The severity of any impacts would depend on where the spill occurred, existing water quality conditions at the spill site, the volume of material spilled, and the effectiveness of any efforts to contain and clean up the spill. In general, these factors also apply to the disposal of other types of waste materials that would be generated from the project, such as disposal of cuttings and drilling muds from the micropile anchorage installation. Spills or leaks of dredged material in open water would produce a turbidity plume with elevated concentrations of suspended sediments, reduced water clarity, and potentially elevated contaminant concentrations that would disperse within a few hours due to natural mixing processes and particle settling.

Spills of dredged material that occurred during transport to an upland disposal site would affect water resources only if the material was spilled directly, or subject to transport by wind or storm runoff, into a surface water body. Although dredged sediments would be dewatered, the material would still be moist and cohesive, and the volume of material subject to spills during transport is considered too small to cause impacts related to altered stormwater drainage, flooding, or siltation. Instead, a small spill could contribute to the existing potential for polluted runoff and/or degradation of water quality in receiving water bodies, although this contribution would be too small to cause water quality impacts.

Spills into or near open water of gasoline or other petroleum products, such as oil and hydraulic fluids required for operation of motorized equipment (e.g., dredge or tug), could occur during retrofit operations, as well as during transport of dredged material. Although unlikely, large oil spill volumes could degrade water quality, with the potential for toxicity and contaminant bioaccumulation in aquatic organisms. Spill containment and cleanup protocols, such as boom deployment, storage requirements, and notification procedures, are specified in spill response portions of the dredging operation plan prepared and implemented by the dredging contractor. Large spills of oil or petroleum products on land also have the potential for leaching into groundwater. However, the potential for migration of petroleum spills within the upland portions of the project site would be too small to cause an impact because the contractor would be required to implement spill control and cleanup measures.

The potential impacts on water resources from spills during transport of contaminated soils (e.g., soils excavated from the vicinity of some aerial guideways; see section 3.6) to an upland disposal site would be negligible and comparable to those associated with potential spills of dredged materials.

3.2 NOISE

A Noise Technical Study (BART et al. 2005c) was prepared to evaluate noise impacts from the project. The environmental analysis determined that construction activities would temporarily elevate noise levels at noise sensitive receptors.[1] However, a combination of using quieter construction methods (e.g., an oscillating or rotating hydraulic system) and applying noise mitigation measures for selected construction methods would reduce construction noise levels at affected noise sensitive receptors to within acceptable limits (BART et al. 2005c). There would be no permanent noise impacts from the project.

Underwater noise impacts, including potential vibration and sound pressures on the marine environment, are addressed in section 3.9 (Biological Resources). The following analysis discusses airborne noise impacts only.

3.2.1 Existing Setting

The existing setting for noise is summarized below and described in greater detail in the Noise Technical Study (BART et al. 2005c).

3.2.1.1 Acoustical Fundamentals

Details regarding acoustical fundamentals are provided in the Noise Technical Study (BART et al. 2005c). Technical terms are defined in Table 3.2-1.

3.2.1.2 Existing Noise Environment

Construction activities associated with the project could affect the noise environment of sensitive receptors near construction activities. The Transbay Tube is located underwater, and the Oakland Transition Structure is located in an unpopulated area with no nearby noise sensitive receptors. The at-grade and above-grade portions of the aerial guideway track in Oakland are located in urbanized, densely populated areas where noise sensitive uses, such as residences, recreation areas, a hospital, a school, and businesses are located; the San Francisco Transition Structure is located in a popular commercial location. Pile driving proposed at the San Francisco Transition Structure and the Ferry Plaza platform would occur in the waters at the edge of San Francisco Bay.

3.2.1.3 Noise Survey and Sensitive Receptor Identification

The degree to which noise from the project would adversely affect the environment in the vicinity of the BART system depends on the sensitivity of surrounding land uses, the proximity of construction activities to these sensitive uses, the type of equipment used for construction, the degree of noise control on the equipment, and the time of day and duration of noise producing construction activities. To assess the existing daytime noise environments in the vicinity of the retrofit work locations, a series of short-term (10-minute) noise measurements

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1 Noise sensitive receptors are defined as any location or land use where noise can interrupt on-going activities, which can result in community annoyance. Noise sensitive receptors consist of, but are not limited to, schools, residences, libraries, parks, hospitals, and other care facilities.

Table 3.2-1. Definitions of Acoustical Terms

Term	*Definition*
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 μPa (20 micronewtons per square meter).
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
C-Weighted Sound Level, dBC	The sound pressure level in decibels as measured on a sound level meter using the C-weighting filter network. The C-weighting filter de-emphasizes the very low and very high frequency components of the sound but provides no weighting over the human hearing frequency range.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 dB in the evening from 7:00 to 10:00 P.M. and after addition of 10 dB to sound levels measured in the night between 10:00 P.M. and 7:00 A.M.
Day/Night Noise Level, L_{dn}	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 dB to levels measured in the night between 10:00 P.M. and 7:00 A.M.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, and tonal or informational content as well as the prevailing ambient noise level.

Source: Illingworth & Rodkin, Inc. (2002)

were made near selected work areas along the project alignment (see Figure 3.2-1) to characterize the typical existing noise environment. Noise measurements were conducted between 1:00 PM and 4:00 PM during the afternoons of Thursday, January 2, 2003, and Friday, January 3, 2003. A summary of these measurements is presented in Table 3.2-2 and discussed below.

The areas around the aerial structures, stations, and transition structures proposed for retrofit work were visited to identify nearby noise sensitive receptors and monitor existing ambient noise levels in potential noise impact areas during daytime hours. No nighttime work would be conducted at any above-grade locations.

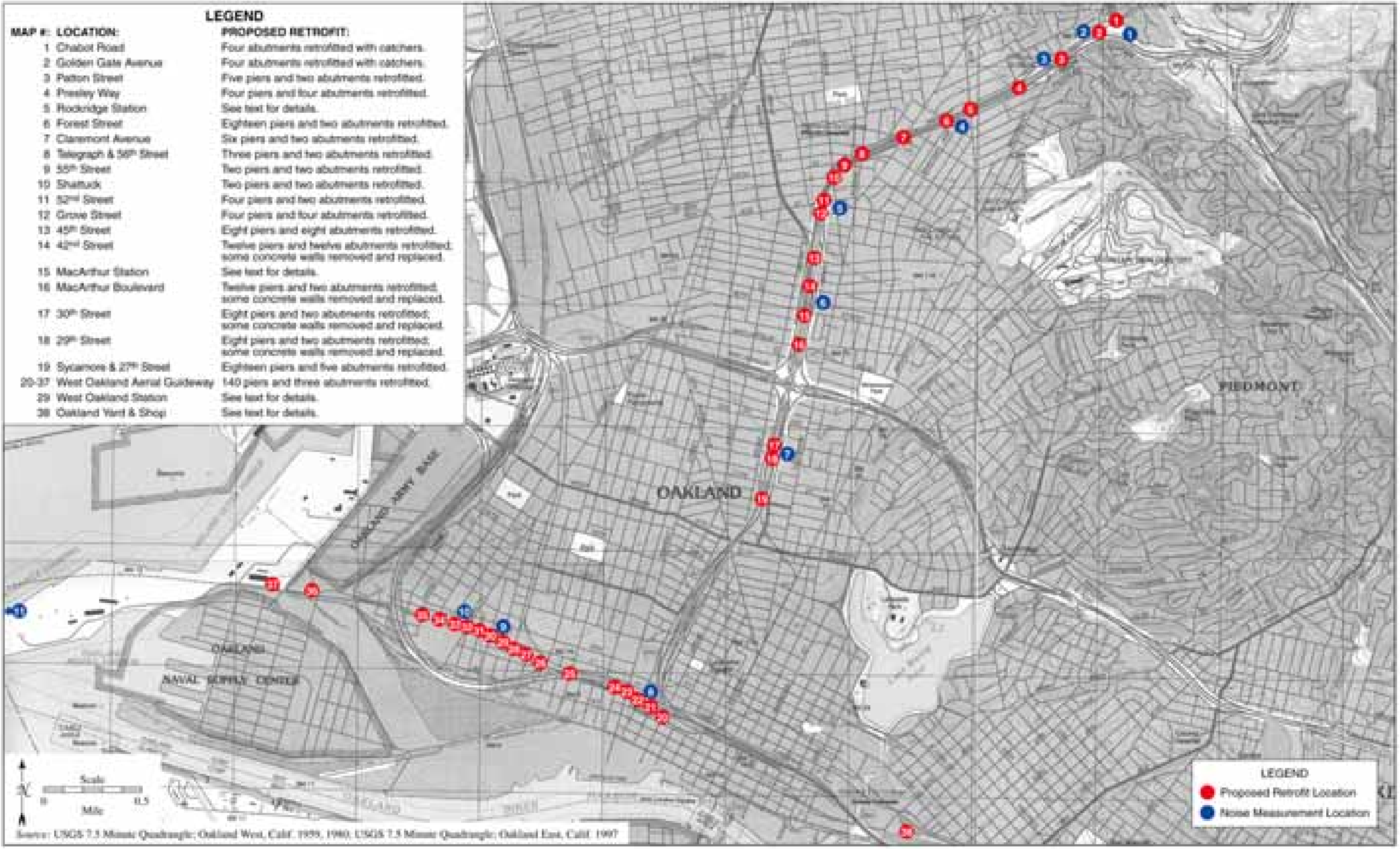


Figure 3.2-1. General Location of Aerial Structures and Station Retrofits and Noise Measurement Locations

Table 3.2-2. Short-term (10-Minute) Noise Measurement Results at Sensitive Receptors Near Work Locations

MEASUREMENT LOCATION		A-WEIGHTED NOISE LEVEL, dBA						
No.[1]	*Work Location*[2]	L_{max}	L_{01}	L_{10}	L_{eq}	L_{50}	L_{90}	L_{min}
1	1. Chabot Road	62	61	57	56	55	54	53
2	2. Golden Gate Avenue	73	72	64	63	61	60	59
3	3. Patton Street	74	72	69	66	65	62	60
4	6. Forest Street	76	73	70	68	68	65	62
5	11. 52nd Street	82	79	72	70	68	66	62
6	15. MacArthur Station	81	78	74	72	71	68	66
7	18. 29th Street	75	74	67	64	60	58	55
8	22. Viaduct at Brush Street	77	76	70	66	63	60	58
9	30. Viaduct at Chester Street	75	72	67	64	61	58	57
10	32. Viaduct at Lewis Street	85	84	77	73	65	58	53
11	San Francisco Transition Structure	68	64	62	60	59	57	56

Notes:
1. These numbers correspond to the "Noise Measurement Location" numbers (in blue) on Figure 3.2-1.
2. These numbers correspond to "Proposed Retrofit Location" numbers (in red) on Figure 3.2-1.

Project Area Divided into Four Distinct Noise Environments

Based on the site visits, the noise environments and the position of noise sensitive receptors relative to the location of the proposed seismic retrofit work may be divided into four distinct environments:

1. Near the west portal of the Berkeley Hills Tunnel, where the BART track alignment is not positioned between State Route 24, Interstate 580, or Interstate 980 (proposed retrofit locations 1 and 2 on Figure 3.2-1).
2. Where the BART track alignment is positioned between State Route 24, Interstate 580, or Interstate 980 (proposed retrofit locations 3 to 19 on Figure 3.2-1).
3. Where the BART track is elevated on the West Oakland Aerial Guideway (proposed retrofit locations 20 to 37 on Figure 3.2-1).
4. The San Francisco Transition Structure (see Figure 2-10).

Environment 1 — Near the West Portal of the Berkeley Hills Tunnel. This area is largely residential with recreation areas and a school near the BART alignment. The closest noise sensitive receptor at location 1 (Figure 3.2-1) is a building at the Chabot Recreation Center, approximately 100 feet north of the work location. A residence approximately 200 feet north from the work location is the next closest noise sensitive receptor to location 1. The closest noise sensitive receptor at location 2 is a residence, approximately 200 feet north of the work location.

Because State Route 24 is immediately south of location 2, there are no noise sensitive receptors south of this location.

Ambient daytime noise levels near these noise sensitive receptors were dominated by local traffic on Chabot Road and more distant traffic on State Route 24, with measured L_{eq}s ranging from 56 to 63 dBA. Passing BART trains, helicopter over-flights, and trucks on Chabot Road produced the highest noise levels in these areas, with maximum (L_{max}) levels ranging from 68 to 73 dBA.

Environment 2 — BART Tracks between Highway Lanes. In this area, the BART tracks are surrounded by multi-lane highway traffic and pass through urbanized, densely populated areas, where noise sensitive uses such as residences, recreation areas, a hospital (Oakland Children's Hospital, located on 52nd Street, just west of retrofit locations 11 and 12 shown on Figure 3.2-1), and commercial areas are located. Typically, noise sensitive receptors are at least 250 feet from the proposed work locations and are either fully or partially shielded by the intervening highway structures.

Ambient daytime noise levels in these areas are typically dominated by traffic noise from the highways with measured Leqs ranging from 64 to 72 dBA and maximum noise levels of 74 to 81 at the closest noise sensitive receptors. Passing BART trains and local traffic produced maximum noise levels in these areas, but did not affect average levels.

Environment 3 — BART Tracks on the West Oakland Aerial Guideway. In this area the BART tracks are elevated on the West Oakland Aerial Guideway, running approximately parallel to Interstate 880 and 7th Street, moving to an elevated position above the median of 7th Street before dropping and entering the Transbay Tube. Surrounding land uses in the area are largely commercial and industrial with a commercial/residential mix of uses along the northeastern side of 7th Street where BART is elevated above the median. In this portion of the project, residences above ground-floor commercial uses are approximately 50 feet from piers that are proposed for retrofit.

Ambient daytime noise levels in these areas are typically dominated by traffic noise from Interstate 880 and 7th Street and passing BART trains. Measured L_{eq}s at the noise sensitive receptors closest to the Aerial Guideway ranged from 66 to 73 dBA, with passing BART trains producing maximum noise levels of 75 to 85 dBA and trucks and buses on surface streets producing maximum levels of between 68 and 72 dBA.

Environment 4 — San Francisco Transition Structure. The San Francisco Transition Structure is located on the Bay side of the San Francisco Ferry Terminal Plaza. This is a commercial area with pedestrian viewing areas, a restaurant, and a small parking platform. Port offices and businesses lease nearby building space from the Port. Measurements of ambient daytime noise levels in the terminal plaza showed that average noise levels range from 59 to 60 dBA L_{eq} with maximum noise levels reaching 68 dBA.

3.2.2 Proposed Action

3.2.2.1 Factors for Evaluating Impacts

The impacts of adverse noise effects on people from normal construction activities are based on the applicable standards and the existing ambient noise level. Noise impacts would occur if the project resulted in:

- Noise levels that are projected to exceed the allowable levels set forth in the BART Design Criteria (see Appendix C, Table C-1).

3.2.2.2 Impacts and Mitigation

The retrofit activities would require the use of heavy machines and equipment, which would generate noise and vibration. Table 3.2-3 provides a summary of construction noise level data developed by FHWA that shows typical noise levels from construction equipment. Retrofit work would also require the use of stationary construction equipment such as pumps, generators, and/or compressors operating relatively continuously during the work.

Transbay Tube

Micropile Anchorage. Spoils and drilling muds from this activity would be transported to the east portal of the Tube and removed via truck. Because the portal is located in an industrial area with no nearby sensitive receptors and truck traffic would pass through industrial areas to freeways, there would be no noise impacts from truck traffic during micropile anchorage work.

Vibro-Replacement. Noise levels resulting from the construction of stone columns during vibro-replacement were monitored in San Luis Obispo County (Illingworth & Rodkin, Inc. 1999). Internal combustion engines, which run the generator, crane, and air-compressor, are the dominant noise sources. Noise resulting from the operation of the vibratory probe is mostly masked by noise from the other equipment. Noise levels were measured at a reference distance of 270 feet. Typical A-weighted noise levels during construction ranged from 68 dBA to 70 dBA L_{eq}. The maximum hourly average noise level reached 75 dBA L_{eq}. Adjusted to a reference distance of 50 feet, typical noise levels would be 83 to 85 dBA L_{eq}, and the maximum hourly noise level would be 90 dBA L_{eq} at a reference distance of 50 feet.

Noise sensitive "commercial use" receptors, such as professional office buildings or restaurants, are located 150 to 200 feet from the San Francisco Transition Structure (Environment 4). Continuous noise from this operation would be 73 to 78 dB L_{eq} at the nearest (commercial) receptor. Barge work within about 500 feet of the shore would generate noise levels exceeding 70 dBA, the BART threshold for commercial areas with no nighttime residency.

Vibro-replacement activities would not impact noise sensitive receptors near the San Francisco Transition Structure, however, because temporary noise control barriers will be installed around all noise-generating construction equipment, providing for noise reductions of up to 10-15 dBA (within BART limits). No work would occur near sensitive receptors in the City of Oakland.

Stitching the Tube (Rotary or Oscillating Pile-Driving Equipment). Near the San Francisco Transition Structure (Environment 4), noise levels resulting from dredging and the proposed oscillating or rotating hydraulic equipment would fall within the range of typical construction noise. Hourly average noise levels are expected to be a maximum of about 85 to 88 dBA L_{eq} at a reference distance of 50 feet. Barge work within about 500 feet of the shore would generate noise levels exceeding 70 dBA, the BART threshold for commercial areas with no nighttime residency.

Table 3.2-3. Typical Construction Equipment Noise Emission Levels

Equipment	*Typical Noise Level (dBA) at 50 Feet*	*Equipment*	*Typical Noise Level (dBA) at 50 Feet*
Air Compressor	81-85	Grader	83-85
Backhoe	80-83	Hoe-Ram	85-90
Chain Saw	85	Impact Wrench	85
Compactor	82	Jackhammer*	88-89
Compressor	85-90	Loader	85-88
Concrete Truck	81	Paver	80-89
Concrete Mixer	85	Pile Drive, Impact	101
Concrete Pump	82	Pile Driver, Sonic	96
Concrete Vibrator	76	Pump	80-85
Crane, Derrick	86-88	Rock Drill	98
Crane, Mobile	83-87	Roller	74
Dozer	84-88	Scraper	89
Drill Rig	88	Slurry Machine	91
Dump Truck	84	Slurry Plant	78
Excavator	84	Truck	85-89
Generator	85	Vacuum Excavator	85-88
Gradall	86		

* Jackhammers (90 lb. class) rated at 82 dBA at 7 meters are available. This would be equivalent to 74 dBA at 50 feet. These are silenced with molded intricate muffler tools.

Source: National Cooperative Highway Research Program (1999)

Stitching the tube with rotary or oscillating equipment would not impact noise sensitive receptors near the San Francisco Transition Structure, however, because temporary noise control barriers will be installed around the noise-generating construction equipment, providing for noise reductions of up to 10-15 dBA (within BART limits). No work would occur near sensitive receptors in the City of Oakland.

Stitching the Tube (Conventional Pile-Driving Equipment). Typical noise data for conventional pile drivers are presented in Table 3.2-3, which indicates a maximum A-weighted noise level of 101 dBA at a distance of 50 feet. Noise measurements taken while driving large diameter steel piles in the San Francisco Bay region indicate noise levels could be expected to reach 110 dBA at a distance of 50 feet (Illingworth & Rodkin, Inc. 2001). Maximum allowable noise emission limits established by BART for impact pile drivers are 100 dBA for equipment acquired before

1986, and 95 dBA for equipment acquired after January 1, 1986. Project noise levels are projected to exceed these noise emission limits.

The nearest receptors that could be subject to pile driver noise would be located 150 to 200 feet from the barge-mounted equipment. Predicted maximum A-weighted noise levels would range from 90 to 100 dBA at the nearest sensitive receptor location. This exposure would be temporary, but would occur for the duration (about 2 years) when pile driving is closest to the San Francisco Transition Structure (Environment 4), and would interfere with speech communication outdoors and indoors.

Sensitive receptors near the San Francisco Transition Structure will not be impacted by pile-driving noise from stitching activities, however, because the following project actions will reduce noise levels to within acceptable BART limits: pile driving will be scheduled to avoid high public use times at the Ferry Plaza; pile drivers will be shrouded with noise barrier materials; temporary noise control barriers will be installed around noise-generating construction equipment; and, advanced public notice regarding pile-driving, including a hotline for noise complaints, will be provided. For additional details, see the Noise Technical Study (BART et al. 2005c).

San Francisco Seismic Joint Restoration. Installation of a tunnel liner sleeve would result in no public disturbance or effects on the acoustical environment because all work would be done within the Tube.

San Francisco Transition Structure

The primary source of construction noise associated with retrofits at the San Francisco Transition Structure is the pile installation associated with construction of pile array, piles and collar anchorage, or isolation and support walls. There would also be noise generated when existing concrete support piles are removed and spoils are contained and removed from the site. In addition, dredging and excavation of the Bay bottom around the structure for retrofits proposed as part of the Steel Piles Concept or the Isolation Walls Concept would occur. The following impact discussions are organized by the type of pile-driving equipment that could be used.

Rotary or Oscillating Pile-Driving Equipment. Noise levels resulting from dredging and the proposed oscillating or rotating hydraulic pile installation equipment would fall within the range of typical construction noise near the San Francisco Transition Structure (Environment 4). Hourly average noise levels are expected to be a maximum of 85 to 90 dBA L_{eq} at a reference distance of 50 feet. The predicted continuous noise level is 73 to 78 dBA at the nearest (commercial) sensitive receptor. This work would occur close to sensitive receptors (public areas and a restaurant), where noise levels would exceed 70 dBA, the BART threshold for commercial areas with no nighttime residency.

Sensitive receptors near the San Francisco Transition Structure will not be impacted by dredging and use of proposed oscillating or rotating hydraulic pile installation equipment, however, because temporary noise control barriers will be installed around all noise-generating construction equipment, providing for noise reductions of up to 10-15 dBA (within BART limits).

Conventional Pile-Driving Equipment. If a conventional impact pile driver is used in this area, noise levels would cause a substantial disturbance to persons outside in public areas, and inside the restaurant and other nearby buildings. Maximum noise levels would exceed the BART emission limit of 125 dBA at distances less than 25 feet, and would exceed the 95 to 100 dBA BART limit at distances of 300 feet.

Sensitive receptors near the San Francisco Transition Structure will not be impacted by high noise levels from pile-driving, however, because the following project actions will reduce noise levels to within acceptable BART limits: pile driving will be scheduled to avoid high public use times of the Ferry Plaza; pile drivers will be shrouded with noise barrier materials; temporary noise control barriers will be installed around noise-generating construction equipment; and, advanced public notice regarding pile-driving, which includes a hotline for noise complaints related to surrounding uses, will be provided. For additional details, see the Noise Technical Study (BART et al. 2005c).

Oakland Transition Structure

Because the transition structure is located in a fenced-in industrial area, with no nearby noise sensitive receptors, no noise impacts would result.

Aerial Guideways and Stations

Pile installation at aerial guideways and stations would use both impact (e.g., conventional pile-driving) and non-impact drilling techniques (e.g., an oscillating or rotating hydraulic installation system). The following impacts are organized by project location and the type of construction equipment that could be used.

Construction Noise at Retrofit Locations 1 and 2. The closest noise sensitive receptors to Locations 1 and 2 are approximately 70 feet from the edge of the BART tracks, near the west portal of the Berkeley Hills Tunnel (Environment 1). No pile installation would occur at Locations 1 and 2. Retrofitting the four abutments at Location 1 (Chabot Road) may produce intermittent maximum noise levels of 85 dBA at the school and 80 dBA at the closest residence. Continuous maximum noise levels may reach 75 dBA at the school and 70 dBA at the closest residence. Retrofitting the four abutments at Location 2 (Golden Gate Avenue) may produce intermittent maximum noise levels of 80 dBA at the closest residence. Continuous maximum noise levels may reach 70 dBA at the closest residence.

Sensitive receptors located near the abutments at Locations 1 and 2 will not be impacted by construction activities, however, because the following project actions will reduce noise levels to within acceptable BART limits: temporary noise control barriers will be installed around noise-generating construction equipment; and advanced public notice regarding construction activities, which includes a hotline for noise complaints, will be provided to nearby uses. For additional details, see the Noise Technical Study (BART et al. 2005c). Although construction noise levels would be within acceptable BART limits with implementation of above project measures, the following mitigation measure is identified to further reduce noise levels.

Mitigation Measure. The following measure will further reduce noise levels related to project activities at retrofit Locations 1 and 2:

- Prohibit construction equipment that does not meet the lower BART noise emission limit (85 dBA at 50 feet). Where feasible, use electric-powered equipment instead of diesel equipment, and hydraulic tools instead of pneumatic tools. Employ effective intake and exhaust mufflers on all internal combustion engines and compressors. Line hopper storage bins and chutes with sound-deadening material. Maximize the physical separation as far as possible between noise generators and noise receptors. Such separation includes, but is not limited to, the following measures:
  - Provide enclosures for stationary equipment and provide barriers around particularly noisy areas on the site;
  - Use shields, impervious fences, or other physical sound barriers to inhibit transmission of noise; and
  - Locate stationary equipment to minimize noise impacts on the nearby residential neighbors.

Construction Noise (Rotary or Oscillating Pile-Driving Equipment) at Retrofit Locations 3 to 19. Seismic retrofit work at these locations, which would potentially affect the area near the BART alignment located between State Route 24, Interstate 580, and Interstate 980 (Environment 2), would produce intermittent maximum and continuous maximum noise levels of about 75 and 65 dBA, respectively, at the closest noise sensitive receptors outside the stations (typically at least 250 feet from work locations). Considering that all of the affected noise sensitive receptors outside the stations are located along arterial roadways, this level of noise from construction activities would meet the BART daytime noise standard. However, construction activities at Rockridge Station (Location 5) and MacArthur Station (Location 15) could expose BART patrons and employees to noise levels in excess of BART limits.

BART patrons and employees at Rockridge and MacArthur Stations will not be impacted by construction activities because the following project actions will reduce noise levels to within acceptable BART limits: temporary noise control barriers will be installed around noise-generating construction equipment; and advanced public notice regarding construction activities, which includes a hotline for noise complaints, will be provided to nearby uses. For additional details, see the Noise Technical Study (BART et al. 2005c). Although construction noise levels would be within acceptable BART limits with implementation of above project measures, the following mitigation measure is identified to further reduce noise levels.

Mitigation Measure. The following measure will further reduce noise levels related to project activities at retrofit Locations 3 through 19:

- Prohibit construction equipment that does not meet the lower BART noise emission limit (85 dBA at 50 feet). Where feasible, use electric-powered equipment instead of diesel equipment, and hydraulic tools instead of pneumatic tools. Employ effective intake and exhaust mufflers on all internal combustion engines and compressors. Line hopper storage bins and chutes with sound-deadening material. Maximize the physical separation as far as possible between noise generators and noise receptors. Such separation includes, but is not limited to, the following measures:

– Provide enclosures for stationary equipment and provide barriers around particularly noisy areas on the site;

– Use shields, impervious fences, or other physical sound barriers to inhibit transmission of noise; and

– Locate stationary equipment to minimize noise impacts on the nearby residential neighbors.

Construction Noise (Rotary or Oscillating Pile-Driving Equipment) at Retrofit Locations 20 to 37. Construction noise at these locations would affect the area near the West Oakland Station and along the West Oakland Aerial Guideway (Environment 3). Facades of the commercial/residential mix of uses along the northeastern side of 7th Street, where the West Oakland Aerial Guideway is in the median of the roadway, are approximately 50 feet from piers that are proposed for retrofit. Based on worst-case intermittent and continuous maximum noise levels of 90 dBA L_{max} and 85 dBA L_{eq} at 50 feet from work areas as described previously, noise from the seismic retrofit work at the West Oakland Station (Location 29) and along the West Oakland Aerial Guideway could exceed the BART daytime noise standard.

Sensitive receptors at the West Oakland Station and along the West Oakland Aerial Guideway will not be impacted because the following project actions will reduce noise levels to within acceptable BART limits: construction will be scheduled to minimize noisiest activities when residents are home; temporary noise control barriers will be installed around noise-generating construction equipment; and advanced public notice regarding construction activities, which includes a hotline for noise complaints, will be provided. For additional details, see the Noise Technical Study (BART et al. 2005c). Although construction noise levels would be within acceptable BART limits with implementation of above project measures, the following mitigation measure is identified to further reduce noise levels.

Mitigation Measure. The following measure will further reduce noise levels related to project activities at retrofit Locations 20 to 37:

- Prohibit construction equipment that does not meet the lower BART noise emission limit (85 dBA at 50 feet). Where feasible, use electric-powered equipment instead of diesel equipment, and hydraulic tools instead of pneumatic tools. Employ effective intake and exhaust mufflers on all internal combustion engines and compressors. Line hopper storage bins and chutes with sound-deadening material. Maximize the physical separation as far as possible between noise generators and noise receptors. Such separation includes, but is not limited to, the following measures:

– Provide enclosures for stationary equipment and provide barriers around particularly noisy areas on the site;

– Use shields, impervious fences, or other physical sound barriers to inhibit transmission of noise; and

– Locate stationary equipment to minimize noise impacts on the nearby residential neighbors.

Construction Noise (Conventional Pile-Driving Equipment) at Retrofit Locations 3 to 37. As stated above, no pile installation would occur at retrofit Locations 1 and 2. In addition, impact pile-driving at Rockridge Station (Location 5) and West Oakland Station (Location 29) is unlikely due to overhead height limitations.

Impact pile-driving methods could be used at MacArthur Station (Location 15) and other aerial guideway locations, including near the BART alignment located between State Route 24, Interstate 580, and Interstate 980 (Locations 3 to 19) and along the West Oakland Aerial Guideway (Locations 20 to 37). Impact pile-driving methods would produce noise levels in excess of 100 dBA at 50 feet (unshielded) and could impact sensitive noise receptors, including BART patrons and employees at MacArthur Station, residences outside MacArthur Station, or other identified receptors located near aerial guideway locations, who would be exposed to high noise levels in exceedance of BART limits.

The closest noise sensitive receptor outside MacArthur Station is a residential building on 40th Street, an arterial roadway with relatively high ambient noise, approximately 250 feet from the station walls. Based on this distance, pile-driving noise at this sensitive receptor could reach levels of between 80 to 85 dBA during unshielded pile driving, which is below BART limits. Noise levels within MacArthur Station during unshielded pile driving could reach levels in excess of 100 dBA, however, and could impact BART patrons and employees at this station.

The closest noise sensitive receptors along the BART alignment between State Route 24, Interstate 580, and Interstate 980 are residences located typically at least 250 feet from work locations. Based on this distance, and considering that all of these affected noise sensitive receptors are located along arterial roadways, pile-driving noise at these receptors could reach levels of between 80 to 85 dBA during unshielded pile driving, which is below BART limits.

The closest noise sensitive receptors from the West Oakland Aerial Guideway, located approximately 50 feet from piers that are proposed for retrofit, are the commercial/ residential mix of uses along the northeastern side of 7th Street, where the Aerial Guideway is in the median of the roadway. Based on this distance, pile-driving noise at these receptors could reach levels of up to 105 dBA during unshielded pile driving, which is in excess of BART limits.

BART patrons and employees at MacArthur Station, and receptors near the West Oakland Aerial Guideway, will not be impacted by pile-driving, however, because the following project actions will reduce pile-driving noise levels to within acceptable BART limits: construction will be scheduled to minimize the impact on sensitive receptors (either during daytime hours to avoid impacts to residences and/or during non-commute periods); pile drivers will be shrouded with noise barrier materials; temporary noise control barriers will be installed around noise-generating construction equipment; and advanced public notice regarding construction activities, which includes a hotline for noise complaints, will be provided. For additional details, see the Noise Technical Study (BART et al. 2005c). However, if after proper implementation of noise barriers at MacArthur Station and near the West Oakland Aerial Guideway, noise levels from pile-driving activities are not reduced to within acceptable BART limits as expected, the following mitigation measure is identified.

Mitigation Measure. The following measure will ensure noise levels from pile-driving activities at MacArthur Station and near the West Oakland Aerial Guideway are maintained within acceptable BART limits:

- BART shall require the construction contractor to monitor pile-driving noise at MacArthur Station and retrofit locations near the West Oakland Aerial Guideway. Noise readings shall be taken at the beginning of any pile-driving activity to confirm the contractor has properly installed noise control barriers. If, after proper implementation of noise barriers, pile-driving noise is not reduced to within acceptable BART limits, then other actions shall be taken to reduce excessive noise levels, including:
  - Use vibratory, oscillating, or rotating pile drivers to reduce the noise produced by pile-driving activities; or,
  - Perform pile-driving at night or during non-commute periods. If pile-driving is performed at night, and monitoring shows that residents located within 50 feet of the pile-driving activity are experiencing noise above acceptable BART levels for nighttime noise, temporary relocation will be offered to these residents until nighttime pile-driving is completed.

3.2.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

Dredged Material Reuse within the Project

Noise sources associated with the dredging reuse operation (i.e., backfilling) include a clamshell dredge and three tugboats. Noise would result from use of diesel engines that power the dredging equipment and pumps. The noise level generated by the dredging equipment is typically up to 87 dBA, measured at a distance of 50 feet. Noise levels generated by diesel engines that power the tugboats, which would be used to move the dredge and barge, are similar. Hourly average noise levels, given the anticipated usage factors, are calculated to be 85 to 88 dBA L_{eq} at a reference distance of 50 feet. Barge work within about 500 feet of the shore would generate noise levels exceeding 70 dBA, which is the BART threshold for commercial areas with no nighttime residency.

Dredging would not cause a noise impact near the San Francisco Transition Structure, however, as temporary noise control barriers will be installed around the noise-generating construction equipment, providing for noise reductions of up to 10-15 dBA (within BART limits).

Dredged Material Reuse/Disposal Options outside the Project

Transportation of the project's dredged material to the potential in-Bay, deep ocean, or wetland sites via waterways would generate noise from the operation of tugboats. The noise, however, would not measurably increase existing noise levels and would be indistinguishable from the noise from other maritime traffic. Transportation of the dredged material to landfills would also generate noise associated with the addition of up to 28 daily truck trips, if the trips occurred consecutively during the minimum 22-month dewatering period. The Altamont and Vasco Road Landfills would be accessed via local streets at the Port of Oakland (used almost exclusively by trucks; see section 3.4 [Transportation]), and freeways. These Port streets and freeways experience very substantial truck traffic. Therefore, the noise generated from 28 additional daily truck trips would be negligible, and would not create a measurable increase in noise compared to existing truck traffic noise on these access roads and freeways. Transportation of dredged material outside the project would cause no new noise impacts.

3.3 CULTURAL RESOURCES

An Archaeological Survey Report (ASR) (BART et al. 2005m), Historical Resources Evaluation Report (HRER) (BART et al. 2005k), Historic Property Survey Report (HPSR) (BART et al. 2005j), and a Finding of Effect (FOE) (BART et al. 2005l) were prepared to identify and evaluate all cultural resources (e.g., archaeological sites, buildings, structures, objects, districts) located within the Area of Potential Effect (APE) associated with the project and document potential impacts. The APE includes all areas of potential ground disturbance, including right-of-way and temporary construction lay down areas. For historic resources, the APE also includes buildings and structures that may be affected by vibration from construction equipment. The following information is derived from these documents.

3.3.1 Existing Setting

Important cultural resources are those that qualify as an eligible "historic property" under the National Historic Preservation Act (36 CFR §60.4). To be eligible for listing on the National Register of Historic Places (NRHP), a cultural resource must possess integrity of location, design, setting, material, workmanship, feeling, and association and meet one or more of the following criteria:

A. Is associated with events that have made a significant contribution to the broad patterns of history;

B. Is associated with the lives of persons significant in the past;

C. 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; or

D. Has yielded, or may be likely to yield, information important in prehistory or history.

(See Appendix C, section C.3 for a complete definition of the eligibility criteria.)

3.3.1.1 Archaeological Resources

Archaeological site record searches were conducted at the California Historic Resources Information System, Northwest Information Center, Sonoma State University to determine the location of recorded archaeological sites within 1-mile of the Archaeological Resources APE. A reconnaissance-level survey was conducted to verify the setting of recorded archaeological sites near the Archaeological Resources APE and their relationship to the APE. The reconnaissance survey, in conjunction with the site record searches, determined that there are no recorded historic or prehistoric archaeological resources within the Archaeological Resources APE.

Archaeological sensitivity was also assessed for unrecorded buried historic and prehistoric archaeological resources based on predictive modeling, historic maps, and documented past ground disturbance. No areas were considered to have a high archaeological site potential due to the absence of prehistoric or historic archaeological resources within the Archaeological Resources APE. The sensitivity for buried prehistoric and/or historic deposits at about 80 percent of the approximate 300 excavation sites at 38 project locations (see Figure 2-18) was determined to be low. The other 51 excavation sites at 14 project locations were determined to have a moderate potential for encountering unknown prehistoric or historic cultural remains. Although the dimensions of the planned excavation locations and potential for new ground disturbance would be relatively limited, the possibility for encountering an intact buried prehistoric and/or historic deposit at the moderate potential locations could not be discounted. Therefore, these areas are considered to have a moderate sensitivity for encountering unknown archaeological resources that would meet the eligibility criteria for NRHP listing.

The ground surfaces underneath and adjacent to the Transbay Tube were previously disturbed during the original construction of the facility. Therefore, no potential for intact marine archaeological resources such as shipwrecks exist within the Transbay Tube APE.

3.3.1.2 Historic Architectural Resources

The Historic Architectural Resources APE includes all areas of potential ground disturbance as well as all areas within which project construction equipment vibration could be anticipated to adversely affect standing structures built prior to 1957 (i.e., those that have not been subject to recent seismic engineering standards). In all cases, the Historic Architectural Resources APE boundary was extended to include all structures that could be subject to potential direct and indirect effects resulting from project implementation (i.e., construction equipment noise and vibration). Although the Historic Architectural Resources APE does not always include entire parcel boundaries, it does include all potentially affected structures within a given parcel.

A reconnaissance level survey of the Historic Architectural Resources APE was performed in February 2003. A total of 63 structures were identified in the APE. Of these, 42 structures built prior to 1957 were identified; 27 of these had been previously evaluated by the State Historic Preservation Officer (SHPO) for their NRHP listing eligibility. All of the historic properties (those listed on or eligible for NRHP listing) within the APE are listed in Table 3.3-1.

One of the structures previously evaluated by the SHPO, the San Francisco Ferry Building, is listed on the NRHP under Criterion A due to is association with the Union Ferry Depot, and under Criterion C, as an outstanding example of the neo-classic Beaux Arts architectural style, its seminal use of reinforced-concrete in its steel frame, and association with the prominent San Francisco architect A. Page Brown. Built in 1898 and originally known as the Union Ferry Depot, it is located adjacent to the San Francisco Ferry Plaza (the Plaza is not part of the NRHP property, as it was constructed at a later date). The Ferry Building was modified by a new pile-supported platform surrounding its bay-side perimeter during recent improvements made to the Ferry Terminal (San Francisco Planning Department, Caltrans, and FHWA 1997).

Six of the previously evaluated resources within the APE have been determined by the SHPO to be eligible for NRHP listing as a result of the Interstate 880 Reconstruction Project evaluation (Caltrans 1990; FHWA 1991). One individual property, the Wempe Brothers/Schmidt-Western Paper Box Co. Building, was determined eligible for NRHP listing under Criterion C as it exhibits distinctive characteristics associated with the industrial activity related to expanded railroad commerce that attracted ethnic migrants to Oakland.

The other five NRHP-eligible structures are contributors to the Oakland Point Historic District. This District was determined eligible for NRHP listing under Criteria A and C due to the District's importance as one of the earliest residential, commercial, and ethnic neighborhoods in West Oakland. Built between 1870 to 1880, this neighborhood extended from approximately Broadway to Grove Street and 1st Street to 7th Street and housed the families of businessmen, professionals, artisans, and laborers, many working for the Central Pacific Railroad. Properties supporting immigrants seeking work in West Oakland included hotels, boarding and rental houses, commercial establishments providing food, clothing, and sundries, and recreational establishments such as theaters and bars.

The BART Transbay Tube was determined to be potentially eligible for NRHP listing during the current architectural historical evaluation under Criteria A and C. When it was opened for service on September 16, 1974, it was the deepest and longest underwater transit tube in the world. Its structural form, engineering technique, and method of construction pioneered the use of underwater placement technology now found on other transit systems worldwide. The Transbay Tube has retained its original integrity of location, setting, design, workmanship and materials. In 1997, the American Society of Mechanical Engineers acknowledged the importance of the mechanical engineering innovations of the Transbay Tube by designating the Tube and the BART system a Historic Mechanical Engineering Landmark. As a structure of exceptional mechanical engineering importance achieving significance under Criteria A and C within the past 50 years, the BART Transbay Tube appears eligible for NRHP listing under Consideration G. Consideration G applies to "a property achieving significance within the past 50 years if it is of exceptional importance."

Table 3.3-1. Architectural Historic Properties within the APE

Building Number	*Name*	*Address*	*National Register Eligibility Criteria*
43	San Francisco Ferry Building[1]	Embarcadero at the foot of Market Street	A and C
14	Wempe Brothers/Schmidt-Western Paper Box Co. Building[2]	1155 - 5th Street	C
16	Kohler-Coffey House[2]	719 Chester Street	A and C
22	Dempsey Rental Cottage[2]	710 Henry Street	A and C
23	Dempsey Rental Cottage[2]	714 Henry Street	A and C
37	Montoya Rental House – Mousalemas House[2]	717 Willow Street	A and C
38	Montoya Rental House – Mousalemas House[2]	721-23 Willow Street	A and C
42	BART Transbay Tube[3]	-	A and C, Consideration G

1: Listed on the NRHP
2: Determined Eligible for Listing on the NRHP by SHPO
3: Considered Eligible for Listing on the NRHP

Twenty structures have been previously determined by the SHPO to not be eligible for inclusion on the NRHP. The other 15 structures built prior to 1957 that were evaluated during the current project architectural survey appear to not be eligible for NRHP listing.

The Firestorm Community Mural constructed in 1991 at Rockridge Station is not eligible for consideration as an historic property and NRHP listing. The mural's importance as a contemporary visual neighborhood resource is addressed in section 3.8 (Visual Resources).

3.3.2 Proposed Action

3.3.2.1 Factors for Evaluating Impacts

Impacts on cultural resources are considered to be substantial if the project would have an "adverse effect" on an historic property (eligible for NRHP listing). As identified in 36 CFR §800.5(a)(2), adverse effects on historic properties include, but are not limited to:

(i) Physical destruction of or damage to all or part of the property;

(ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;

(iii) Removal of the property from its historic location;

(iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;

(v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

(vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

3.3.2.2 Impacts and Mitigation

Archaeological Resources

No known historic properties (archaeological) are located within the Archaeological Resources APE. However, it is possible that unknown subsurface prehistoric and/or historic deposits exist in project locations with moderate sensitivity. Should any archaeological resource be encountered during construction, it would be treated according to the provisions of 36 CFR 800.13 under the National Historic Preservation Act. Therefore, impacts would be negligible.

Historic Architectural Resources

Project pile driving construction activities would generate high ground-borne vibration levels, which could damage a structure. Caltrans has identified a vibration threshold of 12.7 mm/sec

(0.5 inches/sec) peak particle velocity (ppv) under which structurally sound buildings that have been designed to modern engineering standards would not be substantially affected. A conservative vibration threshold of 5 mm/sec (0.2 inches/sec) ppv has been used for buildings that are found to be structurally sound, but for which structural damage is a major concern. For structures that have been structurally weakened or historic buildings that have not been previously strengthened by seismic retrofitting such as the six historic properties located within the APE, a conservative threshold of 2 mm/sec (0.08 inches/sec) ppv is often used to provide the highest level of protection (Caltrans 2002).

Typical impact hammer pile drivers generate a ppv of about 0.64 inches/sec at a distance of 25 feet (National Cooperative Highway Research Program [NCHRP] 1999). At a reference distance of 200 feet, the ppv generated by impact hammer pile driving would be approximately 0.08 inches/sec. The predicted ppv would be right at the conservative threshold limit of 0.08 inches/sec often used for historic buildings. Therefore, it is possible that any historic properties within 200 feet of an impact hammer pile driving activity would result in a potential adverse effect on the structures' integrity. The predicted ppv at distances of less than 200 feet from non-impact drilling techniques (i.e., an oscillating or rotating hydraulic installation system) for pile installation would be below this ppv threshold, and would not affect an historic property.

Seven historic properties within the APE are located between 35 and 200 feet of project pile installation activities for the seismic retrofit of aerial guideways, the West Oakland Station, and the San Francisco Transition Structure. The San Francisco Ferry Building has been recently seismically retrofitted, resulting in the incorporation of modern engineering standards that would defray the effects of pile driving. Impact hammer pile installation techniques within 200 feet of the other six structures determined by SHPO to be eligible for NRHP listing has the potential to result in vibration that could damage the physical structures' integrity. The closest historic property, the Wempe Brothers/Schmidt-Western Paper Box Co. Building, is approximately 35 feet from pile installation activities. This structure is concrete-reinforced, such that potential adverse vibration effects would be minimized due to the greater stability associated with this modern engineering design. The other five wooden-framed historic properties are located between 125 and 200 feet from potential pile installation locations, and could potentially be subjected to vibrations of up to 0.08 inches/sec ppv. No other direct impacts on the architectural historic properties would result from the project.

Mitigation Measure. If impact hammer pile installation techniques are used within 200 feet of the five wooden-framed historic properties within the APE, potential impacts related to vibration on these five properties would be avoided with implementation of the following measures:

- A pre-construction survey shall be performed on the five wooden-framed historic properties within the APE to document the existing condition of the structures. Vibration equipment activity within 200 feet of all five wooden-framed historic properties within the project APE shall be monitored during construction. The vibration monitoring equipment shall issue a warning when a peak particle velocity (ppv) approaches 0.08 inches/second. When any reading on the monitoring equipment reaches 0.08 inches/second ppv, work shall immediately cease and the contractor shall adopt alternative pile installation methods such as using pre-drilled piles or a vibratory pile driver to maintain equipment vibration below 0.08 inches/second ppv.

- Vibration monitoring and surveys of all five wooden-framed historic properties within the project APE shall be done prior to, during regular intervals, and after project construction to document structural conditions. The vibration monitoring and structural surveys shall identify and describe any pre-existing internal and external structure cracking, settlement, and distress, and the condition of foundations, walls and other structural elements. The surveys shall be undertaken under the direction of a licensed Professional Structural Engineer in the State of California and shall be in accordance with industry-accepted standard methods. Written reports documenting conditions before and after project completion shall be prepared under the supervision and approval of a Structural Engineer, licensed to practice in the State of California. The reports shall include photo-documentation to verify that no structural damage has occurred to any of the historic properties during construction.

This measure would avoid any potentially "adverse effect" on historic properties as defined in Part 36 CFR §800.5(a)(2), Criterion (i).

Seismic retrofit improvements to the Transbay Tube, such as adding pile clusters around the Tube (stitching the Tube), adding a tunnel liner sleeve along one joint, or compacting the soil surrounding the Tube (vibro-replacement), would not compromise the integrity of the structures' precedent-setting form, engineering technique, or method of construction. All of the character-defining features that make the resource potentially eligible for NRHP listing would continue to serve their original purpose. Conversely, the retrofit improvements would ensure that possible impacts resulting from future seismic activity would be minimized, therefore resulting in beneficial effects on this historic resource.

A Finding of No Adverse Effect may be determined when an undertaking is modified or conditions are imposed to avoid impacts on historic properties (36 CFR Part 800.5 [b]). For the undertaking as a whole, the FHWA proposes that a Finding of No Adverse Effect is appropriate, because the project would avoid adverse effects on historic properties through the implementation of the above mitigation measures. SHPO concurred with the Finding of No Adverse Effect in a letter dated May 13, 2005.

3.3.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

Dredged material reuse or disposal activities would not encroach within or disturb any known or potential cultural resources. Therefore, no impacts on cultural resource impacts would result.

3.4 TRANSPORTATION

This section evaluates ground-based transportation (section 3.4.1), such as traffic and parking issues, as well as vessel transportation issues (section 3.4.2). A Traffic Technical Study (BART et al. 2005h) was prepared to analyze the ground transportation impacts of the project from the west end of the Berkeley Hills Tunnel in Oakland, to the Montgomery Street Station in San Francisco. The environmental analysis determined impacts on ground transportation facilities would result from project construction activity at the aerial guideways and stations, as well as hauling of dredged material to disposal sites. However, no permanent alteration to transportation facilities/operations would result from the project; all traffic impacts would be temporary (BART et al. 2005h).

A Vessel Transportation Technical Study (BART et al. 2005d) was also prepared to evaluate the vessel transportation impacts associated with the project at the Port of Oakland, in San Francisco Bay, and at the San Francisco Ferry Building. The environmental analysis determined that proposed retrofit activities could interfere with the Port of Oakland and San Francisco Ferry Building operations (BART et al. 2005d). However, all identified impacts would be temporary (BART et al. 2005d).

3.4.1 Traffic/Ground Transportation

Potential ground transportation impacts related to seismic retrofit work include, (a) lane closures and detours within public streets to accommodate construction, and (b) truck hauling of dredged material to potential disposal sites. Lane closures and detours within public streets, alterations to public parking, and alterations to public transit stops are related to construction activity on aerial guideways and stations, all within the City of Oakland. The focus of the ground transportation analysis is on construction activities occurring within the City of Oakland. However, this analysis also considers impacts for the hauling of dredged material from the Port of Oakland to various landfills in Alameda County. Project-generated vehicle trips to transport equipment and deliver materials, as well as trips by workers, and transportation of materials to and from the staging areas are expected to be minor and would not impact ground transportation facilities in Oakland and San Francisco (BART et al. 2005h).

3.4.1.1 Existing Setting

Existing Roads

Freeways. The BART alignment is on an aerial structure in two freeway locations: (1) in the median of State Route 24 and Interstate 980 between Chabot Road and Sycamore Street in Oakland; and (2) near the Interstate 880 freeway between Martin Luther King Jr. Way and Union Street. Construction at retrofit locations would not directly impact any of the mainline freeways in the project area; however, some components of the construction work would impact specific freeway ramps and ramp intersections with local streets.

Hauling of dredged material, however, could utilize regional freeways. If dredged material is disposed at the Altamont Landfill or the Vasco Road Landfill, the material would be dried at the Port of Oakland rehandling facility and then transported to the landfills along Interstate 880 south, Interstate 238, and Interstate 580 east. A description of the regional freeways that would be used to haul dredged material to a landfill for disposal is provided in the Traffic Technical Study (BART et al. 2005h).

Streets. There are 40 streets adjacent to, or that cross, the proposed retrofit construction areas. These streets are identified and briefly described in the Traffic Technical Study (BART et al. 2005h). The location of these streets is shown in Figure 3.4-1.

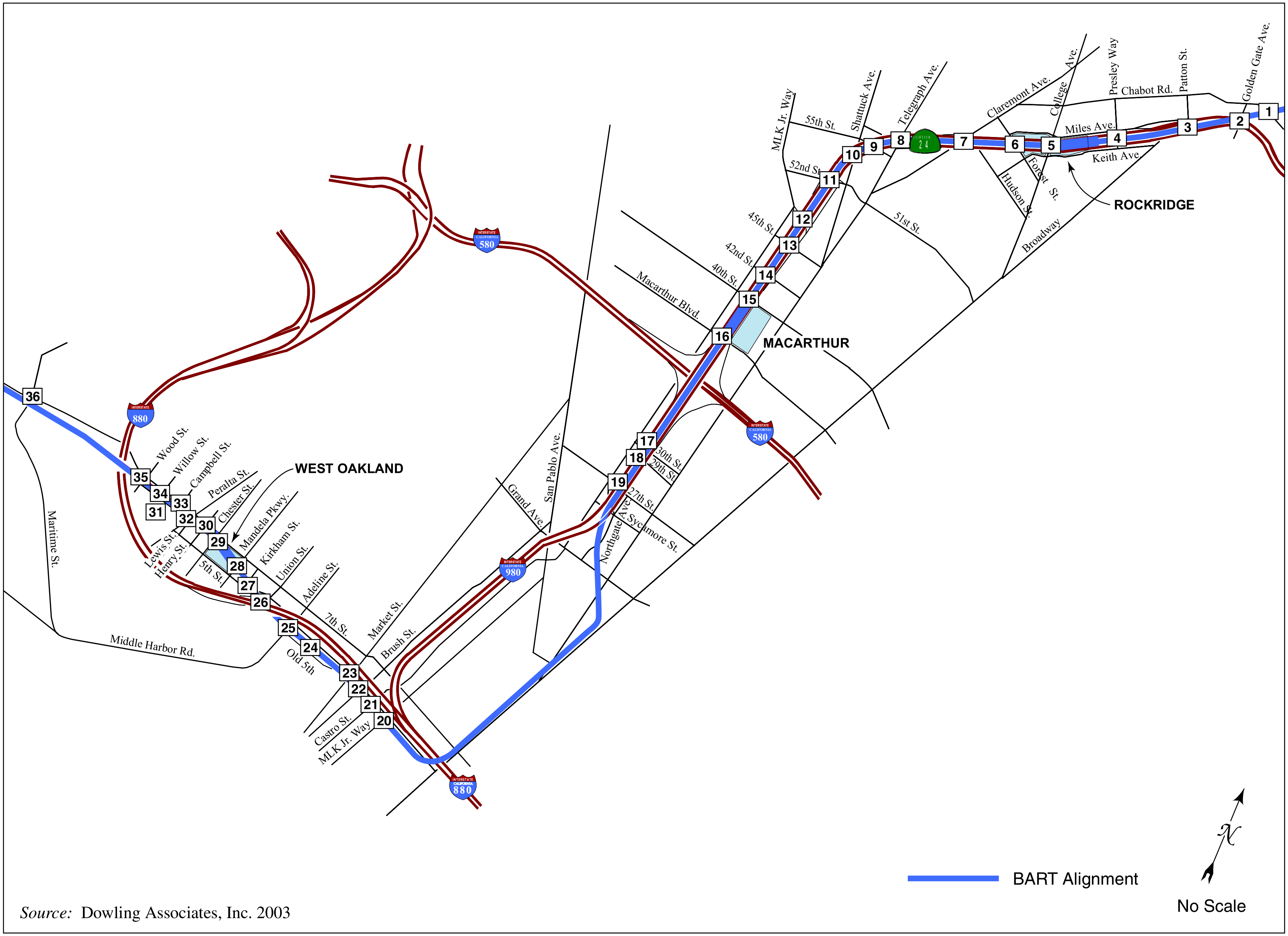
In addition to streets affected by retrofit construction there are several local streets that could be affected by hauling of dredged material from the Port of Oakland to landfill disposal sites. Dredged material to be disposed at the Altamont Landfill would be transported from the Port of Oakland along Interstate 880 south, Interstate 238, to Interstate 580 east. Though there is access between the Port of Oakland and Interstate 580, heavy trucks are restricted on Interstate 580 between Grand Avenue and 106th Avenue in the City of Oakland. Thus, it is anticipated that trucks transporting dredged material would access Interstate 580 from Interstate 238, outside the weight restriction area. Access to Interstate 880 would occur via 7th Street. To travel to the Altamont Landfill, trucks would exit Interstate 580 at the Greenville Road interchange, travel on Southfront Road to Greenville Road, and then north along Greenville Road, which turns into Altamont Pass Road, the access road for the landfill. Upon return, vehicles would go south on Altamont Pass Road to Northfront Road, which has an interchange with westbound Interstate 580. Dredged material to be disposed at the Vasco Road Landfill would exit Interstate 580 directly to Vasco Road. Characteristics of the roads that would be used to haul dredged material to landfill disposal are briefly described in the Traffic Technical Study (BART et al. 2005h).

Existing Traffic Operations

The evaluation of existing traffic operations includes a.m. and p.m. peak hour operations at street intersections near the BART alignment, assessment of mid-block street capacities beneath the BART aerial structure, and operations on freeways used to haul dredged material to disposal sites.

Level of Service. Freeways, roads, and intersections are evaluated in terms of level of service (LOS), which is a measure of driving conditions and vehicle delay. Levels of service range from A (best) to F (worst). Levels of service A, B, and C indicate conditions where traffic can move relatively freely. Level of service D describes conditions where delay is more noticeable. Level of service E describes conditions where traffic volumes are at, or close to, capacity resulting in significant delays. Level of service F characterizes conditions where traffic demand exceeds available capacity, with very slow speeds (stop-and-go), long delays (over 1 minute), and queuing at signalized intersections.

Freeway Operations. Construction at retrofit locations would not directly impact freeways. Hauling of dredged material, however, would utilize regional freeways. A review of freeway operations was undertaken for the three freeways potentially affected by project dredged material hauling (see Table 3.4-1), as part of *The Oakland Harbor Navigation Improvement Project Final Environmental Impact Statement/Environmental Impact Report* (USACE and Port of Oakland 1998). In this table, speeds of 49 miles per hour (mph) or higher indicated LOS A through C. At LOS D, traffic operating conditions become unstable and speeds drop as low as 41 mph. At LOS E, there are virtually no usable gaps in the traffic stream and speeds can drop as low as 30 mph. At LOS F, speeds are below 30 mph with stop-and-go traffic (USACE and Port of Oakland 1998).



Source: Dowling Associates, Inc. 2003

Figure 3.4-1. Project Location Numbers

Table 3.4-1. Existing Operations on Freeway Segments Potentially Affected by Dredged Material Hauling

	A.M Peak Hour		P.M. Peak Hour	
Freeway Segment	*LOS*	*V/C*	*LOS*	*V/C*
Interstate 880 South of 7th Street				
Northbound	B	0.52	B	0.41
Southbound	C	0.54	D	0.85
Interstate 880 North of Interstate 980				
Northbound	C	0.69	B	0.43
Southbound	B	0.46	D	0.80
Interstate 880 South of Interstate 980				
Northbound	F	1.08	D	0.90
Southbound	D	0.80	F	1.11
Interstate 880 North of Interstate 238				
Northbound	F	1.19	F	1.04
Southbound	D	0.84	F	1.18
Interstate 238				
Eastbound	B	0.47	C	0.76
Westbound	C	0.76	C	0.58
Interstate 580 East of Interstate 238				
Eastbound	C	0.61	F	1.00
Westbound	F	1.00	C	0.63
Interstate 580 Ramps at Vasco Road Interchange				
Eastbound Off Ramp After Diverge	F	1.21	F	1.08
Eastbound to Northbound Loop Ramp	A	0.19	D	0.79
Southbound to Westbound Ramp	C	0.70	A	0.25
Westbound On Ramp Prior to Merge	F	1.08	F	1.04

Notes:
LOS = Level of service V/C = Volume of vehicles/Capacity of roadway
1. Density is measured in passenger cars per mile per lane.
Source: USACE and Port of Oakland 1998.

As indicated by Table 3.4-1, congestion is problematic on the freeways serving the Port and landfill areas. Portions of Interstate 880, Interstate 580, and Interstate 580 interchanges operate at LOS F in both the A.M. and P.M. peak hours.

Intersection Operations. Tables 3.4-2 and 3.4-3 summarize LOS criteria for signalized and unsignalized intersections. Intersection operations were evaluated for the A.M. and P.M. peak hours at 14 intersections in the vicinity of retrofit construction activities as well as seven intersections affected by hauling of dredged material.

For retrofit construction activities, intersections were identified as the most likely to be impacted by construction activities based on a field review of the proposed construction areas. The Traffic Technical Study details the methodology used to analyze operations at intersections in the vicinity of retrofit construction (BART et al. 2005h).

Table 3.4-2. Level of Service Criteria for Signalized Intersections

Level of Service	*Control Delay per Vehicle (seconds)*	*Description*
A	$\leq$ 10	Free flowing. Most vehicles do not have to stop.
B	>10 to 20	Minimal delays. Some vehicles have to stop, although waits are not bothersome.
C	>20 to 35	Acceptable delays. Substantial number of vehicles have to stop because of steady, high traffic volume. Still, many pass without stopping.
D	>35 to 55	Tolerable delays. Many vehicles have to stop. Drivers are aware of heavier traffic. Cars may have to wait through more than one red light. Queues begin to form, often on more than one approach.
E	>55 to 80	Substantial delays. Cars may have to wait through more than one red light. Long queues form, sometimes on several approaches.
F	>80	Excessive delays. Intersection is jammed. Many cars have to wait through more than one red light, or more than 60 seconds. Traffic may back up into "up-stream" intersections.
Source: Transportation Research Board, *Highway Capacity Manual (HCM) 2000*, Washington, D.C., 2000, Exhibit 16-2.		

Table 3.4-3. Level of Service Criteria for Unsignalized Intersections

Level of Service	*Average Control Delay (seconds per vehicle)*
A	0 to 10
B	>10 to 15
C	>15 to 25
D	>25 to 35
E	>35 to 50
F	>50
Source: Transportation Research Board, *Highway Capacity Manual 2000*, Exhibits 17-2 and 17-22.	

Existing levels of service were calculated for each intersection affected by retrofit construction and are provided in Table 3.4-4. The intersection of Claremont Avenue and Hudson Street operates at LOS D during the A.M. peak hour due to the high right-turn volume from southbound Claremont Avenue to the State Route 24 on-ramp. All of the other intersections operate at LOS C or better during both the A.M. and P.M. peak hours in terms of average delays for all vehicles. Although average delays for all drivers is consistent with LOS A, drivers at the stop sign at 53rd Street at Shattuck Avenue experience delays consistent with LOS D in the A.M. peak hour and LOS F in the P.M. peak hour.

Table 3.4-4. Existing Operations at Intersections
Potentially Affected by Retrofit Construction

Intersection	*Control*	A.M. PEAK HOUR		P.M. PEAK HOUR	
		LOS	*Delay*	*LOS*	*Delay*
1. Broadway/Patton St. & Miles Ave.	All-Way Stop	C	15.6	B	10.6
2. College Ave. & Keith Ave.	Signal	C	23.3	C	27.7
3. College Ave. & Miles Ave.	Signal	B	15.2	B	12.4
4. Claremont Ave. & Hudson St.	Signal	D	42.7	B	13.6
5. Telegraph Ave. & 56th St./State Route 24 EB On-ramp	Signal	B	10.9	B	18.3
6. Shattuck Ave. & 53rd St.	1-Way Stop	A/D[1]	0.4/30.2[1]	A/F[1]	4.0/>100
7. Brush St. & 5th St.	Signal	B	13.1	B	12.5
8. Market St. & 5th St.	Signal	B	10.4	B	10.9
9. Adeline St. & 5th St.	Signal	C	24.9	C	24.7
10. Union St./Interstate 880 Ramps & 5th St.	Signal	B	17.1	B	18.9
11. Chester St. & 7th St.	2-Way Stop	A/C[1]	2.9/15.6[1]	A/B[1]	2.1/14.3
12. Peralta St. & 7th St.	Signal	A	9.7	A	9.8
13. Wood St. & 7th St.	Signal	B	18.2	B	17.9
14. Maritime Street & 7th St.	Signal	C	22.2	C	27.7

Notes:
LOS = Level of service   Delay = Delay in seconds   EB = Eastbound
1. For signal and all-way stop control, the LOS and delay are the average for all vehicles at the intersection. For 1- or 2-way stop control, there are two measures of LOS and delay: (a) the LOS and delay average for all vehicles passing through the intersection, and (b) the turning movement with the greatest LOS and delay.

Source: Dowling Associates 2002.

A review of intersection operations was undertaken for the six intersections potentially affected by dredged material hauling (see Table 3.4-5). The intersection of Southfront Road and Interstate 580 eastbound Ramp operates at LOS F during the P.M. peak hour due to the high volume of right-turning vehicles at that approach. During this peak period, delays are very high for the westbound right-turning traffic, but all other movements at the intersection operate at LOS A (USACE and Port of Oakland 1998). The Vasco Road and Northfront Road intersection operates at LOS E (below standard) during the P.M. peak hour. All of the other intersections potentially affected by dredged material hauling operate at LOS C or better during both the A.M. and P.M. peak hours (USACE and Port of Oakland 1998).

Table 3.4-5. Existing Operations at Intersections
Potentially Affected by Dredged Material Hauling

Intersection	A.M. PEAK HOUR		P.M. PEAK HOUR	
	LOS	*Delay*	*LOS*	*Delay*
7th Street and Interstate 880 SB On Ramp[1]	A	2.8	B	6.6
7th Street & Interstate 880 NB Off Ramp[1]	C	16.4	C	16.8
Southfront Road & Interstate 580 EB Ramps	A	4.8	F	High
Southfront Road & Greenville Road	B	13.8	B	12.6
Altamont Pass Road/Greenville Road & Landfill access[2]	B	5.3	B	6.5
Northfront Road & Interstate 580 WB Ramps[2]	B	5.9	B	8.2
Vasco Road & Northfront Road	C	15.7	E	48.7

Notes:
LOS = Level of service Delay = Delay in seconds
EB=Eastbound NB=Northbound SB=Southbound WB=Westbound
1. Level of service at this intersection has been estimated based on traffic conditions prior to completion of Interstate 880.
2. Delay expressed is largest average delay of all turning movements.
Source: USACE and Port of Oakland 1998.

The existing mid-block operations of selected street segments were evaluated by comparing the highest directional peak-hour traffic count to the street segment volume thresholds (Table 3.4-6). The traffic volumes on Telegraph Avenue and Shattuck Avenue beneath the BART aerial structure are consistent with LOS D operations. All other segments have traffic volumes that are consistent with LOS C or better operations.

Table 3.4-6. Operations at MTS Street Segments
Potentially Affected by Retrofit Construction

Location No. [1]	*Street*	*Peak Hour*	*Highest Peak Hour Volume*	*Number of Lanes*	*Level of Service*
5	College Avenue	5:00-6:00 P.M.	519	1	C
7	Claremont Avenue NB	5:00-6:00 P.M.	1,067	2	C
7	Claremont Avenue SB	5:00-6:00 P.M.	197	2	A
8	Telegraph Avenue NB	5:00-6:00 P.M.	1,314	2	D
8	Telegraph Avenue SB	5:00-6:00 P.M.	1,481	2	D
10	Shattuck Avenue	5:00-6:00 P.M.	780	1	D
11	52nd Street	4:00-5:00 P.M.	440	2	A
16	MacArthur Boulevard	5:00-6:00 P.M.	824	3	B
20	Martin Luther King Jr. Way	5:00-6:00 P.M.	506	1	C
23	5th Street W. of Market	8:00-9:00 A.M.	601	2	C
24	5th Street E. of Adeline	5:00-6:00 P.M.	1,036	2	C
31	7th Street	5:00-6:00 P.M.	573	2	B
36	Maritime Street	4:00-5:00 P.M.	340	2	A

Notes:
NB = Northbound SB = Southbound
1. These location numbers are shown on Figure 3.4-1.
Source: Dowling Associates 2002.

Existing Parking

There are both on-street and off-street parking areas adjacent to the BART alignment within the project area.

On-Street Parking. Most of the streets that cross the BART alignment within the project area have on-street parallel curb parking on both sides of the street. The following streets do not have parking on either side of the street at the BART alignment (location numbers below are shown on Figure 3.4-1):

- Location 1: Chabot Road;
- Location 2: Golden Gate Avenue;
- Location 3: Patton Street;
- Location 5: College Avenue, which has bus and taxi loading areas along the curbs;
- Location 19: Northgate Avenue;
- Location 25: Adeline Street;
- Location 26: 5th Street; and
- Location 36: Maritime Street.

Fortieth Street (Location 15) has on-street parking on the north curb only.

The on-street parking spaces appear to be most fully utilized in areas closest to the BART stations. Near the Rockridge Station, these locations include Presley Way (Location 4), Forest Street (Location 6), Hudson Street (Location 7), and Claremont Avenue (Location 7). Near the MacArthur Station, parking spaces were almost fully utilized on 40th Street (Location 15). Near the West Oakland Station, parking spaces are used on Mandela Parkway (Location 28), Chester Street (Location 29), Henry Street (Location 30), and 7th Street (Location 31).

Station Areas. Seismic retrofit construction activity at the Rockridge and West Oakland Stations would temporarily close some parking spaces at station lots and increase demand for on-street parking. Detailed parking surveys were conducted on Wednesday, April 2, 2003, to determine the total numbers of parking spaces within ½ mile of each station. The surveys also inventoried parking restrictions and mid-day parking occupancies on each individual block.

Rockridge Station. There are approximately 6,050 on-street parking spaces within ½ mile of the Rockridge Station. There is short-term metered parking on College Avenue and on several side streets intersecting College Avenue. Neighborhood permit parking, generally with a 2-hour limit, is in effect on most residential streets within ¼ mile of Rockridge Station. There are 4-hour parking limits beyond that range. About 5,170 of the 6,050 parking spaces in the project area are not controlled by permit or time-limit restrictions. Street cleaning occurs twice a month on each side of the street (4 days a month) from 12:30 P.M. to 3:30 P.M. (during the 1st and 3rd or 2nd and 4th weeks of each month; sweeping days vary by specific block). On street cleaning days, it is expected that half of the uncontrolled spaces (about 2,590) would be unavailable.

Parking counts were conducted on a day with no street cleaning to determine the base level of demand for parking in the area. This parking demand for non-permit parking was found to peak in the afternoon around 3:00 P.M. at 3,340 stalls, or about 65 percent occupancy of the 5,170 total uncontrolled spaces. However, the peak demand exceeds the supply that would be available on 4 days per month during street cleaning.

West Oakland Station. In the vicinity of the West Oakland Station, there are approximately 4,630 on-street parking spaces within ½ mile of the station. There is some neighborhood permit parking in the vicinity of the West Oakland Station. About 4,040 of the 4,630 spaces are not controlled by permit or time-limit restrictions. On street cleaning days (4 days per month), it is expected that half of these stalls (2,020) would be unavailable. On the survey day, with no street cleaning, parking demand for non-permit parking was found to peak around 12:00 noon at 2,120 stalls.

Off-Street Parking. Seismic retrofit construction work would also occur within two BART station parking lots.

Rockridge Station. The Rockridge Station has 911 parking spaces for automobiles (including some designated for disabled persons) and 12 motorcycle parking spaces. A parking validation system is in effect where BART passengers must validate their numbered parking space from within the paid fare gate area. There are no additional parking lots available for commuter parking adjacent to the BART parking lot. Bicycle parking is provided by 56 lockers and 133 rack spaces.

West Oakland Station. The West Oakland Station has 469 parking spaces for automobiles (including some designated for disabled persons) and 24 motorcycle parking spaces. There are several private parking lots near the West Oakland Station that charge a fee for commuter parking. Bicycle parking is provided by 8 lockers and 91 rack spaces.

Existing Transit

Regional and local rail transit service is provided by BART. Local bus transit service in the project area is provided by Alameda Contra Costa Transit District (AC Transit).

BART. The BART system is comprised of 104 miles of track, connecting communities in Contra Costa, Alameda, San Francisco, and San Mateo counties with 43 stations. The system is a combination of aerial, subway, and surface track, separated from general vehicular traffic. BART operates from 4 A.M. to midnight on weekdays, 6 A.M. to midnight on Saturdays, and 8 A.M. to midnight on Sundays.

AC Transit. Several AC Transit routes use streets and bus stops in the project area. The details of these transit routes are summarized in the Traffic Technical Study (BART et al. 2005h).

Existing Bikeways

Caltrans has defined three different bikeway types. A Class I bikeway is essentially a bike path completely separate from other traffic. A Class II bikeway is a bike lane, generally a striped lane denoted by signs, that allows one-way bike travel on the edge of a street or highway. A

Class III bikeway or bike route is a shared facility between bikes, vehicles, and pedestrians. A Class III bike route connecting the Rockridge area with the Oakland Hills is designated on College Avenue north of the Rockridge Station (Location 5), continuing on Chabot Road, and crossing under the BART alignment at Golden Gate Avenue (Location 2). A Class III bike route connecting downtown Oakland with Berkeley is designated on Shafter Avenue and Colby Street, using Forest Avenue (Location 6) to cross under the BART alignment. A Class II bike route has been established on both sides of Telegraph Avenue north of State Route 24. A Class I bike route has been constructed along the south side and parallel to 7th Street west of Maritime Street to provide access to the Middle Harbor Shoreline Park.

Existing Pedestrian Facilities

Most of the streets in the project area have sidewalks on both sides of the street, with the following exceptions:

- Location 1: Chabot Road, unpaved shoulder on both sides; and
- Location 12: Martin Luther King Jr. Way off-ramp, no pedestrians permitted.

Field surveys of pedestrian activity were conducted at each retrofit location in April 2002. Only a small number of pedestrians were observed at many of the locations, however pedestrian activity was observed at the following locations:

- Location 3: Patton Street, associated with Chabot Elementary School;
- Location 5: College Avenue, associated with Rockridge Station, business district, and Claremont Middle School;
- Location 7: Hudson Street and Claremont Avenue, associated with Hardy Park, casual carpool staging area1 (a.m. peak period only), and AC Transit transbay bus stops (p.m. peak period only);
- Location 8: Telegraph Avenue;
- Location 15: 40th Street, primarily the south curb, associated with MacArthur Station and bus stops; and
- Location 29: Chester Street, associated with West Oakland Station.

Construction activity would also occur at the San Francisco Transition Structure on the Ferry Plaza Platform. The transition structure is beyond the primary pedestrian portion of the Ferry Plaza Platform used by ferry passengers. The platform adjacent to the transition structure is, however, used by pedestrians viewing San Francisco Bay.

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1 "Casual car pools" are informal car pools that form when drivers and passengers meet at designated locations. Generally people wanting to cross the Bay Bridge congregate in an informally designated area, and are picked up by drivers crossing the bridge and then are dropped off in designated areas in San Francisco (generally Fremont and Mission Streets). Both driver and passenger benefit because in the morning car pools are able to bypass the long delays at the Bay Bridge toll plaza. In the evenings carpools can take advantage of the car pool-only on-ramp to the Bridge, and car pool lanes on Interstate 80 and Interstate 880. Casual car pools are considered convenient because no pre-arrangement or fixed schedule is necessary. There are a number of East Bay pickup locations, such as Hudson Street.

3.4.1.2 Proposed Action

3.4.1.2.1 Factors for Evaluating Impacts

The following criteria were used to evaluate project impacts to traffic and ground transportation.

Factors for Evaluating Freeway and Street Segment Impacts. The project would impact transportation on freeway and street segments if it caused the level of service on a freeway or street segment in the MTS to degrade to LOS F. This measure is also used by the Alameda County Congestion Management Agency.

Factors for Evaluating Intersection Impacts. The project would impact intersections if:

- For intersections that would otherwise operate at LOS D or better, cause intersection operations to degrade to worse than LOS D;
- For intersections that would otherwise operate at LOS E, cause an increase in the average critical movement delay by 6 seconds or more or cause the LOS to deteriorate to LOS F; or
- For intersections that would otherwise operate at LOS F; cause an increase in the average critical movement delay by 4 seconds or more.

Factors for Evaluating Parking Impacts. The project would impact parking if it greatly reduced parking supply more than it reduced parking demand.

Factors for Evaluating Transit Impacts. The project would impact transit if it increased transit demand to the point where it could not be accommodated by existing or planned transit capacity.

Factors for Evaluating Bicycle Impacts. The project would impact bicyclists if it created particularly hazardous conditions for bicyclists or eliminated bicycle access to adjoining areas.

Factors for Evaluating Pedestrian Impacts. The project would impact pedestrians if it resulted in overcrowding on public sidewalks, created hazardous conditions for pedestrians, or eliminated pedestrian access to adjoining areas.

Factors for Evaluating Temporary Construction Impacts. Unless otherwise noted, the factors used to evaluate permanent project impacts also apply to the construction period. The project would impact vehicle traffic, including truck traffic, transit service, or bicycle or pedestrian travel during the construction period if it created hazards for any of those travel modes, caused considerable delays, or eliminated access to adjoining areas.

3.4.1.2.2 Impacts and Mitigation

The primary impact on ground transportation during retrofit construction relates to the temporary closures of sidewalks, parking areas, and traffic lanes. The analysis of closures presented in this report is based on 21 BART Seismic Retrofit Strategy Reports, prepared between August 2, 2001, and February 15, 2002 (Bechtel/HNTB Team 2001a-r; BART 2002e-g), and field review. It is expected that proposed lane/sidewalk closures would be modified as the design team refines the construction plans and traffic strategies. For the purposes of this analysis, reasonable worst-case temporary closure impacts on project area streets are assumed.

Freeway Segment Operations. No impacts on freeway operations are expected from seismic retrofit construction. Traffic generated by transport of construction workers or equipment to and from retrofit construction sites would use regional freeways, but would not add significant traffic volumes to any individual freeway segment during typical commute peak periods. See also section 3.4.1.2.3 for impacts on freeway segment operations resulting from dredged material hauling.

Intersection Operations. Impacts on intersection operations resulting from dredged material hauling are discussed in section 3.4.1.2.3. Traffic generated by transport of construction workers or equipment to and from retrofit construction sites would use local streets and intersections, but would not add significant traffic volumes to any individual critical turn movements at intersections in Oakland or San Francisco during typical commute peak periods. However, the maximum potential lane closures related to retrofit construction would increase delay at several locations, and would cause two intersections that would otherwise operate at LOS D or better to operate at peak hour LOS E or F:

1. College Avenue and Keith Avenue – P.M. peak hour only; and
2. Claremont Avenue and Hudson Street – both A.M. and P.M. peak hours.

Impacts to these two intersections will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and traffic management plan (TMP) that specifically addresses accommodations for local street traffic at these locations throughout the duration of retrofit activities. TMP components will include configuring construction staging areas to accommodate a 100-foot southbound turn lane or control northbound signalization and temporarily remove parking (approximately 4 spaces) on College Avenue and designing construction staging areas to accommodate two northbound lanes on Claremont Avenue. For additional details, see the Traffic Technical Study (BART et al. 2005h).

Street Segment Operations. Traffic generated by transport of construction workers or equipment to and from retrofit construction sites would use local streets, but would not add significant traffic volumes on any individual street segments in Oakland or San Francisco during typical commute peak periods. However, street segment operations will be affected by retrofit construction. Many of the lane closures associated with retrofit construction would occur in mid-block locations away from street intersections. These closures may not affect the operations of the intersections, but could require drivers to merge from two or more lanes into fewer lanes.

Peak hour traffic volumes were compared to the level of service thresholds established for street segments. The evaluation compares the existing number of lanes and assumes single lane operation in each direction on each street segment. This is a worst-case assumption; it is expected that lane closures will not be as extensive as assumed. It is expected that the extent of proposed lane closures will be modified as the design team refines the construction plans and traffic strategies.

If through-traffic is limited to a single lane during project construction, traffic volumes would exceed the LOS F threshold criteria on one MTS street segment, Telegraph Avenue (Location 8, southbound). Impacts to this street segment will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for local street traffic at this location throughout the duration of retrofit activities. TMP components will include configuring construction staging areas to accommodate two through-southbound lanes on Telegraph Avenue. For additional details, see the Traffic Technical Study (BART et al. 2005h).

Truck Operations. Truck operations would be affected by retrofit construction. During the retrofit construction period, the project would temporarily increase traffic hazards by closing lanes and creating design features that do not comply with Caltrans design standards for truck movements. Adeline Street (Location 25) and Maritime Street (Location 36) are primary access routes to the Port of Oakland. Temporary lane closures at the intersections of Adeline Street with 5^{th} Street and Maritime Street with 7^{th} Street would result in turn radii that are not adequate for trailer trucks, and would increase traffic hazards to motor vehicles.

Impacts to truck operations will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for truck traffic at these locations throughout the duration of retrofit activities. TMP components will include configuring construction staging areas at the Adeline Street/5^{th} Street and the Maritime Street/7^{th} Street intersections to accommodate sufficient turning radii for trailer trucks. For additional details, see the Traffic Technical Study (BART et al. 2005h).

Parking. Parking would be affected by retrofit construction. Construction at the Rockridge and West Oakland Stations would temporarily close some parking spaces within the parking lots, and temporarily eliminate some on-street parking. A detailed construction-phasing plan will be developed, which will determine the total number of parking spaces that would be available at each station at any given time. BART currently proposes to complete the seismic retrofit work at the station parking lots in phases so that a limited number of parking spaces would be impacted at any given time.

At the Rockridge Station, Phase 1 of construction (Piers 1 and 2) would impact approximately 30 parking spaces. Phase 2 of construction (Piers 3 and 4) would impact six parking spaces for disabled persons that would need to be temporarily relocated. Although it is unknown exactly where these six disabled parking spaces will be relocated, all six disabled parking spaces will remain in Rockridge Station at a nearby, comparable location. Phase 3 of construction (Piers 5 to 8) would impact approximately 100 parking spaces, or about 11 percent of the total parking supply. On-street parking on all but 4 days of the month is adequate and could accommodate parking displaced at the Rockridge Station during retrofit. On the days with street cleaning, displacement of parking at the Rockridge Station would impact on-street parking.

The construction phasing plan for the West Oakland Station generally proposes seismic retrofit work at two piers during each phase. Approximately 20 to 30 parking spaces would be closed during each phase of construction, or up to 6 percent of the total supply. On-street parking on all but 4 days of the month is adequate and could accommodate parking displaced at the West Oakland Station during retrofit. On the days with street cleaning, displacement of parking at the West Oakland Station would impact on-street parking.

Parking would also be affected in locations other than the Rockridge and West Oakland Stations. Curb parking would be temporarily removed during all phases of construction at each location where on-street curb parking exists. The construction easement drawings dated January 9, 2002, indicate a standard construction easement length of 100 feet along each side of a street. This corresponds to the elimination of five parallel parking spaces on each side of the street. Therefore, construction at each of the following locations with on-street parking within a reasonable walking distance of BART stations would be temporarily impacted by the elimination of approximately 10 parking spaces at each location during the construction period: Presley Way (Location 4), Forest Street (Location 6), Hudson Street (Location 7), Claremont Avenue (Location 7), Mandela Parkway (Location 28), Chester Street (Location 29), Henry Street (Location 30), and 7th Street (Location 31).

Impacts to parking will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for parking at these locations throughout the duration of retrofit activities. TMP components will include coordination with the City of Oakland to temporarily relax parking permit restrictions, reschedule street cleaning operations, and notification of all parking space closures at the Rockridge and West Oakland Stations. For additional details, see the Traffic Technical Study (BART et al. 2005h). In addition, the following mitigation measures are identified.

Mitigation Measures. Implementation of the following mitigation measures will further ensure that parking impacts are avoided throughout the duration of project retrofit activities:

- BART shall provide on-site or off-site replacement parking facilities on a one-space for one-space basis for private property where on-site parking supply is reduced below demand by construction. If on-site or off-site replacement parking facilities cannot be identified, BART shall financially compensate the property owners for the use of the on-site parking spaces during the period that construction activities affect on-site parking.
- BART shall temporarily relocate the six disabled parking spaces to the best available remaining parking locations at the Rockridge Station during the periods that construction requires temporary closure of these disabled parking spaces.

Transit. The project would not increase transit demand such that demand could not be accommodated by existing or planned transit capacity. However, there are potential impacts related to transit circulation and access; these are discussed below.

Bicycle Circulation. There would be no permanent impacts on bicycle circulation. However, retrofit construction would temporarily create narrowed curb lanes that would be less than the recommended width by Caltrans[2] and could reduce bicycle safety on several routes used by bicycles. These include the existing Class III bike routes on College Avenue (Location 5) and Forest Avenue (Location 6). Construction of the project may also introduce narrowed curb lanes and temporarily reduce safety in locations that are included in the City of Oakland recommended bikeway network, including Claremont Avenue (Location 7), Telegraph Avenue (Location 8), Shattuck Avenue (Location 10), 52nd Street (Location 11), 40th Street (Location 15), Market Street (Location 23), Mandela Parkway (Location 28), and 7th Street (Location 31).

Impacts to bicycle circulation will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for bicyclists at these locations throughout the duration of retrofit activities. TMP components will include posting signs to direct bicyclists through construction areas. For additional details, see the Traffic Technical Study (BART et al. 2005h).

Pedestrian Circulation. The project would not permanently increase traffic hazards to pedestrians. There would be no permanent impacts on pedestrian circulation.

However, during retrofit construction, it would be necessary to temporarily close the sidewalk on at least one side of the street in each location shown on Figure 3.4-1, with the exception of Location 1 (Chabot Road) and Location 12 (Martin Luther King Jr. Way off-ramp); these areas do not have sidewalks. If project construction temporarily closes the sidewalk on one side of the street at a time, pedestrians would detour to the sidewalk on the other side of the street. This would cause some inconvenience but would not cause substantial increases in delay for pedestrian movements. If project construction closes the sidewalk on both sides of a street, pedestrians would have to detour to adjacent streets, may lose access to some areas, and may incur significant delays compared to their normal pedestrian routes.

Impacts to pedestrian circulation will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for pedestrians at specific locations with significant amounts of pedestrian traffic throughout the duration of retrofit activities. TMP components will require that sidewalks remain open on at least one side of the street during all construction phases at locations that have significant amounts of pedestrian traffic. For additional details, see the Traffic Technical Study (BART et al. 2005h).

Other Temporary Construction Impacts. Potential temporary impacts of seismic retrofit construction at specific locations are evaluated below.

Patton Street (Location 3). During construction adjacent to the northbound lanes on Patton Street, the BART Seismic Retrofit Strategy Reports (Strategy Reports) currently call for two-way operation on the 22-foot wide southbound lane. Two-way operation on the southbound lane of Patton Street may not be feasible due to the minimal width for two-way operation and the difficulty of providing a safe crossing between northbound Patton Street and the off-ramp from

2 The Caltrans Highway Design Manual refers to American Association of State Highway and Transportation Officials (AASHTO) standards, which recommend a width of 1.5 meters from the curb for a Class II bike lane and a minimum curb lane width of 4.3 meters for a Class III bikeway so bicycles and general traffic can move side by side with safety.

State Route 24. As a result, northbound Patton Street would be impacted if the northbound lanes adjacent to construction are closed, reducing access across State Route 24.

Rockridge Station (Location 5). Bus stops on College Avenue are located north and south of the BART tracks, about 22 feet from the nearest BART column. The bus loading areas are located immediately adjacent to the BART columns. The proposed construction plans (BART 2002a) would impact these loading areas by closing the entire southbound curb lane during Phase 1 of construction and the entire northbound curb lane during Phase 2 of construction. At a minimum, this would require relocation of the bus stops on the affected curb lane, and possibly the bus stops on the opposite curb due to reduced street width. Taxi loading areas at the Rockridge Station would also need to be temporarily relocated during construction. Relocation of bus and taxi loading areas would cause considerable delay to bus and taxi travelers.

Hudson Street Near Claremont Avenue (Location 7). A casual carpool staging area located along Hudson Street, approaching Claremont Avenue, would be impacted by the temporary closure of the curb parking lane during construction that would block off the area currently used by drivers waiting for riders. It would be necessary to temporarily designate an alternative location for queued vehicles. Most nearby alternative locations, such as further east on Hudson Street or on southbound Claremont Avenue, would temporarily remove on-street parking in front of adjacent residents and businesses. Other locations would significantly increase travel time for some carpool users.

52nd Street On-Ramp (Location 11). The Strategy Reports propose temporary closure of the on-ramp from 52nd Street to State Route 24 and Interstate 580. This closure would require traffic to continue west on 52nd Street and use the on-ramp from southbound Martin Luther King Jr. Way or find alternate routes to the freeway. This on-ramp carries approximately 12,400 daily vehicles. The detour would impact traffic operations as it could temporarily increase the traffic volume on westbound 52nd Street adjacent to Children's Hospital from 4,500 daily vehicles to 16,900 daily vehicles. The detour would also impact traffic operations at the intersection of Martin Luther King Jr. Way and 52nd Street and may increase travel time for drivers by delays equivalent to LOS F.

MacArthur Station (Location 15). Bus stops on 40th Street at the MacArthur Station are located east of the BART structure. The bus loading area is located immediately adjacent to the BART columns. The proposed detour plans (BART 2002a) would impact these bus stops by closing the entire eastbound curb lane during Phase 1 of construction, and requiring relocation of the bus stops. Taxi loading areas on 40th Street at the MacArthur Station would also need to be temporarily relocated during construction. Relocation of bus and taxi stops would cause considerable delay to bus and taxi travelers.

Temporary impacts to traffic operations from temporary closure of street lanes, and relocation of a casual carpool location, and bus and taxi loading areas will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for traffic operations at the affected locations throughout the duration of retrofit activities. TMP components will include provisions for a single northbound lane on Patton Street or a detour route during closure of northbound Patton Street, a temporary detour at 52nd Street, alternative carpool loading locations, bus loading areas on College Avenue and eastbound 40th Street, and temporary taxi loading areas at Rockridge and MacArthur Stations. For additional details, see the Traffic Technical Study (BART et al. 2005h).

3.4.1.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

DREDGED MATERIAL REUSE WITHIN THE PROJECT

Dredged material reuse within the project would not affect traffic/ground transportation.

DREDGED MATERIAL REUSE/DISPOSAL OPTIONS OUTSIDE THE PROJECT

Because dredged material would be transported by barge to any of the in-Bay or upland offsite disposal locations, dredged material reuse/disposal at these sites would not affect traffic/ground transportation.

If dredged material is disposed at a landfill site, impacts related to dredged material hauling would occur from the movement of up to 28 trucks per day (each with 12-cy capacity) from the Port of Oakland to either the Altamont or Vasco Road landfills. Dredged material disposal would occur for approximately 22 to 30 months, if trips occurred successively during the dewatering period (rather than spread evenly over the 4 year construction period).

Freeway Segment Operations. Hauling of dredged material to the Altamont or Vasco Road Landfills would result in impacts to four freeway segments currently operating at LOS F during the A.M. and P.M. peak hours:

1. Interstate 880 South of Interstate 980, northbound in A.M. peak hour, southbound in P.M. peak hour;
2. Interstate 880 North of Interstate 238, northbound in A.M. peak hour, southbound in P.M. peak hour;
3. Interstate 580 East of Interstate 238, westbound in A.M. peak hour, eastbound in P.M. peak hour; and,
4. Interstate 580 Ramps at Vasco Road Interchange, eastbound off ramp in both A.M. and P.M. peak hour, westbound on ramp in both A.M. and P.M. peak hour.

Temporary impacts on freeway operations at these four locations will be avoided, however, because the construction contractor will be required to transport dredged material from the Port of Oakland to landfill disposal sites outside of peak hours (6 A.M. to 10 A.M. and 3 P.M. to 7 P.M.). For additional details, see the Traffic Technical Study (BART et al. 2005h).

Intersection Operations. Hauling of dredged material would add approximately 28 trucks per day to intersections along the proposed haul routes. The addition of these truck trips could result in impacts to one intersection (Southfront Road and Interstate 580 eastbound ramp) currently operating at LOS F during the P.M. peak hour.

Temporary impacts on intersection operations at the Southfront Road/ Interstate 580 eastbound ramp intersection will be avoided, however, because the construction contractor will be required to transport dredged material from the Port of Oakland to landfill disposal sites outside of peak hours (6 A.M. to 10 A.M. and 3 P.M. to 7 P.M.). For additional details, see the Traffic Technical Study (BART et al. 2005h).

3.4.2 Vessel Transportation

3.4.2.1 Existing Setting

The existing setting for vessel transportation is summarized below and described in greater detail in the Vessel Transportation Technical Study (BART et al. 2005d).

The project construction area would be located within the San Francisco Bay and Oakland Harbor Regulated Navigation Areas (USCG 1999). The San Francisco Bay and Oakland Harbor Regulated Navigation Areas, and the designated traffic lanes are shown in Figure 3.4-2.

The project area does not contain any designated anchorage areas. Anchoring along the Transbay Tube is expressly prohibited (as signified by the purple zone surrounding the Transbay Tube in Figure 3.4-3). Without pre-approval of the USCG, anchoring is also expressly prohibited within the Oakland Outer Harbor Entrance Channel.

Port of Oakland and Vicinity

The Port of Oakland is one of the major port facilities in the U.S., loading and discharging more than 98 percent of the containerized goods entering and leaving northern California. The port specializes in container ship operations and has facilities such as deepwater berths, container cranes, and connections to rail lines. The Port of Oakland facilities adjacent to the BART Transbay Tube include the former Matson Terminal (now called the Outer Harbor Terminal), the Outer Harbor Entrance Channel, and the Outer Harbor.

Former Matson Terminal/Outer Harbor Terminal. As illustrated in Figure 2-7 (see Chapter 2), the Outer Harbor Terminal includes Berths 32, 33, and 34; a storage yard; and freight station. Berths 32 and 33 serve containerized cargo with large waterfront gantry cranes. Berth 34 has side ramps to serve roll-on/roll-off cargo, such as cars (Port of Oakland 2002b). During 2002, approximately 116 vessel calls were made at the Outer Harbor Terminal. The Port of Oakland intends to refurbish and upgrade the Outer Harbor Terminal (including Berths 32, 33, and 34); it will be closed for renovation until the end of 2005.

Outer Harbor Entrance Channel. As shown in Figure 3.4-3, approximately 2,300 feet of the Transbay Tube underlie the Oakland Outer Harbor Entrance Channel. The Oakland Outer Harbor Entrance Channel allows deep draft vessels, such as container ships, to access 16 berths within the Outer Harbor of the Port of Oakland. The channel is approximately 800 feet wide and is maintained to a depth of 42 feet. Plans are in progress to further deepen the channel to a depth of 50 feet to better accommodate modern deep-draft container vessels, limit delays due to tides, and reduce the risk of vessels running aground.

Based on the number of annual ship calls to the Outer Harbor in 2002, it is estimated that approximately 42 cargo ship transits occurred in the Bay over the Oakland end of the Transbay Tube in a given week.

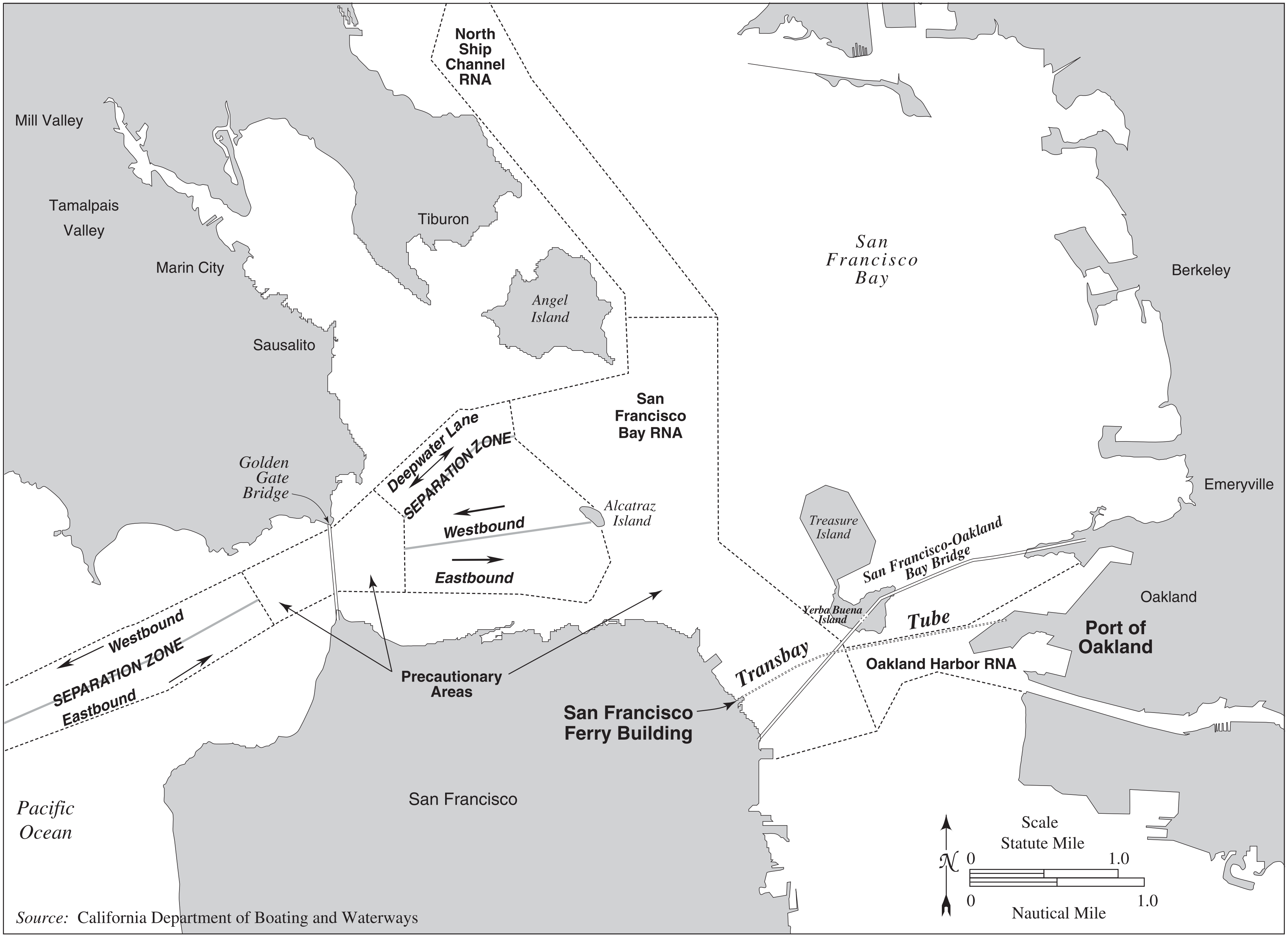

Figure 3.4-2. Relationship of the San Francisco Regulated Navigation Area, Designated Vessel Traffic Lanes, and the Project Construction Area

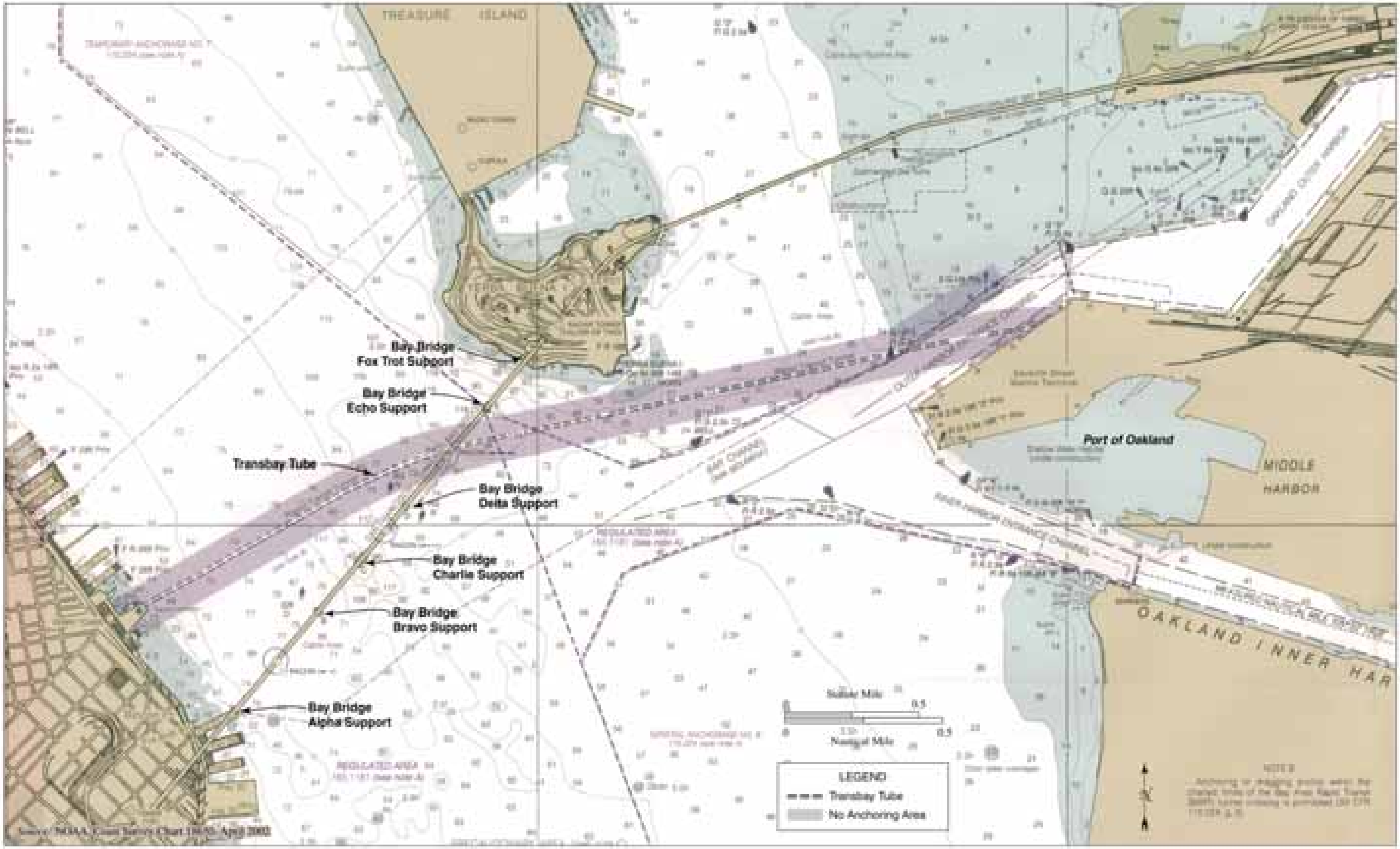

Figure 3.4-3. Features of San Francisco Bay in the Project Construction Area

During 2002, 1,095 ships called on berths within the Port of Oakland Outer Harbor.

Outer Harbor. As shown in Figure 3.4-4, the Port of Oakland Outer Harbor includes Berths 7 through 37 (this includes all terminals served by the Outer Harbor Entrance Channel, including the 7th Street Terminals). Ships enter the Outer Harbor via the Outer Harbor Entrance Channel (see Figure 3.4-4). There is a turning basin for ships in the Outer Harbor along the face of Berths 25 to 30. According to the Port of Oakland, all ships accessing any Outer Harbor terminal must use this turning basin. The Outer Harbor has some unique terminals, terminals that provide services that are not available anywhere else at the Port of Oakland. For example, Berth 10 is the only sediment handling facility at the Port. Berth 10 is used to process sediments from dredged operations in the Bay. The Outer Harbor also includes the only breakbulk[3] facilities at the Port and the only roll-on/roll-off cargo (cars and other vehicles) handling facilities (Port of Oakland 2002b). According to the Port of Oakland, the steamship lines that utilize the Outer Harbor typically only make calls at Outer Harbor terminals and not at terminals in the Middle or Inner Harbors of the Port.

San Francisco-Oakland Bay Bridge

The San Francisco-Oakland Bay Bridge is the eighth longest bridge in the world (NOAA Fisheries 2002b). As illustrated in Figure 3.4-3, the bridge originates at Rincon Point in San Francisco, crosses Yerba Buena Island, and terminates in Oakland. The bridge has a total of 14 supports, labeled west to east with the phonetic alphabet.[4] Near the Transbay Tube there are six bridge supports, with four bridge spans through which vessels can pass. The Transbay Tube passes under the Delta-Echo bridge span (NOAA Fisheries 2002b).

San Francisco Ferry Building and Vicinity

The San Francisco Ferry Building is located in downtown San Francisco on the far eastern edge of the city on the western edge of the Bay. As shown in Figure 3.4-5, the Ferry Building has three platforms (the North Terminal, Ferry Plaza, and South Terminal) providing six berths. The North Terminal is used by the Tiburon and Vallejo ferries, the Ferry Plaza is used by the Larkspur and Sausalito ferries, and the South Terminal serves ferries going to and from the East Bay/Alameda. Three ferry companies, with various routes, operate from the Ferry Building: Blue and Gold Ferry; Golden Gate Ferry; and Harbor Bay Ferry. Service is provided by two types of vessels: monohulls and catamarans.

3.4.2.2 Proposed Action

3.4.2.2.1 Factors for Evaluating Impacts

The following criteria were used to evaluate impacts to vessel transportation.

Would the project (construction barges, moorings, or other components):

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3 Breakbulk facilities are facilities that handle loose, noncontainerized products. Examples include steel slabs and coils.
4 The phonetic alphabet is used in place of letters in radio transmissions so as to clearly define which letter is being used.

- Violate regulations for a Regulated Navigation Area established by the USCG;
- Interfere with operation of designated traffic lanes or fairways (navigable channels);
- Interfere with passage underneath bridges or other confined air draft areas;
- Substantially increase conflicts between vessels in the Bay; or
- Preclude the use of vessel infrastructure.

3.4.2.2.2 Impacts and Mitigation

Violate Regulations of a Regulated Navigation Area. If the vibro-replacement method is used to retrofit the Transbay Tube, it could violate regulations by anchoring vibro-replacement equipment barges in the Outer Harbor Entrance Channel and San Francisco Bay, outside the anchorage areas designated by the USCG.

Mitigation Measures. Impacts to vessel transportation related to anchoring will be prevented by implementing the following mitigation measure**:**

- Prior to activities that require anchoring vessels in the Bay, BART and/or its contractor shall acquire an Anchorage Waiver Permit. An Anchorage Waiver permit, issued by the USCG, typically requires notifying the Captain of the Port 11th USCG District in writing of expected activities; providing official and ongoing notice to mariners during construction; developing a mooring plan; and marking equipment and any debris for visibility. Compliance with Anchorage Waiver permit requirements would prevent the project from violating regulations for the Oakland Harbor and San Francisco Bay Regulated Navigation Areas.

Interfere with Operation of Designated Vessel Traffic Lanes*.* If the vibro-replacement method is used, vibro-replacement construction barges could interfere with operation of the Outer Harbor Entrance Channel (Figure 3.4-6). As shown in Figure 3.4-6, the presence of construction barges in the Outer Harbor Entrance Channel could prevent access to the Outer Harbor, essentially precluding the use of this area of the Port. The presence of construction barges was identified as an impact by both the USCG and Port of Oakland.

Mitigation Measures. Impacts on vessel operations at the Outer Harbor Entrance Channel will be prevented by implementing either of the following mitigation measures:

- Alter the method by which vibro-replacement is conducted to create a smaller construction arrangement to leave space for vessel passage in the Outer Harbor Entrance Channel where feasible. BART shall consult with the Port of Oakland to determine the amount of space that must be left open for vessel passage.
- In those areas where it is not possible to perform vibro-replacement and leave adequate open space in the Outer Harbor Entrance Channel for vessel passage, BART shall instead utilize micropile anchorage. Micropile anchorage is feasible throughout the Transbay Tube, with the exception of approximately 200 feet underlying a sump pump[5] complex

5 A sump pump is a pump that turns on automatically when water is detected. The sump pump complex in the Transbay Tube is meant to remove any water that should enter the Tube.

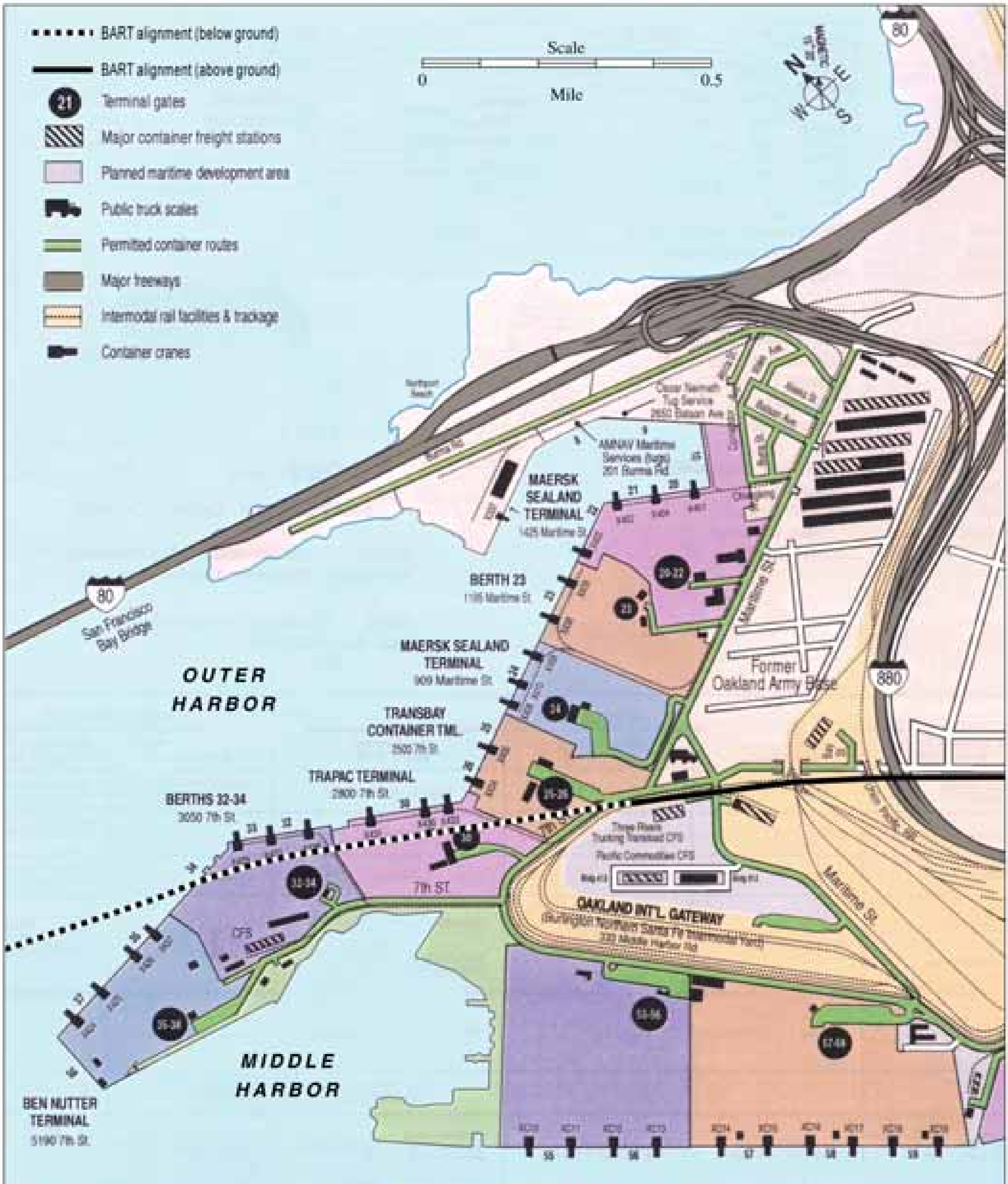

Figure 3.4-4. The Outer Harbor at the Port of Oakland

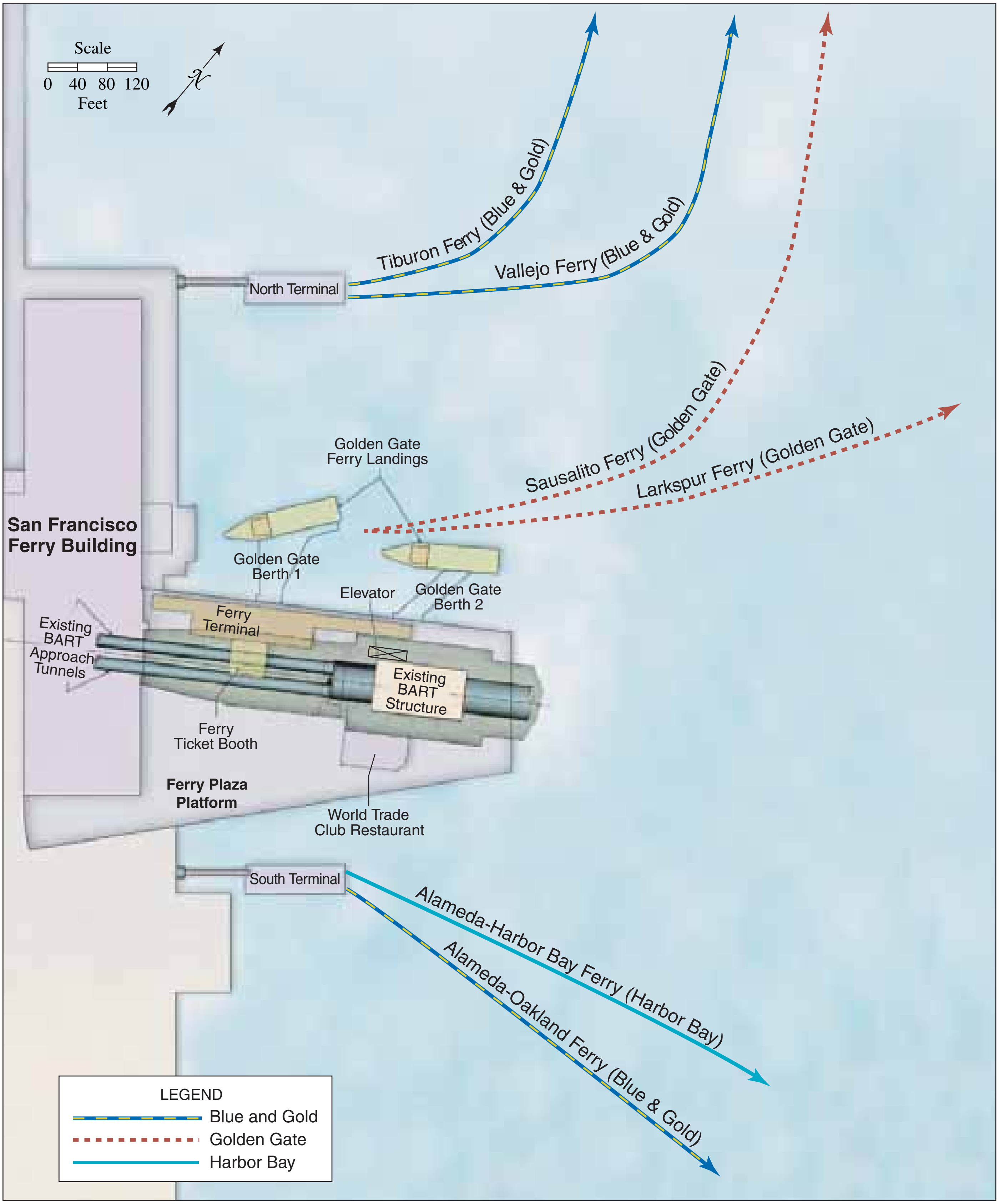

Figure 3.4-5. Ferry Routes Departing the San Francisco Ferry Building

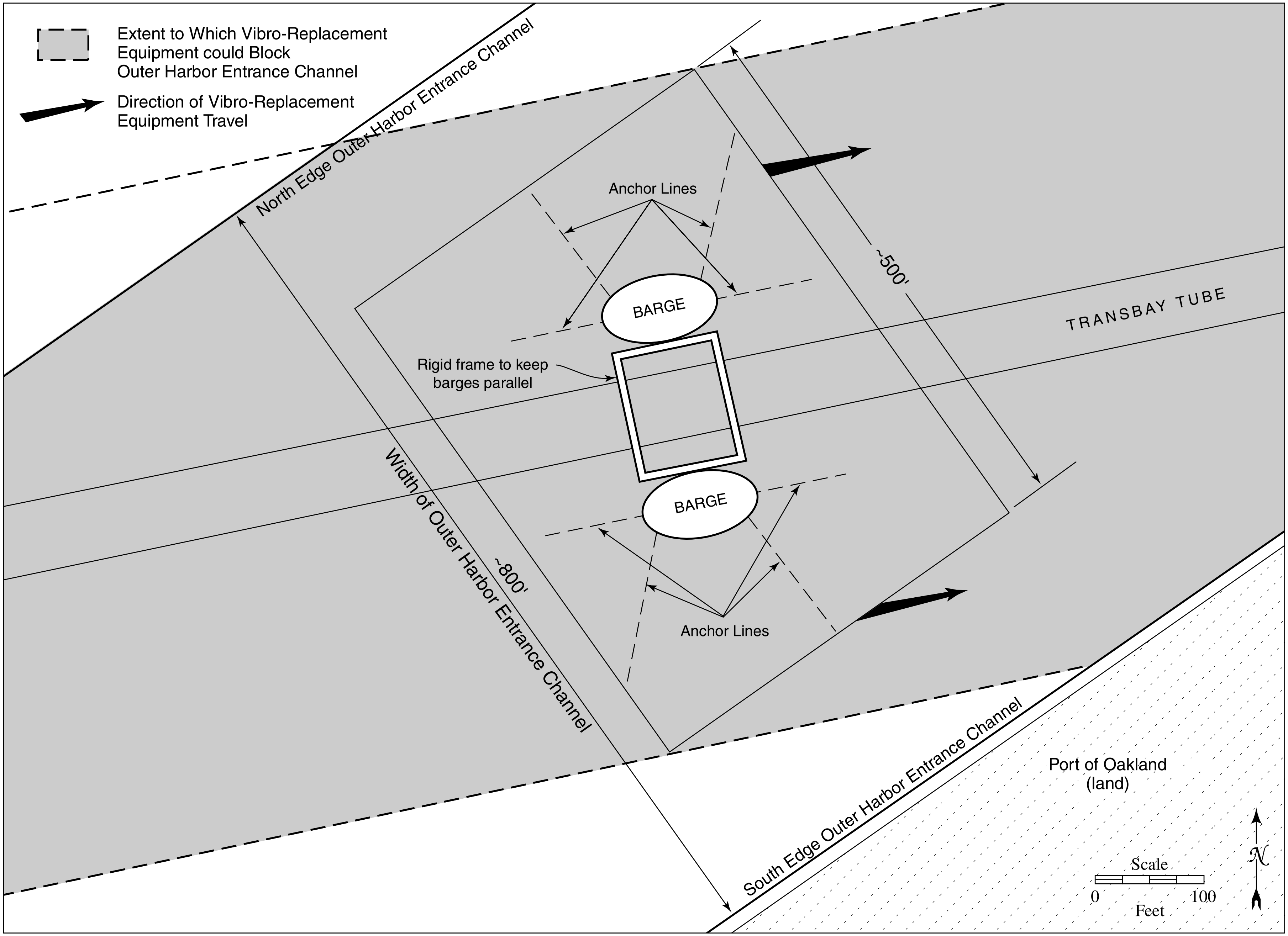

Figure 3.4-6. Extent to Which Vibro-Replacement could Block Outer Harbor Entrance Channel

that is immediately offshore of Berth 34. Micropile anchorage would not require any construction within the waters of the Outer Harbor Entrance Channel.

Under this mitigation measure neither vibro-replacement nor micropile anchorage would be performed on that portion of the Transbay Tube immediately offshore of Berth 34 (approximately 200 feet). As part of the *BART Seismic Vulnerability Study* (BART 2002a), various liquefaction scenarios that could potentially occur at portions of the Transbay Tube were analyzed.

Under the worst-case scenario, uplift forces capable of significantly affecting the Tube did not occur when the liquefaction distance spanned less than 320 continuous feet. Thus, the proposal to forego retrofit of the Tube for 200 feet, a distance less than the minimum 320 feet required to result in uplift, would not subject the Tube to damage during a seismic event. In addition, since each section of the Tube is 330 feet long, a portion of the Tube section in question would still undergo retrofit, further decreasing the potential for damage to the Tube.

Interfere with Passage Underneath the Bay Bridge. As vibro-replacement moves along the Transbay Tube, the construction barges could be present within 1,000 feet of both the Charlie-Delta and Delta-Echo spans (Figure 3.4-3) for 4 to 5 months. Construction is expected to interfere with only one span at any given time, leaving at least three spans west of Yerba Buena Island open for vessel passage. Discussions with the San Francisco Bar Pilots found no particular preference for specific bridge spans. So, while the project would involve construction underneath the Bay Bridge, the project is not expected to disrupt or impact vessel passage underneath the bridge.

Substantially Increase Conflicts between Vessels in the Bay. Construction work in the Outer Harbor Entrance Channel could bring construction barges into close proximity to vessels entering and exiting the Port of Oakland Outer Harbor. Applicable mitigation measures for this impact are described above, under *Interfere with Operation of Designated Vessel Traffic Lanes.* Dredging in the proximity of the San Francisco Ferry Building could also bring construction barges into close proximity to vessels entering and exiting the ferry terminal. This potential impact and applicable mitigation measures are described in section 3.4.2.2.3, below.

Preclude the Use of Vessel Infrastructure at Port of Oakland

Water-based retrofit activities. Vibro-replacement offshore Berth 34 could preclude use of this berth for approximately 1 month, in addition to the impacts to the Outer Harbor Entrance Channel (discussed above).

Land-based retrofit activities. Vibro-replacement activities on land within the Port of Oakland would disrupt approximately 300 feet along the BART right-of-way at any given time. This would mean cargo could not be feasibly moved across a strip of land approximately 300 feet long, between the berth and terminal yard. Because there is approximately 1,700 feet of land fronting Berths 32, 33, and 34, a strip of land approximately 1,400 feet would still be available to move goods from Berths 32, 33, and 34 to the Outer Harbor Terminal. Figure 2-7 illustrates the configuration of Berths 32, 33, 34, the BART right-of-way, potential construction area, container storage areas, the freight station, and terminal gates. Figure 2-7 demonstrates the need to maintain sufficient space to facilitate cargo movement between the berths and yard areas of the terminal. The Port of Oakland estimates that a strip of land or "driveway" of approximately

120 feet is needed to move containers from berths to the terminal area. Thus, while on land, vibro-replacement and stitching would disrupt storage of containers and queuing of trucks along the construction area boundaries; retrofit activities would not eliminate primary berth operations.

Mitigation Measures. Impacts on operations at the Outer Harbor Terminal of the Port of Oakland will be prevented by implementing either of the following mitigation measures:

- Schedule vibro-replacement to occur during a time when no container ships are scheduled to arrive at Berth 34. In 2002, only two ships called on Berth 34. Further, the Outer Harbor Terminal, including its berths (32, 33, and 34), will be undergoing refurbishing and will not be used from 2003 to 2005; retrofit activities during this period would avoid any potential conflicts with ships calling at Berth 34.
- Do not perform vibro-replacement in the area immediately offshore Berth 34 (see also mitigation measures proposed above for the Outer Harbor Entrance Channel). Not performing vibro-replacement at this Berth would allow it to remain operable throughout retrofit activities. As discussed earlier, it is possible to substitute micropile anchorage in place of vibro-replacement along most of the tube, with the exception of 200 feet of the Transbay Tube immediately offshore of Berth 34. However, based on seismic vulnerability studies, it would be possible to forgo retrofit along small segments (less than 300 feet) of the Tube without subjecting the Tube to uplift large enough to damage the Tube during a seismic event.

***Preclude the Use of Vessel Infrastructure at San Francisco Ferry Building**.* Construction work would preclude the use of some of the vessel infrastructure at the Ferry Building. The northern berth of the South Terminal could be closed due to construction for up to 1 year (under Construction Methods 1[6] or 2[7]). Golden Gate Berth 2 would be unavailable for at least 3 months (Construction Method 2) or as much as 1 year (Construction Method 1). This impact would disrupt ferry service for approximately 5,500 daily ferry passengers.

Mitigation Measures. Impacts to vessel transportation at the San Francisco Ferry Building, related to Construction Method 1 and Construction Method 2 will be prevented with implementation of the measures described in Table 3.4-7.

3.4.2.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

DREDGED MATERIAL REUSE WITHIN THE PROJECT

Stitching and associated dredging and dredged material reuse could result in up to nine barges and two tugboats in the vicinity of the Ferry Building. Further, construction barges with dredged

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6 Construction Method 1 proposes using a marine-based construction to retrofit the San Francisco Transition Structure. Under Construction Method 1, a construction barge and supply barge would be stationed on the waterside of the Ferry Plaza platform. Part of the platform that currently supports pedestrian viewing and ferry terminal activities would be temporarily removed in the areas of the new pile array to allow access by the construction barge.

7 Construction Method 2 proposes using a crane placed on top of the existing Ferry Plaza platform to retrofit the San Francisco Transition Structure. Under Construction Method 2, a supply barge would be positioned on the south side of the platform. Compared to Construction Method 1, this would reduce the amount of platform removal necessary during construction and would reduce disruption to nearby ferry operators.

Table 3.4-7. Mitigation Measures to Limit Vessel Transportation Impacts under Construction Methods 1 and 2

Mitigation Measure	*Applicable to Construction Method 1 (Duration)*	*Applicable to Construction Method 2 (Duration)*
Adjust schedules of East Bay ferries (Oakland-Alameda and Alameda-Harbor Bay) to accommodate all East Bay ferries on the southern berth of the South Terminal (Figure 3.4-5). If ferry companies maintain schedules similar to current arrangements, it should be possible to accommodate all East Bay ferries at the southern berth with only minor timetable adjustments (changes in arrival or departures of no more than 15 to 20 minutes). Based on meetings with representatives from Alameda-Harbor Bay Ferry and the Port of San Francisco, this mitigation measure would allow East Bay ferries to accommodate a similar passenger load with the same frequency from the same geographic area with minimal disruption to passengers.	Yes (1 year)	Yes (2 weeks)
Make arrangements for access to the Pacific Bell Park ferry berth or the Pier 27 ferry berth. Either the Pacific Bell Park ferry berth or the Pier 27 ferry berth would be suitable monohull ship berths in the vicinity of the Ferry Building that could be used by East Bay monohull ferries in the event that an East Bay catamaran goes out of service or that could be used for maintenance of Golden Gate monohull ferries (personal communication, N. Dempsey 2003). Either the Pacific Bell Park ferry berth or the Pier 27 ferry berth should be available for the period during which Golden Gate Berth 2 is inoperable. Based on meetings with representatives from Alameda/Harbor Bay Ferry and the Port of San Francisco, this mitigation measure would allow East Bay and Golden Gate ferries to continue operations in the event of unscheduled maintenance.	Yes (1 year)	No
Adjust schedules of Golden Gate ferries so that all monohull vessels can use Golden Gate Berth 1 while Golden Gate Berth 2 would be inoperable. If ferry companies maintain schedules similar to current arrangements, it should be possible to accommodate all Golden Gate monohull ferries and some catamarans at Golden Gate Berth 1 with only minor timetable adjustments (changes in arrival or departures of no more than 15 to 20 minutes).	Yes (1 year)	Yes (3 months)
Build a new float at Pier ½ (Figure 3.4-5) so that it can serve Golden Gate catamaran ferries displaced at Golden Gate Berths 1 and 2 as well as serve as a repair area for any East Bay or Golden Gate catamarans in need of servicing. This mitigation measure, in addition to the mitigation measures described above, would allow Golden Gate ferries to accommodate a similar passenger load with the same frequency from the same geographic area with minimal disruption to passengers. This mitigation measure would also allow any necessary maintenance of East Bay and Golden Gate catamarans.[8]	Yes (1 year)	Yes (3 months)
Alter supply barge operations so that the supply barge would only be present at night or outside the times when the Alameda-Harbor Bay Ferry would be using the South Terminal. This mitigation measure would limit closure of the northern berth of the South Terminal to 1 to 2 weeks.	No	Yes (2 weeks)

8 Subsequent to completion of seismic retrofit activities proposed at the Ferry Plaza Platform, the Port of San Francisco may redesign and permanently relocate the Golden Gate Ferry Slip to a nearby pier (e.g., Pier ½). In the event the Port of San Francisco receives the necessary environmental approvals and funding to complete these actions, BART will coordinate with the Port to avoid duplication of efforts to restore full access to the Golden Gate Ferry berths.

material would move back and forth from the alignment of the Transbay Tube, and from the end of the Ferry Platform Plaza to a dredged material storage area. The construction barges associated with dredging would move in and out of areas regularly and frequently traversed by ferries that berth at the Ferry Building. The movement of large construction barges in the vicinity of the Ferry Building substantially increases the risk of vessel conflicts in the Bay. The following mitigation measure is identified for this impact.

Mitigation Measure. Impacts to vessel transportation related to stitching and dredged material reuse within the project, on the San Francisco Ferry Building and vicinity, will be prevented by implementation of the following mitigation measures:

- Barges associated with stitching shall not be present within 600 feet of the Ferry Terminal berths at the same time as barges associated with dredged material excavation/storage or barges associated with placement of fill or reuse of dredged material.
- Barges associated with dredged material excavation and storage shall not be present within 600 feet of the Ferry Terminal berths at the same time as barges associated with stitching or barges for placement of fill or reuse of dredged material.
- For construction within 600 feet of the Ferry Terminal berths, no more than one barge accepting/storing dredged material shall be present at any time.
- For construction within 600 feet of the Ferry Terminal berths, construction barges moving dredged material shall operate only during those hours when ferries are not in service (before 6:00 A.M. and after 9:30 P.M.). During hours when ferries are in service, construction barges shall remain stationary.
- For dredged material excavation and reuse activities more than 600 feet from Ferry Terminal berths, no more than two barges for accepting/storing dredged material shall be present at any time.

If any dredged material (up to 11,000 cy) is displaced during backfill activities associated with stitching the Tube, it will be disposed offsite at one of the permitted in-Bay or upland reuse/disposal sites, along with the additional 95,900 cy of displaced dredged material associated with retrofits at the San Francisco Transition Structure. Up to 31 barges (each with approximately 3,500 cy of capacity) would be required to transport the total combined 106,900 cy of dredged material; these barges will be required to operate consistent with USCG regulations and guidelines. Movement of these 31 barges would, therefore, have no impacts on vessel transportation.

DREDGED MATERIAL REUSE/DISPOSAL OPTIONS OUTSIDE THE PROJECT

Dredging activities and offsite disposal would result in up to eight barges (one less barge needed for clamshell excavators than under the reuse scenario above) and two tugboats in the vicinity of the Ferry Building, substantially increasing the risk of vessel conflicts in the Bay. This impact and applicable mitigation measures are described above, under dredged material reuse within the project.

Barges moving dredged material from the project site to any of the disposal sites located outside the project area will be required to operate consistent with USCG regulations and guidelines. Sixty-four (64) total barge trips (each barge with a capacity of approximately 3,500 cy) would be needed to dispose of the maximum 222,000 cy of dredged material to an offsite location. Whether spread over the 4 year construction period, or if each 2-day barge trip occurred consecutively (resulting in about 4.5 months of successive barge trips), this minimal amount of activity would not interfere with operation of a vessel traffic lane, substantially increase conflicts between vessels, or preclude the use of vessel infrastructure. The barges will travel in appropriate vessel traffic lanes when disposing of dredged material at any of the potential sites. Although the Alcatraz disposal site is located within a vessel traffic lane, disposal at this site would not be expected to cause interference with the operation of the lane.

3.5 GEOLOGY/SEISMICITY

This section addresses the existing local and regional geologic conditions within the project area and analyzes geologic hazards and general geotechnical issues such as unstable slopes, faults, and seismicity. This assessment relies on published reports and the general geologic setting as indicators of potential geologic hazards. Design-level engineering geology and geotechnical investigation, subsurface exploration, laboratory testing, and analyses are not required by NEPA. Those investigations would be completed before construction of the project.

3.5.1 Existing Setting

3.5.1.1 Regional Geologic Setting

The project is located in the central portion of the Coast Ranges geologic/geomorphic province of central and northern California. The Coast Ranges have a general northwest orientation and are characterized by north-northwest trending folds and faults. This area consists of sedimentary, metamorphic, volcanic, and igneous rocks, ranging in age from Jurassic/ Cretaceous age (100 to 200 million years ago) to the present (Oakeshott 1978).

The San Francisco Bay region is located within a northwesterly oriented geomorphic depression, or broad valley, which is partially filled by San Francisco Bay. This geomorphic feature and the surrounding mountains are approximately 1 million years old (within Quaternary time), which is relatively recent in tectonic origin. Basement complex bedrock beneath the San Francisco Bay Area consists of the Jurassic Franciscan Formation. Cretaceous through Pliocene sedimentary rocks overlie the basement complex. These sedimentary rocks are covered onshore by Pleistocene and Recent alluvium, consisting of lenticular gravel, sand, silt, and clay deposits, as wells as marsh deposits and artificial fill along the perimeter of the Bay. Offshore, beneath the Bay, sediments consist of five formations of late Quaternary age, including the Alameda, San Antonio, Posey, Merritt Sand, and Bay Mud formations. The Bay Mud consists of unconsolidated to moderately consolidated, saturated, organic-rich silty marine clays (Trask and Rolston 1951; CDMG 1969; Blake et al. 1974).

3.5.1.2 Regional Seismicity

The San Francisco Bay Area is one of the more seismically active regions in California. There are at least six active faults within 30 miles of the project area, including the San Andreas, Hayward, Rodgers Creek, Calaveras, Green Valley, and Concord faults (Figure 3.5-1). These active faults trend northwesterly; display a similar right-lateral, primarily horizontal movement; and are responsible for several large historical earthquakes. Segments of these faults have been designated by the California Division of Mines and Geology (CDMG) as Alquist-Priolo Special Studies Zones, which indicate areas of potential surface fault rupture. None of these faults traverse the project area. However, the Alquist-Priolo Special Studies Zone for the Hayward fault, the closest to the project area, lies approximately 500 feet northeast of the northernmost aerial guideway to be seismically retrofitted, with the fault trace approximately 1,100 feet from the guideway (CDMG 1987, 1994).

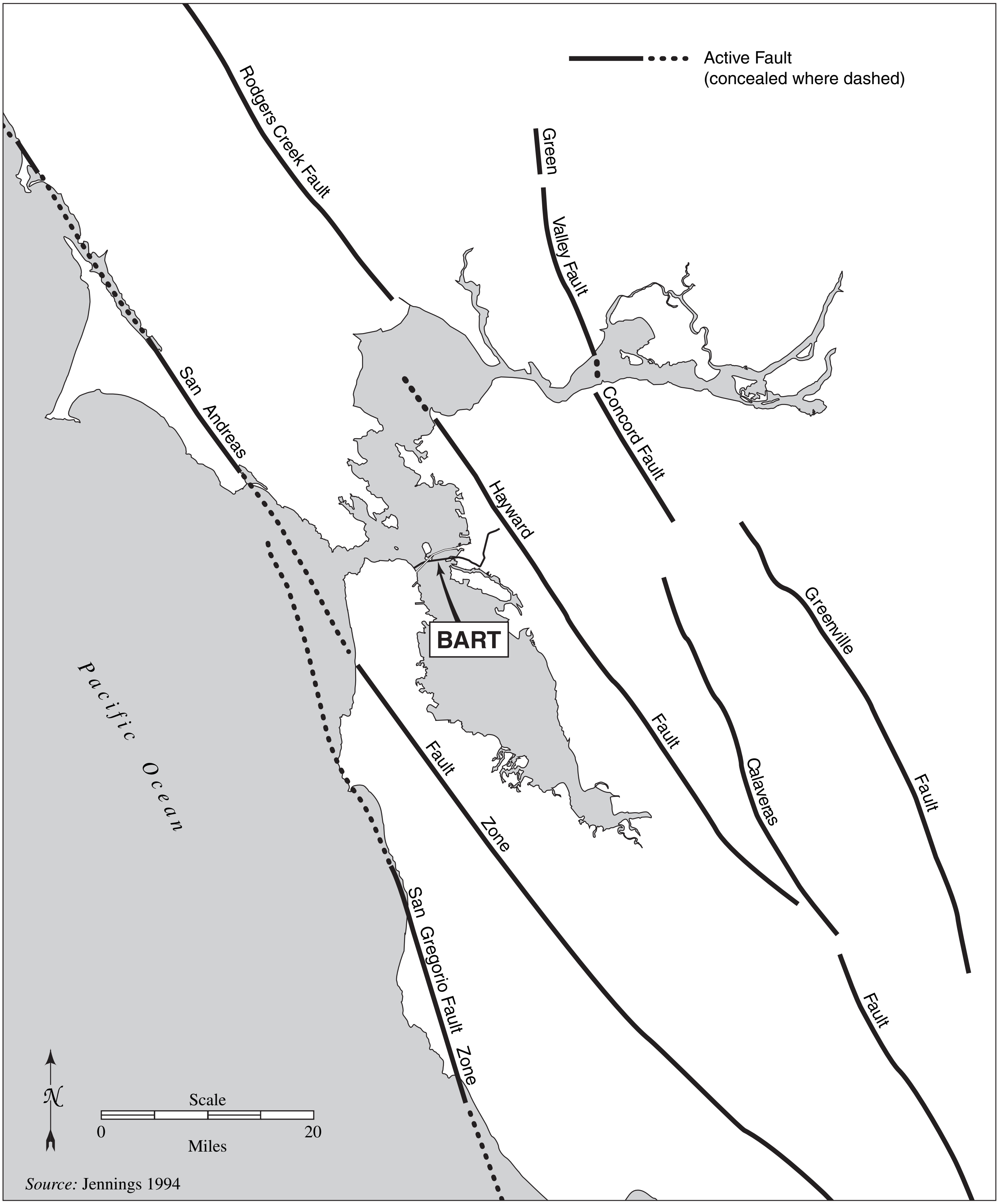

Figure 3.5-1. Principal Active Faults in the San Francisco Bay Area

The San Andreas and Hayward faults have been responsible for the largest earthquakes in the project area. The San Andreas fault, located approximately 8 miles southwest of the Montgomery Street Station at its closest point to the project, was responsible for the magnitude 7.8 San Francisco earthquake in 1906, and the magnitude 7.1 Loma Prieta earthquake in 1989. Similarly, the Hayward fault was responsible for the approximate magnitude 7 Hayward earthquake in 1868 (CDMG 1987; USGS 2003a, 2003b). These earthquakes caused widespread damage throughout the greater San Francisco Bay Area. An earthquake probability report (USGS 2003c) concluded that the Hayward/Rodgers Creek fault system has a 32 percent probability for one or more magnitude 6.7 or greater earthquakes from 2000 to 2030. Similarly, the San Andreas fault has a 21 percent probability for one or more magnitude 6.7 or greater earthquakes on the San Francisco Peninsula portion of the fault, from 2000 to 2030. Overall, the San Francisco Bay Area has a 62 percent probability of a similar size earthquake during this timeframe.

3.5.1.3 Geologic Conditions in the Project Area

Oakland Topography and Stratigraphy

The topography from the Oakland Transition Structure eastward to Martin Luther King Jr. Way is generally flat to gently sloping to the west. The elevation over this 3-mile portion of the BART alignment rises from sea level to approximately 20 feet above mean sea level (msl). From 12th Street northward to the Rockridge Station, the topography is gently sloping to the southwest, rising over 3 miles from approximately 20 feet above msl to 160 feet above msl. From the Rockridge Station northeast to the Berkeley Hills Tunnel, the grade increases from gently to moderately sloping, to the southwest, as the BART right-of-way transitions from the coastal plain to the Berkeley Hills. The elevation gain over this approximate 2-mile portion of the alignment is approximately 120 feet, reaching a maximum elevation of approximately 280 feet above msl.

With the exception of the Oakland Harbor area, undifferentiated Quaternary surficial deposits, including marine deposits, alluvium, and artificial fill, underlie most of the BART alignment through the City of Oakland (Blake et al. 1974; Geomatrix Consultants 2002). The near surface soils along the north Oakland portion of the right-of-way consist primarily of interbedded sandy silts and clay units. Marine and marsh Bay Mud, overlain by artificial fill, primarily underlie the portion of BART alignment located in the harbor area.

The fill material generally consists of sand and clay dredged from tidal flats and offshore areas. Upland soil, construction debris, and other materials of unknown origin may also have been used. Geologic maps indicate that portions of the right-of-way located west of Interstate Highway 880 are located on artificial fill (Helley et al. 1997). Historical maps indicate that the section of the right-of-way located east of the freeway in west Oakland is located within the original shoreline of Oakland (1878 First Ward Map). The Bay Mud generally consists of clay with organic material that is exposed at the surface near the former Bay margin and ranges in thickness from less than 1 foot to about 120 feet beneath the Bay.

San Francisco and San Francisco Bay Topography and Stratigraphy

The topography from the San Francisco Transition Structure to the Montgomery Street Station is generally flat, but slopes gently toward the east-northeast. The elevation gain from sea level, over this 0.75-mile section, is approximately 25 feet above msl. Artificial fill deposits of varying composition underlie this short segment of BART. The fill in this area typically consists of clay, silt, sand, rock fragments, organic material, and/or manmade debris (Blake et al. 1974). This fill material is generally subject to liquefaction and was responsible for extensive damage in the 1989 Loma Prieta earthquake (USGS 2003d). Liquefaction is a form of seismically induced ground failure, in which saturated loose sandy sediments lose strength and change from a solid state to a liquid state.

Fine-grained Bay Mud surrounds the Transbay Tube. The Bay Mud is separated into two units, Younger Bay Mud and Older Bay Mud. The Transbay Tube was constructed within the Young Bay Mud, which is primarily a soft silty clay, has a high percentage of water, is pliable and weak, and is highly compressible. These deposits have caused the most engineering difficulties during construction of the Transbay Tube and other structures along the margin of the Bay. The strength of the Young Bay Mud increases with depth as a result of the pressure from above. The Young Bay Mud deposits are generally 60 to 130 feet thick in the vicinity of the Transbay Tube (CDMG 1969; BCDC 1967; Trask and Rolston 1951).

Old Bay Mud deposits are present beneath the Young Bay Mud. A sand layer sometimes separates the two units. The Old Bay Mud is more consolidated than the Young Bay Mud, due to the increased overburden pressure and reduction in moisture. These dense sands and stiff clays provide a good foundation for piles and similar structures (BCDC 1967).

Borings drilled for the San Francisco Ferry Terminal Project (Treadwell & Rollo 1995) encountered 90 to 120 feet of soft to medium-stiff clay of the Young Bay Mud. A 15- to 25-foot-thick layer of dense to very dense sand to clayey sand underlies these Young Bay Mud deposits. Stiff clay of the Old Bay Mud is present beneath the sand to a depth of approximately 190 feet.

3.5.2 Proposed Action

3.5.2.1 Factors for Evaluating Impacts

Geologic impacts would be considered substantial if the project:

- Is located on strata or soil that is unstable, or would become unstable as a result of the project.
- Exposed people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismically induced fault rupture, strong ground shaking, or ground failure, including liquefaction, lateral spreading, differential settlement, or subsidence.

3.5.2.2 Impacts and Mitigation

Transbay Tube and San Francisco Transition Structure

Topography and Stratigraphy. Project construction within Bay sediments would result in localized changes in bottom topography. Activities associated with the vibro-replacement alternative for retrofit of the Transbay Tube would not disturb bottom sediments; however, compaction of the subsurface sediments is expected to cause a permanent yet localized drop of approximately 1 foot in the bottom elevation of the Bay.

Tidal surges in and out of the Bay create currents along the bottom, which in turn causes scour and erosion to occur in areas of high velocity currents, and deposition to occur in areas of slower currents. Changes to the bathymetry (i.e., bottom topography of the Bay) of approximately 1 foot would result in temporary disruption of these underwater depositional processes and associated suspended sediments. However, depositional equilibrium would be reestablished within a short period, resulting in settling of suspended sediments. Because no regional, long-term depositional disruptions would occur, impacts associated with vibro-replacement of the Tube would be negligible.

Dredging would be required for stitching at the San Francisco end of the Tube and either of the two alternative retrofit options for the San Francisco Transition Structure; the total area of Bay bottom disturbance from these combined retrofit techniques would be up to 8 acres. Although the bathymetry would be modified, the proposed area of dredging is located in an industrial, predominantly disturbed area, where previous dredging has occurred. Dredging would temporarily disrupt bottom sediments; however, similar to prior dredging episodes in this area, depositional equilibrium would be reestablished within a short period. As no regional, long-term depositional disruptions would occur as a result of dredging in this area, impacts would be negligible.

However, dredging would potentially result in unstable geologic conditions within the Bay Mud deposits which, as noted above, are highly compressible. Temporary 40 foot deep excavations over an area up to 200-feet by 100-feet could result in potential slope failure if constructed too steeply. However, temporary slopes created for stitching the Tube near the San Francisco Transition Structure will be constructed with shallow slopes and will be completed in accordance with recommendations by a licensed geotechnical engineer. Therefore, impacts associated with slope failure are not anticipated. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

Seismicity. Although the BART system fared well during the magnitude 7.1 Loma Prieta earthquake in 1989, more severe ground shaking could occur as a result of a larger earthquake and/or an earthquake centered closer to the project area. The project involves seismic retrofit of the BART system, consistent with recommended mitigation measures in CDMG Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (CDMG 1997). As a result, the rail system would become substantially stronger, resulting in protection of life safety[1] and the massive public capital investment represented by the permanent facilities of the BART system. In addition, seismic retrofit would prevent prolonged interruption of BART service to the public in the event of a major earthquake. This would be a beneficial impact.

Oakland Transition Structure, Stations, and Aerial Guideways

Topography and Stratigraphy. Stitching excavations would be required for installation of each stitching piling group on the Oakland end of the Tube. Other excavations would be completed for enlarged footings/foundations for stations and aerial guideways. As these excavations would be temporary, no permanent changes in topography would occur from the project. However, as described for the San Francisco Transition Structure, stitching excavations would potentially result in unstable geologic conditions, including potential slope failure if constructed too steeply. However, temporary slopes created for stitching the Tube near the Oakland Transition Structure will be constructed with shallow slopes and will be completed in accordance with recommendations by a licensed geotechnical engineer. Therefore, impacts associated with slope failure are not anticipated. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

Seismicity. The project would have a beneficial impact as described above for the Transbay Tube and San Francisco Transition Structure.

3.5.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

No geologic/seismic impacts would occur from dredged material reuse or disposal.

1 For the purposes of the seismic retrofit project, life safety is the level of retrofit that will provide a low risk of endangerment to human life for any event likely to affect the retrofitted structure. In general, non-collapse of a structure is considered adequate to provide life safety.

3.6 HAZARDOUS MATERIALS

Hazardous materials present in subsurface soils or groundwater that are disturbed during the proposed seismic retrofit activities have the potential to impact workers, public health and safety, or the environment. Depending on the nature and extent of contamination that may be present, excavated soil and/or groundwater produced from dewatering operations may be subject to a variety of regulatory requirements or other specific management procedures. This section evaluates issues related to potential contaminated soil and groundwater in the vicinity of project components.

3.6.1 Existing Setting

3.6.1.1 Phase I and Phase II Reports

A Phase I Environmental Review (Geomatrix Consultants 2001, hereafter referred to as the Phase I report) and a Phase II Field Investigation Report (Geomatrix Consultants 2002; hereafter referred to as the Phase II report) were conducted to assess potential environmental issues that could be encountered during onshore construction activities associated with seismic upgrade of the aerial guideways and stations. Issues related to potentially contaminated dredged material are addressed in section 3.1 (Water Resources) and section 3.9 (Biological Resources).

The Phase I report identified land uses adjacent to the alignment that had the potential to adversely affect soil or groundwater under the alignment. The report included an Environmental Data Resources, Inc. (EDR) regulatory database search of the seven state and federal lists that document known locations of hazard substance releases, including "Calsites" (DTSC/California Environmental Protection Agency [Cal-EPA]); the Cortese List (Office of Planning and Research); Leaking Underground Storage Tanks (LUST) (RWQCB); Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) (USEPA Superfund sites); National Priority List (USEPA Priority Superfund sites); Annual Work Plan (Cal-EPA); and Spills, Leaks, Investigations, and Clean-ups (Surface spills only; non-LUST sites) (RWQCB). As part of the Phase I report, these databases were searched for sites located within a 1-mile radius of the proposed seismic retrofit sites.

The Phase II report consisted of soil and groundwater samples collected in areas identified in the Phase I report as potential areas of concern. The report summarized the analytical results of 29 soil boring samples and 15 groundwater grab samples collected in the project area. Analytical results were used to evaluate the potential risk to those with possible direct contact (i.e., construction workers) and to assess the options and procedures for soil management.

Summary of Conditions

Based on the EDR regulatory database search documented in the Phase I report, more than 540 hazardous materials/waste sites are located within 0.5 mile of the BART alignment between the east portal of the Transbay Tube and the west portal of the Berkeley Hills Tunnel. A screening process was developed to prioritize the sites with respect to potential impairment of soil and groundwater in the vicinity of the project. Table 3.6-1 summarizes the findings based on the regulatory database and historic uses of the alignment and adjacent properties.

Table 3.6-1. Location of Potential Chemical Releases

*Location**	*Chemicals that May Have Been Released in Soil*	*Chemicals that May Have Been Released in Groundwater*
Aerial Structures 1-15	No impacts to shallow soil are anticipated	Petroleum hydrocarbons
Aerial Structures 16-19	Petroleum hydrocarbons, PAHs, solvents, and metals (including aerially-deposited lead)	Petroleum hydrocarbons
Aerial Structures 20-28	Petroleum hydrocarbons, PAHs, and PCBs	Petroleum hydrocarbons and solvents
Aerial Structures 29-37	PCBs, PAHs, solvents, and metals	Petroleum hydrocarbons and chlorinated solvents
* See Figure 2-18 for the location of these aerial structures.		

Based on the results of the Phase I report, borings were drilled in areas suspected of subsurface contamination. Based on the analytical results of samples collected for the Phase II investigation, detectable concentrations of volatile organic compounds (VOCs), total petroleum hydrocarbons (diesel) (TPHd), polycyclic aromatic hydrocarbons (PAHs), and metals listed as hazardous under California Code of Regulations (CCR) Title 22 are present in soil and groundwater in the vicinity of the project. However, with one exception, all soil samples contained concentrations of these compounds less than construction worker risk-based screening levels (RBSLs). Benzo(a)pyrene, which is typically used as an indicator of PAHs, was detected in a soil sample collected at a depth of 2.5 feet, at a concentration in excess of the RBSL, near aerial structure number 25, located along 5th Street, between Adeline and Chestnut Streets (see Figure 2-18).

VOCs detected in groundwater were within both drinking water standards and the discharge limits for disposal into the storm drain, in accordance with RWQCB-mandated National Pollutant Discharge Elimination System (NPDES) permit requirements. There is no specific drinking water standard or discharge limit for TPHd. However, the TPHd concentrations are less than the discharge limit for oil and grease, which is similar to TPHd.

Lead in soil was not detected at concentrations that exceeded RBSLs for construction workers. However, lead concentrations were detected within the upper 5 feet of soil, in 8 of 19 borings drilled along the east-west trending portion of the right-of-way in west Oakland, at concentrations that warrant further sampling and analysis to determine the appropriate disposal option. These elevated lead concentrations were detected in the vicinity of aerial guideway numbers 23, 25-28, 31, and 36 (see Figure 2-18).

3.6.2 Proposed Action

3.6.2.1 Factors for Evaluating Impacts

Soil and groundwater contamination impacts would be considered substantial if the project:

- Creates a significant hazard to the public or the environment through the release of petroleum products or hazardous substances into the environment; or
- Is located on or near a property that is on a list as having hazardous substances compiled by government agencies which, as a result, could create a substantial hazard to the public or the environment.

3.6.2.2 Impacts and Mitigation

Stitching on the Oakland side of the Tube would involve soil excavation to a depth of 20 to 60 feet below the existing ground surface. No dewatering of the excavation site would be required (BART 2002a). At all but the West Oakland Aerial Guideway and West Oakland Station, groundwater elevations are below proposed excavation depths. Thus, retrofit activities would not generate any dewatering wastes at most of the construction sites. Groundwater may be encountered in the vicinity of the West Oakland Aerial Guideway and West Oakland Station. In this case, a waste discharge requirement from the RWQCB would be required for discharging the dewatering effluent to the stormdrain (see Appendix C, section C.6). The effluent would be tested in accordance with NPDES permit requirements and either disposed into the storm drain, if determined to be within permit discharge limits, or disposed off-site at a designated disposal facility. Alternatively, clean dewatered groundwater (per RWQCB discharge requirements) could be used for onsite dust suppression. See section 3.1 (Water Resources) for additional information regarding groundwater conditions.

Based on the sampling results from the Phase II investigation (Geomatrix Consultants 2002), direct exposure to onsite construction workers with unacceptable risk (i.e., in excess of RBSLs) is unlikely at all locations sampled, with one exception. Analytical results from samples collected in the vicinity of aerial structure number 25 (see Figure 2-18) indicate levels of PAHs that exceed construction worker RBSLs and/or typical background concentrations.

In addition, during excavations or drilling for foundation work in all other areas (i.e., the Oakland Transition Structure, all stations, and all aerial structures), the construction team may encounter unexpected petroleum waste or hazardous waste in soil and/or groundwater. However, implementation of a Health and Safety Plan, for each retrofit location, and a Soils Management Plan will ensure the proper handling and disposal of contaminated soils during excavation activities. Because construction contractors will follow the prevention procedures stipulated in these plans, impacts associated with exposure of onsite workers to contaminants are not anticipated. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

Although lead concentrations in soil were below RBSLs, lead was detected within the upper 5 feet of soil at several locations at concentrations that warrant further sampling and analysis to determine proper disposal options. In addition, previously undetected contaminated soil may be encountered in other areas during project excavations. Potential generation of excavation spoil piles with elevated lead or other contaminant concentrations could increase onsite construction workers' exposure to contaminated soils if disposed in an inappropriate manner, including reuse as clean fill or disposal at facilities not equipped to safely handle hazardous wastes. The following mitigation measure is identified for this impact.

Mitigation Measures. The following measure will ensure proper handling and disposal of hazardous materials.

- Excavated soil in the vicinity of aerial guideway numbers 23, 25-28, 31, and 36 shall be analyzed for lead and other contaminants prior to disposal or reuse as fill at other locations. If lead or other contaminants are found at levels that require the soil to be characterized as hazardous waste, the soil must be disposed at a permitted hazardous waste facility.

3.6.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

No hazardous materials impacts would occur from dredged material reuse or disposal. Furthermore, although the dredged material may be tested unsuitable for aquatic disposal, it would not be expected to qualify as hazardous material.

3.7 RISK OF UPSET/SAFETY

This section evaluates safety issues during project construction, as well as the potential for construction to increase risks during upset events (such as earthquakes and other emergencies). Construction activities can increase risk to workers, passengers, and those in the community that are in the immediate area. Due to the nature of the BART system, many of the retrofit locations are in areas that support heavy pedestrian and vehicular traffic. The use of heavy equipment, construction activity at ground level and above, as well as the movement of construction structures (such as barriers, scaffolding, fencing) all pose an increased risk to the general public. BART has developed plans and procedures in compliance with occupational health and safety requirements that would mitigate the risk at each of the retrofit locations, including specific plans for unique situations.

3.7.1 Existing Setting

3.7.1.1 System Safety

The *System Safety Program Plan* defines BART's technical and managerial safety activities (BART 2002n). The System Safety Department's organization, methods, procedures, documentation, and its relationship with regulatory agencies and other BART departments are prescribed in the *System Safety Program Plan*. Also, the shared safety-related responsibilities of BART's operations, maintenance, and engineering departments are defined in the *System Safety Program Plan* (BART 2002n). The *System Safety Program Plan* complies with the requirements of the California Public Utilities Commission General Order No. 164, *Rules and Regulations Governing State Safety Oversight of Rail Fixed Guideway Systems.*

BART Emergency Plan

BART maintains an *Emergency Plan,* last updated in November 2002, to provide guidance for mobilizing BART and other public safety resources to respond to various types of emergencies that may occur within the BART system (BART 2002c). The plan outlines procedures for all BART personnel who could respond in the event of an emergency, such as management, train operators, system operators, police, and power and electrical personnel. The plan also provides guidance for organizations that may be asked to assist, depending on the nature of the emergency, such as local fire and police agencies. To support the implementation of the *Emergency Plan*, BART staffs an Emergency Operations Center and has a designated Emergency Service Coordinator.

The plan is tailored for emergencies that could occur within different parts of the BART system. For example, procedures for emergencies in the Transbay Tube are different than procedures for emergencies at aerial stations.

The *Emergency Plan* indicates that there are crucial systems used to respond to all emergencies. These include:

- Communications equipment used to interconnect stations, trains, the operations control center, and BART police;

- Communications equipment used to inform passengers about potential or existing emergencies and the proper response to such emergencies;
- Ventilation and ventilation control systems;
- Equipment to control power to the trains (e.g., the Third Rail);
- Fire fighting equipment; and
- Devices and structures that limit access to BART right-of-way, tracks, and tunnels.

System Security

BART has taken steps to heighten awareness of potential terrorist attacks that could potentially occur along the entire system. Although details of most security procedures are confidential, BART has implemented the following types of security procedures to increase security: new or enhanced threat assessment tools and hardware, such as closed circuit television; enhanced access control; training and drills for personnel; inspections and police patrols; and, intensified security awareness campaigns directed at both personnel and riders. BART employees have been provided with training to encourage a greater awareness of their surroundings and to report suspicious behavior or activities. To help heighten rider awareness of their surroundings, BART has increased communications with customers regarding system security through the use of passenger bulletins, advertisements, newsletters, and reports by local media.

3.7.1.2 Existing Emergency Services

BART Police

BART police are an autonomous law enforcement agency, staffed by 284 persons, of which 204 are sworn peace officers. BART police provide a full range of law enforcement services, and include a bicycle patrol, canine unit, and a Special Problems and Rescue team. BART police officers have the same powers of arrest as city police officers and county sheriff deputies. BART officers may take enforcement action on or off of BART jurisdiction, anywhere within the State of California if there is immediate danger to persons or property. BART police facilities are located in Concord, Walnut Creek, El Cerrito, Oakland, San Leandro, Hayward, Castro Valley, Dublin/Pleasanton, San Francisco, Daly City, Colma, San Bruno, and the San Francisco International Airport BART station (BART 2004b).

Oakland Fire and Police

The 46 fire stations of the Oakland Fire Department provide firefighting and rescue services within the City of Oakland (City of Oakland 2004). The department consists of approximately 500 firefighting and emergency medical personnel, 26 engine companies, 7 truck companies, and other specialized units for aircraft rescue, urban search and rescue, hazardous materials, and wildfires (personal communication, J. Williams 2003). Rescue and emergency services are further enhanced by the 735 police officers of the City of Oakland (personal communication, R. Stewart 2003).

San Francisco Fire and Police

The 48 fire stations of the San Francisco Fire Department provide firefighting and rescue services to the 47.5 square miles of the City of San Francisco. The department consists of approximately 1,700 firefighting and emergency medical field personnel, 42 engine companies, 18 truck companies, 18 ambulances, two rescue squads, and two fireboats. Other specialized units include cliff rescue, hazardous materials, and wildland fires (City and County of San Francisco 2003a). Rescue and emergency services are further enhanced by the 2,000 police officers of the City of San Francisco (City and County of San Francisco 2003b).

3.7.2 Proposed Action

3.7.2.1 Factors for Evaluating Impacts

The following criteria were used to evaluate potential impacts to worker safety, public safety, and consistency with emergency plans and policies during project construction. Substantial adverse impacts would occur if the project would:

- Violate applicable construction codes/health and safety standards;
- Introduce members of the public into areas of active construction;
- Disable or substantially impair emergency response equipment (such as communications, ventilation, and fire fighting);
- Substantially impair implementation of existing emergency procedures (e.g., make a station unsuitable as an evacuation point, make it difficult to transport rescue crews or equipment);
- Substantially increase demand on fire and police services beyond existing capacity; or
- Make the BART tracks or right-of-way less secure.

3.7.2.2 Impacts and Mitigation

Construction activities are planned for many locations that are adjacent to public roads, sidewalks, BART stations, BART tracks, public areas, and railroad tracks. As such, workers, BART riders, and the public may be affected by construction activities to varying degrees.

Violate Applicable Construction Codes/Health and Safety Standards

Prior to commencement of construction, contractors will be required to prepare a Health and Safety Plan, for each retrofit location, which will ensure all contractors follow applicable public safety standards (see Appendix C, section C.7 for safety standards). In addition, specifically for work on the Transbay Tube, Site Specific Work Plans will be prepared that include emergency procedures and specific measures to prevent compromising the integrity of the Tube. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

In those locations where it would be necessary to relocate utilities, this would be done consistent with both BART's construction procedures and the utility owner's construction standards. Worker safety would be enhanced through BART coordination with the affected utility agencies. In addition, Caltrans prescribes procedures, standards, and practices for utility relocation required for construction of transportation projects.

In one location, retrofit would require construction close to an existing rail line. The Union Pacific Railroad has construction safety requirements for work adjacent to their tracks. These requirements would also be incorporated into BART construction contracts.

In many locations, construction activities would encroach into existing traffic lanes or parking areas. This may result in the relocation of parking, narrowing or closing lanes, forcing two-way traffic to share a lane, or detouring traffic. BART would require in contract specifications that each contractor follow Caltrans traffic handling procedures (as detailed in the *Manual of Traffic Controls for Construction and Maintenance Work Zones,* 1996), including safety measures such as the use of K-rails, signage and flagmen.

Given BART's standard construction procedures and health and safety requirements, no impacts to worker safety are anticipated.

Introduce Members of the Public into Areas of Active Construction

BART intends to close, reroute, or shield any pedestrian walkways, traffic lanes, parking areas, and piers potentially exposed to project construction, as needed. In those situations where construction requires the closure or narrowing of traffic lanes, BART will require contractors to develop construction traffic management plans consistent with Caltrans standards and professional practice, including detours, construction signage, and flagmen (for greater detail see section 3.4 [Transportation]).

At the San Francisco Ferry Building, large construction equipment would be close to the Transbay Tube and transition structure, and it would be necessary to remove large portions of the Ferry Plaza platform. Construction would require the closure of two ferry berths, and ferries and ferry riders would be detoured to areas outside the active construction area (for more details see section 3.4). To maintain access to the World Trade Club, temporary construction walkways along the upper deck of the restaurant (the deck above the Ferry Plaza platform) are proposed. Use of this elevated walkway could expose the public to additional risk, which is a safety impact.

BART intends to maintain normal service during retrofit of the Transbay Tube. While patrons and BART personnel would not have direct contact with these activities, the Transbay Tube would be undergoing active construction. Procedures for stitching, micropile anchorage, and vibro-replacement have yet to be fully developed. These activities would increase the risk of water leaking into the Tube; the risk of other construction activities causing water leakage into the Transbay Tube is uncertain. However, implementation of Site Specific Work Plans that include emergency procedures and specific measures to prevent compromising the integrity of the Tube and the presence of equipment and personnel necessary to perform emergency repairs on the Transbay Tube will ensure adherence to applicable public safety regulations (see Appendix C, section C.7). For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

Mitigation Measures. The following measures will further ensure public safety during construction activities on or in the vicinity of the Transbay Tube.

- Any temporary walkways used to access the World Trade Club shall be inspected for consistency with the California Building Code (CCR Title 24, Part 2). Any temporary walkways shall be screened from construction dust and debris. Screening shall also prevent any pedestrians from accessing any part of the construction area.[1]
- For those types of construction work that have never been performed on the Transbay Tube, activities which could harm the integrity of the Transbay Tube, such as placement of vibro-replacement probes and barge anchors, and micropile anchorage, shall be tested, and, if necessary, refined, during hours when BART trains are not in service.
- BART shall shutdown train service through the Transbay Tube if the integrity of the Tube is deemed to be in jeopardy by members of BART's System Safety Department or Emergency Operations Center, BART Police, Oakland Fire and Police Department, San Francisco Fire and Police Department, or the construction supervisor for retrofit work on the Transbay Tube. Other portions of the BART system could remain in operation even with shutdown of the Transbay Tube.

Disable or Substantially Impair Emergency Response Equipment

Construction activities have the potential to impair the use of communications equipment used to interconnect stations, trains, the operations control center, and BART police; communications equipment used to inform passengers about potential or existing emergencies and the proper response to such emergencies; ventilation and ventilation control systems; equipment to control power to the trains (e.g., the Third Rail); and fire fighting equipment. However, BART contract specifications will require provisions for maintenance of communication and ventilation control systems and/or provisions for back-up systems during all retrofit activities. Because construction contractors will be required to follow the emergency response equipment procedures stipulated in their contracts, impacts associated with impairment of emergency response systems are not anticipated. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

Substantially Impair Implementation of Existing Emergency Procedures

BART's *Emergency Plan* (BART 2002c) has defined procedures for evacuation of BART trains in the Transbay Tube and on aerial structures during regular operations. During construction, some of the stations and track areas may not be appropriate for emergency evacuation and some rescue equipment may not be able to access parts of the system due to the presence of construction equipment and vehicles. However, implementation of Site Specific Work Plans or adherence to operational changes issued by the System Safety Department, delineating emergency procedures for evacuation of BART trains, coordination with the City of Oakland and San Francisco Fire Departments, and providing notification to the Operations Control

1 Subsequent to completion of seismic retrofit activities proposed at the Ferry Plaza Platform, the Port of San Francisco may redesign the World Trade Club entrance within its current location. In the event the Port of San Francisco receives the necessary environmental approvals and funding to complete this action, BART will coordinate with the Port to avoid duplication of efforts to restore full access to the World Trade Club.

Center regarding major construction activities will ensure adherence to applicable public safety regulations (see Appendix C, section C.7). For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

Mitigation Measures. The following measure will further ensure public safety during retrofit activities.

- Appropriate signage illustrating evacuation procedures for any stations/areas under construction shall be developed, provided during preparation of the construction contract documents, and put in place for the public before construction begins.

Make the BART Tracks or Right-of-Way Less Secure

Retrofit activities would introduce new construction equipment and persons into the BART system and into the BART right-of-way. Construction activities and storage of construction equipment and supplies may require the removal of barriers to the BART right-of-way. With removal of these barriers, the BART right-of-way would be at greater risk for vandalism, terrorism, and trespassing. Because all contractors will be required to follow specific procedures for maintaining the security of the BART right-of-way and the provisions of BART's System Safety Plan and Emergency Response Plan stipulated in their contracts, impacts related to security of the BART right-of-way are not anticipated. BART will also perform background checks and provide badges to all contractors. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

3.7.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

No safety-related impacts would occur as a result of dredged material reuse or disposal. Furthermore, although the dredged material may be rendered unsuitable for aquatic disposal, it would not be expected to qualify as hazardous material.

3.8 VISUAL RESOURCES

A Visual Resources Technical Study (BART et al. 2005b) was prepared to analyze project impacts on visual character, visual quality, and the viewing audience, and the potential for project-related light and glare. The project area analyzed consists of all BART facilities located along approximately 12.3 miles of track, of which 2.5 miles are located at-grade (surface level), 3.3 miles on aerial structures supported by columns, and 6.5 miles underground or underwater (the Transbay Tube is underwater for 3.6 miles). The technical study describes the visual environment in detail and includes photographs showing project construction sites and surroundings; this section summarizes the conclusions of the technical study.

3.8.1 Existing Setting

A description of the visual environment is provided below for the project worksites (from east to west) in Oakland (section 3.8.1.1) and San Francisco (section 3.8.1.2) in terms of visual character, visual qualities, and viewing audience. The project setting is also characterized with regard to light and glare (section 3.8.1.3).

Visual character is defined as the forms, lines, colors, and textures of a project setting. *Visual quality* is defined in terms of three variables, or evaluative criteria, including vividness (visual power of landscape components), intactness (integrity of the natural or built environment), and unity (compatibility of landscape elements). The *viewing audience* is defined as the major viewer groups experiencing a visual resource or landscape. Visual character and quality are also summarized in Table 3.8-1, located at the end of section 3.8.1.2.

3.8.1.1 Existing Visual Resources — Oakland

Rockridge Station

Visual Character. The Rockridge Station is an entirely aerial station within the median of State Route 24; it spans College Avenue and straddles a drop-off area and two parking lots.

Views from the aerial platform to the north encompass residences, trees, and the Oakland-Berkeley Hills. Views to the south, along College Avenue, are predominantly of commercial uses. Views to the east are of the Oakland-Berkeley Hills, with mature trees and some buildings in the foreground. Views to the west look toward downtown Oakland and the hills.

The Rockridge Station is the site of the Firestorm Community Mural, a work of art composed of more than 2,000 handmade ceramic tiles created by community members, former President Bill Clinton, and local lawmakers, to commemorate the Oakland Hills Fire of 1991. The mural and plaque are shown in Figure 3.8-1.

Visual Quality. The visual quality of the Rockridge Station's setting ranges from moderate to high. The setting is a well-maintained suburban neighborhood with some memorable visual features, such as the Firestorm Community Mural and commemorative plaque. Views from the above-grade station platform encompass the Oakland-Berkeley Hills to the east. Intactness is low, however, as the freeway, BART tracks, and BART station physically and visually divide the neighborhood. Despite the relatively uniform surroundings and presence of some landscaping, the station is isolated and distinct from its surroundings, so the visual unity of the setting is low.

Viewing Audience. Because of the station's location near the Rockridge neighborhood's commercial center, the high level of associated pedestrian activity, periodic use of the station for community group gatherings and events, and the presence of the mural, this station is a widely recognized, visible presence in the neighborhood.

MacArthur Station

Visual Character. The MacArthur BART Station is an at-grade station, bordered by the station parking lot immediately to the east and neighborhood commercial uses and residential uses to the west. The station is the site of two wall paintings mounted on interior walls (north wall and south wall), as shown in the photographs in Figure 3.8-2. Views from the vicinity of the station are confined by the overpass and columns, but include surrounding residential and commercial land uses. Views to the east and west are dominated by the freeway in the foreground, with treetops, commercial building and residential rooftops in the middleground, and the distant Oakland-Berkeley Hills ridgeline. Views to the north and south are dominated by the BART tracks and freeway. To the north, the ridgeline of the Oakland-Berkeley Hills is visible. To the south, only the rooftops of the tallest buildings in downtown Oakland are visible.

Visual Quality. The overall visual quality of MacArthur Station ranges from low degrees of intactness and unity to highly vivid in its features. The station is located in an urban, mixed-use neighborhood that is not itself visually vivid. However, the station contains two wall paintings and a public plaza housing four sculptures; these are considered highly vivid. The station's setting, however, is typically urban with a mix of uses, and the BART tracks, station, and parking lot are isolated from this setting. For these reasons, intactness and unity are considered low.

Viewing Audience. The viewing audience includes patrons of the BART station, motorists along nearby roadways, pedestrians, patrons of adjacent businesses, and residents living close to the station.

West Oakland Station

Visual Character. The West Oakland Station is an aerial station (i.e., ground-level ticket offices and gates with an aerial platform), surrounded by a parking lot. Views from the elevated West Oakland platform encompass, in the foreground and middleground, the upper stories and rooftops of commercial and residential uses to the east and BART's West Oakland parking lot and light industrial uses to the west. Distant, panoramic views toward the Port of Oakland and San Francisco Bay are available to the west. The skyline of the Oakland-Berkeley Hills is visible in the distance to the north and east.

Visual Quality. Visual quality of the surroundings of the West Oakland Station ranges from low to moderate. The West Oakland Station is located in an urban neighborhood with typically mixed uses and no distinct natural or built features, and vividness is low. The Aerial Guideway and station interrupt the otherwise regular street grid and reduce intactness to low levels. The station is architecturally compatible with its surroundings and therefore unity is considered moderate.

Rockridge Station - Exterior

Rockridge Station - Bronze Plaque

Rockridge Station - Firestorm Community Mural

Rockridge Station - Mural Detail

Figure 3.8-1. Rockridge Station


MacArthur Station - Exterior


MacArthur Station - Sculpture


MacArthur Station - Mural Painting


MacArthur Station - Sculpture Detail

Figure 3.8-2. MacArthur Station

Viewing Audience. The viewing audience is similar to that identified for the West Oakland Aerial Guideway. It includes a wide range of viewers, including patrons of the BART station, motorists on nearby streets, pedestrians, patrons of businesses in the area, and residents living close to the station.

West Oakland Aerial Guideway

Visual Character. The visual character of the Aerial Guideway's setting varies as it passes through different neighborhoods in West Oakland. The Aerial Guideway between the Aerial Transition Structure and Maritime Street is located in an industrial area associated with the Port of Oakland. There are warehouses to the north and south. The remainder of the Aerial Guideway, between Maritime Street in the Port and the downtown tunnel, passes through a variety of neighborhoods in West Oakland. At Pine Street, just east of where the tracks cross beneath the Interstate 880 freeway, the line passes through a mix of commercial and residential uses. Residential neighborhoods lie to the north; the Main Oakland U.S. Post Office is to the south at 7th and Willow streets.

After leaving the West Oakland Station, the BART tracks leave 7th Street and begin to parallel 5th Street. Immediately east of the West Oakland Station, surrounding land uses are residential and commercial. East of Mandela Parkway, the tracks are bordered on the north by the Interstate 880 freeway corridor, with light industrial and commercial areas beyond the freeway. Land uses remain light industrial and commercial as the line crosses Filbert and Myrtle streets, transitioning to industrial uses as the tracks approach the Interstate 880 freeway and turn to the north toward the Oakland City Center/12th Street Station.

Visual Quality. Visual quality is generally low near the Port of Oakland and increasingly moderate approaching downtown Oakland. The setting of the Aerial Guideway exhibits a low degree of vividness because of the surrounding mix of light industrial, commercial, and residential uses and the absence of distinctive natural or built features. The Aerial Guideway disrupts the otherwise uniform grid of the streets it crosses, and contributes to a low degree of intactness. The setting of the Aerial Guideway is uniformly urbanized along its length and exhibits a moderate unity of visual appearance.

Viewing Audience. The Aerial Guideway is visible to a wide range of viewers along its length, including motorists on cross-streets and streets paralleling the BART system, pedestrians, patrons of industrial and commercial businesses in the area, and residents living nearby.

Aerial Transition Structure

Visual Character. The Aerial Transition Structure is located in an industrial area within the Port, partially screened by a low retaining wall and bordered on the southwest by a segment of the San Francisco Bay Trail, a regional multi-use trail planned to eventually encircle San Francisco Bay; a rail line; a private access road; and warehouses to the south. The trail frontage is landscaped along its southwest side. Farther east, new landscaping was observed at the intersection of Maritime and 7th streets.

Visual Quality. Overall visual quality in this area is low, although it is unified by the San Francisco Bay Trail. The predominantly industrial setting and varied land uses, infrastructure, and equipment contribute to low degrees of vividness and intactness. However, the uniformly landscaped trail unifies the otherwise visually unrelated features in the immediate area of the Aerial Transition Structure, and unity is therefore characterized as moderate.

Viewing Audience. The Aerial Transition Structure is visible to motorists on 7th and Maritime streets and bicyclists and pedestrians on the portion of the San Francisco Bay Trail that parallels the Aerial Structure.

Oakland Transition Structure

Visual Character. The visual environment is dominated by industrial and marine-related development (e.g., cargo terminals) and infrastructure (e.g., roadways, train tracks, cranes, and equipment).

Visual Quality. The overall visual quality at this location is low. The setting is utilitarian, characterized by industrial and Port-serving infrastructure, which contributes to a low degree of vividness. Ongoing redevelopment of the area with a variety of Port-related uses contributes to a heterogeneous setting with a low degree of intact features. The setting is visually varied, with each Port terminal configured for a different tenant and operations, so visual unity is low.

Viewing Audience. The Oakland Transition Structure is fenced to prevent public access. During normal operations, it is not visible to motorists on 7th Street or to bicyclists and pedestrians on the segment of the San Francisco Bay Trail paralleling 7th Street.

Other Seismic Retrofits — Chabot Road

Visual Character. The Chabot Road overpass just west of the Berkeley Hills Tunnel portal is surrounded by the most dense vegetation found along the project alignment. Notwithstanding the presence of ivy, weedy species, and grasses, the area supports mature, dense, attractive landscaping that visually blends in with native vegetation observed farther upslope toward the portal of the tunnel. There are several small stands of redwoods, as well as mature pines and eucalyptus, on the slopes. Views of the Chabot Road overpass and adjacent vegetation are shown in Figure 3.8-3.

Visual Quality. The Chabot Road overcrossing is surrounded by steep, heavily vegetated slopes with nearby development, and is highly vivid. The BART tracks divide the area and reduce the intactness of the landscape to low levels, but as slopes are otherwise largely undisturbed in this area, it retains a moderate degree of visual unity.

Viewing Audience. The viewing audience includes motorists and pedestrians along Chabot Road.

Other Seismic Retrofits — Golden Gate Avenue

Visual Character. At the bridge overcrossing of Golden Gate Avenue, the slopes on either side of the roadway, north and south of the BART line, are densely vegetated. Several young, but

Chabot Road Overpass

Chabot Road Overpass

Figure 3.8-3. Chabot Road Overpass

established, native redwood trees (*Sequoia sempervirens*) are present within 15 feet of the bridge supports. Chabot Park is located northwest of BART's Golden Gate overpass between Patton Street and Golden Gate Avenue. The southeastern edge of the Park (occupied by tennis courts) is located at least 50 feet from the Golden Gate overpass and is screened from the overpass by mature slope vegetation. Views of the Golden Gate Avenue overpass and adjacent vegetation are shown in Figure 3.8-4.

Visual Quality. The semi-natural setting of the Golden Gate Avenue BART overcrossing, including landscaping and nearby residential development, contribute to a moderately vivid setting. While the BART tracks visually divide the area and reduce intactness to low levels, consistent landscaping on either side of the overcrossing maintains a moderate degree of visual unity.

Viewing Audience. The viewing audience includes motorists along Golden Gate Avenue and pedestrians including local residents.

Other Seismic Retrofits — Hardy Park

Visual Character. At Claremont Avenue and Hudson Street, the BART line and State Route 24 pass over Hardy Park, a Caltrans-owned facility operated by the City of Oakland Office of Parks and Recreation. Hardy Park comprises a collection of recreational facilities at the northern end of the Rockridge-Temescal Greenbelt. The Greenbelt follows the Temescal Creek alignment, roughly paralleling Claremont Avenue for three blocks.

A mural is painted on the State Route 24 underpass on Claremont Avenue near Hudson Street, across the street from Hardy Park and its playground. Known as the Oceanus Mural, the 3,000-square-foot work of art was commissioned by Caltrans in 1977. It was restored by the original artist and community volunteers in July 2003, and was rededicated in September 2003.

Visual Quality. The visual quality in the vicinity of BART's Hardy Park overcrossing is variable. Hardy Park recreational facilities surround the BART overpass; the open space, landscaping park facilities, and Oceanus mural on the underpass contribute to a highly vivid setting. The park is divided by the freeway and BART overpass, reducing intactness to low levels. However, the park is unified by its single recreational purpose as well as by landscaping and hardscape, and unity within this landscape is therefore high.

Viewing Audience. The viewing audience includes park patrons as well as motorists on adjacent roadways.

Other Seismic Retrofits — Remaining Bridges and Overpasses

The existing setting of the remaining bridges and overpasses in the project area is described in the Visual Resources Technical Study (BART et al. 2004b). Since the project would have no impact on visual resources at these locations, they are not discussed further.

3.8.1.2 Existing Visual Resources — San Francisco

San Francisco Transition Structure

Visual Character. The Northeastern Waterfront is centrally located on the center of San Francisco's downtown waterfront area and is a popular scenic and recreational destination. The centerpiece of the Embarcadero waterfront is the Ferry Building at the terminus of Market Street; it establishes a strong visual link with that corridor and anchors the western edge of the Ferry Plaza.

The Transition Structure and World Trade Club are located on the Ferry Plaza near its eastern tip. The Golden Gate Ferry Terminal and an elevated pedestrian walkway is adjacent to the World Trade Club on the Ferry Plaza.

There are panoramic views eastward from the Ferry Building Marketplace and Ferry Plaza and adjacent waterfront. Views encompass San Francisco Bay and associated ferry, barge, and boat traffic; open sky; Yerba Buena Island and Treasure Island; the western span of the Bay Bridge connecting San Francisco and Yerba Buena; and the distant Oakland-Berkeley Hills. In contrast, views toward San Francisco's waterfront from the Bay, as viewed by Bay Bridge motorists, ferry passengers, and boaters, are dominated by the skyline of the City of San Francisco in the background. As viewed from the Bay, the waterfront is set against a backdrop of mid-rise and high-rise hotels and office buildings of the Financial District and the city's downtown.

Visual Quality. The juxtaposition of dramatic, natural landscape features (the panoramic Bay, wooded Yerba Buena Island, and Marin Headlands) and built features (Bay Bridge, Ferry Building Marketplace, San Francisco waterfront, and a portion of Treasure Island) contribute to a highly vivid setting, viewed from waterfront, Bay Bridge, and waterborne vantage points. The Ferry Plaza and surrounding waterfront are moderately visually intact, since they are visually distinct from their surroundings (e.g., the adjacent waterfront) and the plaza houses a number of unrelated and visually distinct uses, including the Ferry Building Marketplace, the ferry terminal, the World Trade Club and San Francisco Transition Structure, surface parking, pedestrian access, sightseeing, and fishing. Similarly, the project setting exhibits low visual unity, the result of a visually heterogeneous mix of independent, unrelated development and activities.

Viewing Audience. The landside viewing audience for the San Francisco Transition Structure includes patrons of the World Trade Club, ferry terminal, and Ferry Building Marketplace; motorists, pedestrians, and sightseers along The Embarcadero, the waterfront and on the Ferry Plaza; and occupants of the Financial District. Waterside viewers include motorists on the Bay Bridge and ferry and boat passengers in the Bay.

Golden Gate Avenue Overpass

Golden Gate Avenue Overpass

Figure 3.8-4. Golden Gate Avenue Overpass

Table 3.8-1. Existing Conditions: Visual Character and Visual Quality

Project Structure or Element	*Visual Character*	VISUAL QUALITY		
		Vividness	*Intactness*	*Unity*
Rockridge Station	• BART Station in State Route 24 median • Suburban setting (commercial center, single-family residential uses)	Moderate to High	Low	Low
MacArthur Station	• BART Station at grade beneath State Route 24/BART overpass; parking lot • Commercial and residential uses	High	Low	Low
West Oakland Station	• Aerial BART Station along Aerial Transition Structure; parking lot • Residential, commercial uses to north, south • Light industrial uses to southeast	Low	Low	Moderate
West Oakland Aerial Guideway	• Aerial Transition Structure to Maritime Street: Port-serving and light industrial uses, rail lines and roadways • Pine Street to West Oakland Station: commercial, residential uses • West Oakland Station to Mandela Parkway: commercial, residential uses • Mandela Parkway to Filbert and Myrtle streets: commercial, light industrial uses • Filbert and Myrtle streets to downtown Oakland tunnel: light industrial uses	Low	Low	Moderate
Aerial Transition Structure (Port of Oakland)	• Port-serving and light industrial uses • Rail lines, Port access roads • Recreational uses (San Francisco Bay Trail)	Low	Low	Moderate
Oakland Transition Structure (Port of Oakland)	• Port-serving and industrial uses (including fenced, inaccessible transition structure) • Rail lines, Port access roads • Recreational uses (San Francisco Bay Trail)	Low	Low	Low
Other Seismic Retrofits- Chabot Road	• Landscaped open space along roadway slopes • Residential uses	High	Low	Moderate
Other Seismic Retrofits- Golden Gate Avenue	• BART overpass, landscaped slopes • Residential uses • Recreational uses (Chabot Park)	Moderate	Low	Moderate
Other Seismic Retrofits- Hardy Park	• State Route 24/BART overpass • Recreational uses (dog park, Hardy Park Playground tot lot, basketball court, landscaped open space) • Oceanus Mural on State Route 24 underpass at Claremont Avenue and Hudson Street	High	Low	High
San Francisco Transition Structure	• Public facilities (Golden Gate Ferry Terminal) • Commercial facilities (Ferry Building Marketplace restaurants, retail uses; World Trade Club, associated parking) • Recreational facilities (fishing, sightseeing)	High	Moderate	Low

3.8.1.3 Light and Glare

The urban nature of the San Francisco and Oakland settings of the project area mean that nighttime light levels throughout the project area are uniformly high. The San Francisco Transition Structure location is lit by light standards illuminating the surface parking area, ferry terminal, World Trade Club, and the perimeter of the platform. It is also indirectly lit by lights along the Embarcadero Promenade/Herb Caen Way. Throughout Oakland, BART travels almost exclusively along major thoroughfares (boulevards and streets) or within the median of State Route 24, which are illuminated at night at relatively high levels.

3.8.2 Proposed Action

3.8.2.1 Factors for Evaluating Impacts

Criteria used to determine project-related impacts on visual resources are based on the FHWA guidance and methodology provided in the *Visual Impact Assessment for Highway Projects* (FHWA 1988). The project would result in impacts on visual character or qualities if the project resulted in one of the following conditions:

- The visual character of project features contrasted strongly with the project setting, resulting in low visual compatibility; or
- The proposed action changed, through introduction or removal, the existing balance between the qualities of vividness, intactness, and unity of landscape features.

The project would result in impacts related to light and glare if the project resulted in the following condition:

- Changes in the ambient nighttime illumination levels, which would spill light from the project site and affect nearby sensitive uses or activities.

3.8.2.2 Impacts and Mitigation

Oakland

Rockridge Station. Seismic retrofitting of piers at Rockridge Station would take place in proximity to the Firestorm Community Mural and associated Oakland Hills Fire commemorative bronze plaque. A portion of the mural on the building's east-facing facade is located 10 feet west of the two columns identified as Pier 2. Jacketing of the southernmost Pier 2 column would also necessitate removal of the bronze plaque. Because the project includes protective measures that will ensure the preservation of the artworks and restoration of the bronze plaque to its original location, no impacts to the visual character or qualities of the station are anticipated.

MacArthur Station. Construction at MacArthur Station would take place in proximity to the two wall paintings located on the station's north and south walls and the four sculptures located in the station plaza. Because retrofit activities would be short-term, and the project includes protective measures that will ensure the preservation of the artworks during construction, no impact on the station's visual character or qualities is anticipated.

Project construction would be visible to patrons of the BART station but would not change views of or from the station. Residences on 40th Street are sufficiently distant that views from these locations would not be affected. Motorists using the 40th Street undercrossing at the station would temporarily be able to see construction, but the impact on existing views would be negligible. The proposed new infill walls would block only views already confined to the station interior and would likewise have a negligible impact on views.

West Oakland Station. Project construction would be temporary and confined to structural features internal to the station. The proposed project would have no impact on the overall visual character of MacArthur Station or on its visual qualities.

Project construction would be visible to patrons of the BART station but would not change views of or from the station. Views from off-site locations, including adjacent 7th Street, are sufficiently distant and screened by intervening vegetation such that impacts on those views would be negligible.

Aerial Guideways. Project construction could result in the disturbance or removal of ornamental landscaping and decorative hardscaping at several locations where slopes beneath the aerial guideway support such features. These areas will be restored to their pre-project conditions as part of the proposed project, and no impact is anticipated on visual character or the visual quality of unity. As the qualities of vividness and intactness are generally low throughout these areas, no impact on these qualities is expected.

While the proposed column jackets and shear keys would be visible to area motorists, pedestrians, and residents, the new features would not contrast with the existing BART system infrastructure, nor would they block or degrade any existing views.

West Oakland Aerial Guideway. Project construction would result in the temporary disturbance or removal of landscaping along the San Francisco Bay Trail and at the intersection of Maritime and 7th streets. Construction would affect a small segment of the trail, which would be temporarily rerouted within the adjacent 7th Street right-of-way. The project would not permanently affect the trail's alignment or purpose, and the trail would be restored to its pre-project condition upon completion of construction. For these reasons, the proposed project would have no impact on visual character.

Landscaping and hardscaping associated with the San Francisco Bay Trail are among the few visually unifying elements in this area. Landscaping subject to removal during project construction includes ornamental grasses, low shrubs, and vines. Since this disturbance would be temporary and the area would be restored to its pre-project condition after construction, impacts on unity would be negligible. The intactness and vividness of the project area are already low and would not be affected by project construction.

Oakland Transition Structure. Project staging and construction would occur entirely within the fenced yard surrounding the transition structure and would not affect the visual character or quality of the project area.

Other Seismic Retrofits. Because the BART line is contained within the median of State Route 24 throughout most of this segment until Golden Gate Avenue, in the Rockridge neighborhood, proposed seismic improvements would result in negligible effects on the visual character or the qualities of the remaining work sites or their settings. While construction would be visible from nearby residences, businesses or roadways, such activities would be temporary and would not impact views from these locations.

Three worksites are discussed below in more detail because of their visual qualities: the Chabot Road and Golden Gate Avenue overpasses, and Hardy Park.

Chabot Road and Golden Gate Avenue. Project construction associated with the Chabot Road and Golden Gate Avenue overpasses would necessitate the removal of some plantings at these locations, including two small redwood stands and scattered eucalyptus and pine trees at the Chabot Road overpass, and three small stands of young redwood trees near the Golden Gate overpass. As part of the project, these areas would be restored to their pre-project landscaped conditions. For this reason, and because both areas already support relatively dense ornamental and native plantings, the project would have a negligible impact on the overall visual character or visual qualities of the two areas.

Affected observers include motorists and pedestrians along Chabot Road and Golden Gate Avenue. Project impacts on views of the worksites and surrounding areas would be negligible.

Hardy Park. Project construction at the Claremont Avenue and Hudson Street BART/State Route 24 overpass is close to Hardy Park recreational facilities, and would result in the removal of existing landscaping. Construction would be temporary, and the project includes measures to ensure the adequate restoration of park amenities to pre-project conditions, including clean up, regrading, recompacting, repavement or relandscaping of the park, and replacement of any damaged fencing. No impacts to visual character or qualities are anticipated. The Oceanus Mural on the State Route 24 underpass is more than 20 feet from Pier 57, which is the closest pier planned for reinforcement. At this distance, the mural would not be affected by construction activity.

Oakland Yard and Shop Building. As the Oakland Yard and Shop building is located on fenced, private property, inaccessible to the public, no impacts on visual character or qualities are anticipated.

San Francisco

Project construction would detract from the existing degree of intactness because of removal of a portion of the Ferry Plaza and staging of construction equipment and supplies, and would disrupt the visual unity among the already disparate buildings and structures on the Ferry Plaza. However, intactness at this worksite has been identified as moderate and unity is considered low. Moreover, construction effects would be temporary and the platform would be restored to its pre-project condition following construction. Therefore, construction impacts on visual quality would be negligible. Project construction, including removal of a portion of the platform, would not affect the broader scenic setting and construction activities would be temporary.

Dredging associated with retrofit of the Transbay Tube or San Francisco Transition Structure could result in a water surface turbidity plume near the dredge site, which could be visible to nearby viewers, though not visually dominant or even readily apparent. This plume would be relatively small within the context of the larger Bay, and would disperse within hours after dredging stops in that location due to mixing, dilution, and settling of dredged solids. This is considered a negligible impact.

With respect to the viewing audience, the ferry platform serves as only one of numerous locations along the waterfront that offer viewing opportunities to area visitors. The platform's temporary removal during construction (2 – 4 years) is offset by the viewing opportunities available along the length of the Embarcadero and on other nearby piers. However, the project includes installation of noise control barriers consisting of either plywood walls between 8 and 12 feet tall around each worksite, or equipment blankets that would completely enshroud individual pieces of equipment, which could obstruct views from offsite locations for the duration of construction. These noise barriers would not block views from the Ferry Building Marketplace or from other vantage points available along the length of the Embarcadero or inland of the waterfront (e.g., high rise buildings), where views of the Bay would remain available to visitors. For these reasons, platform removal and the presence of construction equipment, noise barriers, and activities would result in negligible impacts on views from the Ferry Building Marketplace. No impacts are expected on other landside and waterside viewers in the project area because of their distance from the project site.

Light and Glare

Project construction could result in the temporary use of high-intensity light sources in the vicinity of the highway and area roadways to illuminate construction activities in low light conditions (e.g., overcast days or nighttime shifts, if applicable). The proposed project includes measures intended to confine light spillover and prevent focused, intense off-site glare (see BART et al. 2005b). Consequently, project construction would have negligible impacts on ambient nighttime light levels or glare generation.

The construction sites where residential uses are within several hundred feet of project construction include the three BART stations, where the BART right-of-way passes along 5th Street east of the West Oakland Station, and where the BART right-of-way crosses Pine Street just east of Interstate 880. The stations (and construction sites) are separated from the nearest residential uses by BART parking lots and/or surrounding roadways. Project construction would occur far enough from residential land uses that impacts would not occur.

3.8.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

Dredged Material Reuse within the Project

The placement of fill at the dredged stitching sites would require the same equipment used for dredging and would take place in the same locations. Therefore, similar to dredging activities, dredge material reuse within the project would have negligible impacts on visual resources.

Dredged material reuse in the project area would also have a negligible impact on the visual vividness of the sites, and no impact on intactness or unity of landscape features is anticipated.

Dredged Material Reuse/Disposal Options outside the Project

Impacts on visual resources associated with transport of dredged material to the eight offsite destinations would be similar for all of the proposed sites. Disposal of dredged material outside the project would occur in addition to fill placement at the stitching sites and San Francisco Transition Structure. Barges would travel in the appropriate traffic lanes from the project site to a disposal site. Because barges are a common sight throughout San Francisco Bay, barge transport of dredged material to locations outside the project would result in no impacts on visual character and visual resources, including the visual qualities of vividness, intactness, and unity, either at the project work sites or along the barge routes.

3.9 BIOLOGICAL RESOURCES

The analysis presented below is based on the results of two technical studies prepared for the project. A Biological Assessment (BA) was prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 [c]), and follows the standards established in the FHWA NEPA guidance. In addition, a Natural Environment Study (NES) was prepared in accordance with Caltrans Environmental Handbook (Volume 3, Chapter 2). The BA and NES provide detailed analyses of impacts on special status species and native habitats that occur in the project area, including Essential Fish Habitat (EFH) (BART et al. 2005f, 2005g).

3.9.1 Existing Setting

3.9.1.1 Marine and Terrestrial Resources

This section provides a description of marine and terrestrial resources, including habitats and vegetation, commercially important fisheries species, and special status species that may occur in, or migrate through, the project area. San Francisco Bay supports a large and diverse community of freshwater, estuarine, and marine fish; macroinvertebrates; zooplankton; phytoplankton; and aquatic vegetation. The Bay is strongly influenced by tidal exchange with nearshore coastal waters and freshwater inflow from the Sacramento and San Joaquin River systems, and other tributaries. Factors that affect the abundance and diversity of the aquatic community include tidal flushing, currents, fluctuations in salinity, and water temperature. Freshwater inflows from the river systems contain significant amounts of nutrients and dissolved minerals and transport a large volume of sediment from the watersheds. Freshwater inflows mix with nutrient-deficient seawater within the Bay, resulting in a highly productive estuarine aquatic environment.

As a result of the diversity of aquatic habitats, and productivity of the estuarine waters, the Bay and western Delta serve as important spawning and nursery areas for many aquatic species, provide foraging habitat, and serve as an important migratory corridor for anadromous fish, which migrate between freshwater and marine environments. The Bay-Delta system has been designated as critical habitat for winter-run Chinook salmon and steelhead. San Francisco Bay and portions of the western Delta have also been identified as EFH for federally managed fish species.

Plankton

The project lies within the Central Bay Subregion of San Francisco Bay. Phytoplankton common here are the diatoms *Chaetoceros* spp. and *Rhizolenia* spp. and some dinoflagellates. Most of these are coastal species that now occur in the Central Bay, beyond their native ranges, because of coastal upwelling and tidal mixing with nearshore coastal marine waters. The majority of the spring phytoplankton bloom is composed of dinoflagellates, a primary food source for zooplanktonic grazers and benthic filter-feeders. Central Bay zooplankton are concentrated in the shoals along the Bay, and are composed mainly of the copepods *Eurytemora affinis, Sinocalanus doerri*, and *Pseudodiaptomous forbesi,* and many larval invertebrate species.

Eelgrass

Eelgrass beds are present intermittently in the shallows of San Francisco Bay, as are both the native and invasive species of *Spartina*. There are approximately 131 acres (53 hectares) of eelgrass beds within the Central Bay (USACE et al. 1998), which is somewhat less than half of the acreage of eelgrass in the entire San Francisco Bay. Eelgrass beds provide refuge and nursery habitat for many fish and invertebrate species including juvenile Chinook salmon *(Oncorhynchus tshawytscha),* Pacific herring (*Clupea pallasi*), shiner surfperch (*Cymatogaster aggregata*), crabs, and bay shrimp. In addition, these beds provide spawning habitat for the Pacific herring and other fish species, and foraging habitat for the California least tern (*Sterna antillarum browni*), many other bird species, and several invertebrate species. None of these beds are close to the project site; beds are located offshore from Emeryville, off the southern end of Alameda Island, and off the northern end of Bay Farm Island.

Benthic Invertebrates

The deep water and coarse-grained sediments in the Central Bay provide habitat for species that are tolerant of strong currents and substrate irregularity. The benthic community in the Central Bay is represented in part by the amphipod *Foxiphalus obtusidens*, the crab *Cancer gracilis*, and the polychaetes *Armandia brevis*, *Mediomastus* sp., *Siphones missionensis*, and *Glycinde picta*.

Sheltered areas of the Central Bay are characterized by finer sediments and biota typical of such sediments. The small clam *Macoma balthica* is abundant here, particularly in intertidal areas. Other common species are the molluscs *Mya arenaria*, *Gemma gemma*, *Musculista senhousia*, and *Venerupis philippinarum*; the amphipods *Ampelisca abdita*, *Photis californica*, *Grandidierella japonica*, and *Corophium* sp.; and the polychaetes *Streblospio benedicti*, *Glycinde* sp., *Exogone lourei*, and *Polydora* sp. Hard substrates support large populations of the Bay mussel, *Mytilus edulis* (Thompson et al. 1994; USFWS 1986). The benthos, or the community living on the seafloor, also provides nursery habitat for the commercially important Dungeness crab (*Cancer magister*).

Fish

A wide variety of fish may be found in the project area. Among them are various flatfish, surfperch, gobies, sculpin, bait and forage fish (anchovies, herring, smelt), pipefish (*Syngnathus* spp.), croakers, silversides, sharks, and rays. Flatfish common to sandy-silt sediments include the English sole (*Parophrys vetulus*), starry flounder (*Platichthys stellatus*), California halibut (*Paralichthys californicus*), and diamond turbot (*Hypsopsetta guttulata*) (USACE 1992). Other common bottom fish include Bay gobies (*Lepidogobius lepidus*) and the Pacific staghorn sculpin (*Leptocottus armatus)*. White croakers (*Genyonemus lineatus*) usually occur in shallow water and feed on benthic invertebrates (Hart 1973).

Northern anchovies (*Engraulis mordax*), a pelagic, or open water marine species, occur in the Bay year round. Anchovies are an important food source for predators such as salmon, jacksmelt, and striped bass. Pacific herring (*Clupea harengus pallasii*) are also an important forage species. Herring enter the Bay in the winter and early spring to spawn in rocky areas, along seaweed or eelgrass covered substrates, on pilings, and on sandy beaches (U.S. Navy 1993). Some of these spawning areas include the shoreline between the Bay Bridge and San Leandro Yacht Harbor, along the Alameda and Oakland waterfront, the shoreline of Yerba Buena and Treasure Islands, and other shoreline areas of Central and San Pablo bays (U.S. Navy 1993; Smith and Kato 1979). Shiner surfperch (*Cymatogaster aggregata*) and pile surfperch (*Rhacochilus vacca*) are commonly found in harbors (Smith and Kato 1979; USACE 1984).

Anadromous fish that migrate through the Bay (saltwater) to spawn in the Sacramento-San Joaquin River system (freshwater), include striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), and Chinook salmon (*Oncorhynchus tshawytscha*). Chinook salmon migrate mainly in the fall, although the winter-run Chinook migrate from November to May (U.S. Navy 1993; USACE 1992). Other anadromous fish found within the Bay include white and green sturgeon (*Acipenser transmontanus* and *Acipenser medirostris*, respectively), which generally migrate upstream in the spring (Smith and Kato 1979). Additional details on managed (EFH) species are contained in the project BA and NES (BART et al. 2005f, 2005g).

Marine Mammals

Marine mammals that occur commonly in the project area include harbor seals (*Phoca vitulina*), the California sea lion (*Zalophus californianus*), gray whale (*Eschrichtius robustus*), and harbor porpoises (*Phocoena phocoena*).

The harbor seal is a year-round resident in coastal California and in San Francisco Bay. The total population of harbor seals in the Bay is estimated at approximately 700 animals (USFWS 1992). Twelve haul-out areas (locations where seals and sea lions rest, breed, or molt out of the water) are known to exist in the Bay. The Yerba Buena haul-out has more than 40 harbor seals during the breeding and molting seasons. Yerba Buena Island is not considered a breeding site; however, pups have been observed there (Kopec and Harvey 1995). Harbor seals use the south side of Yerba Buena Island as a year-round haul-out and foraging site (Kopec and Harvey 1995).

California sea lions have been observed on a regular basis in the shipping channel to the south of Yerba Buena Island, although little information is available on their foraging patterns in the Bay. While California sea lions are known to use the general area of Pier 39 as a haul-out site, the majority are male, and no rookeries (nesting or breeding grounds) are known in the Bay.

The gray whale has been sighted more frequently in recent years in the Bay. Gray whales use the Bay seasonally, but their presence is poorly understood. Observations of gray whales typically occur during the months from December to March, during their winter migration north to Alaska and the Bering Straits.

There are high densities of harbor porpoise just offshore from the Bay. Although they have been observed in the Bay and have the potential to occur in the project area, they are not expected to be abundant in this portion of the Bay.

Marine Birds

Common marine bird species observed in the Central Bay and project area include cormorants, gulls, scoters, murres, guillemots, and grebes, among others. Wintering species include the common loon (*Gavia immer*), surf scoter (*Melanitta perspicillata*), and western grebe (*Aechmophorus occidentalis*) (USFWS 1986, 1995). Waterfowl are typically more abundant in shallow-water habitats but also occur in deep-water habitats. Cormorants and gull species are likely to occur in the project area. Shorebirds, such as sanderlings (*Calidris alba*) and dunlin (*Calidris alpina*), and western snowy plovers (*Charadrius alexandrinus nivosus*) are also present in shallow-water habitats and on mudflats, feeding on small clams, snails, and worms (USFWS 1986, 1995).

Terrestrial Resources

The BART alignment comes ashore in the East Bay beneath Berth 34 in the Port of Oakland, passes through downtown Oakland and extends east to the western portal of the Berkeley Hills Tunnel. Within the Port of Oakland, vegetation is minimal. An adjacent bicycle path is landscaped with ornamental shrubs along its southern edge. The only other vegetation near the BART right-of-way in this area includes weeds growing in nearly barren land near the guideways, and a few ornamental trees. Between downtown Oakland and the final approach to the west portal of the Berkeley Hills Tunnel, the BART tracks are contained in the median of State Route 24. As State Route 24 approaches the Warren Freeway (Highway 13) in the Oakland Hills, the BART tracks leave the State Route 24 median and are at-grade with aerial sections at street crossings until the tracks reach the tunnel.

The land adjacent to the State Route 24/BART right-of-way is either paved, overtaken with weeds, landscaped with poorly maintained ornamental plantings, or covered with wood mulch or rock. There are street trees near the West Oakland Station. Between the MacArthur and Rockridge Stations, vegetation along the BART right-of-way is limited to planted medians and planter strips. The Rockridge Station supports only ivy-filled planters with several mature carob trees (*Ceratonia siliqua*) adjacent to the commuter parking lot.

Coast live oaks (*Quercus agrifolia*) are present in the vicinity of Presley Way, but are approximately 100 feet from the BART alignment. At Patton Street the slopes are covered with ivy and support a few planted Japanese maple trees. At Golden Gate Avenue, the surrounding neighborhood supports fairly dense stands of non-native vegetation. Bridge piers are set into slopes supporting ivy, patches of non-native grasses, and weeds. There are scattered native toyon (*Heteroneles arbutifolia*) shrubs and invasive pampas grass (*Cortaderia selloana*) near the BART bridge over Golden Gate Avenue. Several stands of well-established redwoods (*Sequoia sempervirens*) are present on the slopes near the bridge piers; trees at the northeast corner of the bridge are within a few feet of the support columns.

The segment of the BART system between the Montgomery Street Station and the San Francisco Ferry Plaza is located underground and within the developed urban setting of the City of San Francisco. The San Francisco Ferry Plaza is located on the San Francisco Bay waterfront (Embarcadero area) and extends several hundred feet out into shallow water. Vegetation on the Ferry Plaza is limited to ornamental trees, shrubs, and flowers contained in planters set into the platform surrounding the World Trade Club building and the San Francisco Ferry Terminal.

Berkeley Hills Tunnel — Western Portal

Slopes adjacent to Chabot Road support an understory of ivy, non-native grasses, and weeds. Shrubs include stands of native toyon and non-native pampas grass. The toe of the slope along the north side of Chabot Road, beneath the overpass, also supports an isolated stand of wetland plants. Non-native trees along both sides of Chabot Road include sapling and mature, possibly planted eucalyptus and Monterey pine (*Pinus radiata*). Several stands of California redwood also occur on the slopes on either side of the road, and may have been planted. Several redwoods are located at the southwest corner of the bridge within a few feet of the existing bridge piers. There is a second stand of redwoods about halfway up the northwest slope near the tunnel portal. There is a designated open space preserve at the top of the slope, above the tunnel portals.

A wetland area was identified along the northeastern side of Chabot Road (Reynolds 2002; BART et al. 2005a). This wetland is approximately 1,200 square feet (0.03 acre) and appears to have formed as a result of the road berm, which has blocked drainage off the adjacent slope. It is physically and hydrologically isolated from natural drainage, and supports non-native wetland plants. Two man-made features may contribute to the creation or maintenance of this wetland: an East Bay Municipal Utility District meter box and pipeline that may be leaking, and a municipal storm drain along the north side of Chabot Road that carries substantial runoff during rainfall events (Reynolds 2002).

The California Natural Diversity Data Base (CNDDB 2002) reports that this area also supports the Berkeley kangaroo rat, a federal Species of Concern that prefers foothill woodlands and valley grassland communities.

3.9.1.2 Threatened and Endangered Species

Several state or federally listed threatened or endangered species are known to occur or have a potential to occur in the project area. Seasonal migrations of anadromous fish are well known, as are the spawning or foraging destinations of these and other species. However, the number of individuals or the size of the population that may be in the Bay during the construction period and may be affected by the project are not known at this time. Table 3.9-1 lists the state and federally listed species potentially occurring in the general project area. In Table 3.9-1, species with a reasonable potential to occur in the immediate project area and to be affected by the project are listed in bold print. For these species, occurrence in the project area is described in detail in the Biological Assessment (BART et al. 2005f). Species not listed in bold print in Table 3.9-1 have a very low potential for being affected by the project, and are not discussed further in this EA.

Table 3.9-1. Special Status Species Potentially Occurring in the Project Area

(page 1 of 4)

Common Name	*Scientific Name*	*Status (Fed/State/ Other)*	*Preferred Habitat and Distribution in the Region*	*Potential to Occur in the Project Area*
		MAMMALS		
Humpback whale	*Megaptera novaeangliae*	E/-- /MMPA	Typically migrate in offshore waters off the coast of California August through October.	Project area is outside the traditional migratory corridor. However, humpbacks have occurred in San Francisco Bay on occasion.
Salt marsh harvest mouse	*Reithrodontomys raviventris*	E/E/FP	Tidal *Salicornia* (salt and brackish marsh) habitat.	Not likely to occur due to lack of suitable habitat in the project area.
Steller sea lion	*Eumetopias jubatus*	T/-- /MMPA	Forages in nearshore waters. Annual summer breeding haulout at Año Nuevo, but rarely seen in San Francisco Bay.	Other than a solitary male that occurs at Pier 39, Steller sea lions are unlikely to occur due to unsuitable habitat in the project area. There is potential for this solitary male to forage in the project area.
		BIRDS		
American peregrine falcon	*Falco peregrinus anatum*	D/E/FP	High cliffs, banks, dunes, near water. Has been observed near Oakland Airport and the Bay Bridge.	Known to occur in the project vicinity at the Port of Oakland, on the Bay Bridge, and in downtown Oakland on the Kaiser Building and the PG&E Building; may occur in the project area as a transient during foraging activities.
Bald eagle	*Haliaeetus leucocephalus*	T/E/FP	Coast, rivers, large lakes in open areas.	Known to occur in the project vicinity (i.e., the Alameda Naval Air Station), and could occur in the project area as a transient during foraging activities. Not likely to perch, roost or nest in the project area due to lack of suitable habitat.
California clapper rail	*Rallus longirostris obsoletus*	E/E/FP	Salt and brackish marshes; fresh water marshes in southwest.	Not likely to occur due to lack of suitable habitat in the project area.
California least tern	*Sterna antillarum* (= *ablifrons*) *browni*	E/E/FP	Salt marshes and salt ponds, open flat beaches, river and lake margins, near shallow water.	Known to occur in the project vicinity (i.e., the Bay shoreline including mudflat and sand beach areas), and is expected to occur in the project area as a transient during foraging activities. Breeding colonies occur in the vicinity of the Alameda NAS, Alameda Island, and the Oakland Airport.
California brown pelican	*Pelecanus occidentalis californicus*	E/E/FP	Open coastal habitat.	Known to occur in the project vicinity (i.e., the Bay shoreline including open water, estuaries, beaches; perches on structures such as pilings, docks, levees, riprap and breakwaters). This species is expected to occur in the project area as a transient during foraging activities, but is not likely to roost or nest in the project area due to lack of suitable habitat.

Table 3.9-1. Special Status Species Potentially Occurring in the Project Area

Common Name	*Scientific Name*	*Status (Fed/State/ Other)*	*Preferred Habitat and Distribution in the Region*	*Potential to Occur in the Project Area*
BIRDS (CONT.)				
Western snowy plover	*Charadrius alexandrinus nivosus*	T/--/--	Sandy beaches on marine and estuarine shores.	Known to occur in the project vicinity (i.e., the Bay shoreline including mudflat and sand beach areas). Not likely to nest in the project area due to lack of suitable habitat.
AMPHIBIANS AND REPTILES				
Green turtle	*Chelonia mydas*	T/--/--	Rare visitor to Central California waters.	Not likely to occur due to lack of suitable habitat in the project area, but could occur as a transient to the Bay during foraging activities.
Leatherback turtle	*Dermochelys coriacea*	E/--/--	Rare visitor to Central California waters.	Not likely to occur due to lack of suitable habitat in the project area, but could occur as a transient to the Bay during foraging activities.
Loggerhead turtle	*Caretta caretta*	T/--/--	Rare visitor to Central California waters.	Not likely to occur due to lack of suitable habitat in the project area, but could occur as a transient to the Bay during foraging activities.
Olive (Pacific) Ridley sea turtle	*Lepidochelys olivacea*	T/--/--	Rare visitor to Central California waters.	Not likely to occur due to lack of suitable habitat in the project area, but could occur as a transient to the Bay during foraging activities.
FISH				
Spring-run Chinook salmon	*Oncorhynchus tshawytscha*	T/T/MF	San Francisco Bay, Delta, and tributaries serve as migratory corridors; spawning habitat in upstream reaches of Sacramento River tributaries.	May occur in the project vicinity as strays during seasonal migration.
Winter-run Chinook salmon	*Oncorhynchus tshawytscha*	E/E/MF Critical habitat	San Francisco Bay, Delta, and tributaries serve as migratory corridors; spawning habitat in upstream reaches of Sacramento River; Sacramento River to Golden Gate identified as critical habitat.	May occur in the project vicinity as strays during seasonal migration. There is critical habitat in the project area.
Central California Coast steelhead	*Oncorhynchus mykiss*	T/--/MF	Includes all San Francisco Bay steelhead except Central Valley (Sacramento, San Joaquin rivers) stocks.	May occur in the project vicinity as strays during seasonal migration.
Central Valley steelhead	*Oncorhynchus mykiss*	T/--/MF	Includes steelhead of Sacramento and San Joaquin rivers, San Francisco Bay, and tributary rivers included in critical habitat.	May occur in the project vicinity as strays during seasonal migration.

Table 3.9-1. Special Status Species Potentially Occurring in the Project Area

Common Name	*Scientific Name*	*Status (Fed/State/ Other)*	*Preferred Habitat and Distribution in the Region*	*Potential to Occur in the Project Area*
FISH (CONT.)				
Central California Coast coho salmon	*Oncorhynchus kisutch*	T/E/MF	Occur in coastal rivers from Punta Gorda south to the Lorenzo River.	Not likely to occur in the project area, as fish from this Evolutional Significant Unit (ESU) occur primarily in coastal, not inland, tributaries. Not included in NMFS' list of potentially affected species for the project.
Delta smelt	*Hypomesus transpacificus*	T/T/MF	Sacramento-San Joaquin Delta, lower Sacramento and San Joaquin Rivers identified as critical habitat.	Not likely to occur in the project area due to a distributional restriction to fresh and brackish waters with a western distributional limit of western Suisun Bay.
Tidewater goby	*Eucyclogobius newberryi*	E/--/MF	Brackish tidal channels, ponds, lagoons and tributary mouths including Lake Merced, the Aquatic Park, Lake Merrit, and the mouth of Novato Creek of San Pablo Bay.	Not likely to occur in the project area due to a distributional restriction to low salinity waters of California coastal wetlands and lagoons.
PLANTS				
Beach layia	*Layia carnosa*	E/E/1B	Point Reyes area >30 feet (PE). Other 22 occurrences found in Humboldt, Monterey and Drakes Bay.	Not likely to occur due to lack of suitable habitat in the project area.
California seablite	*Suaeda californica*	E/--/1B	Salt flats and marsh habitat (upper littoral). Two of 10 occurrences were reported from the yacht harbor in Palo Alto, west of Albany.	Not likely to occur due to lack of suitable habitat in the project area.
Marsh sandwort	*Arenaria paludicola*	E/E/1B	One occurrence at Presidio Swamp, Fort Point (San Francisco).	Not likely to occur due to lack of suitable habitat in the project area.
Presidio clarkia	*Clarkia franciscana*	E/E/1B	Coastal scrub from 25 to 35 m.	Not likely to occur in the project area due to lack of suitable habitat.
San Francisco lessingia	*Lessingia germanorum*	E/E/1B	Coastal scrub and remnant dunes from 25 to 90 m; 4 occurrences at the Presidio and one on San Bruno Mountain.	Not likely to occur in the project area due to lack of suitable habitat.
Soft bird's beak	*Cordylanthus mollis* ssp. *mollis*	E/R/1B	Coastal salt marsh habitat. Point Pinole Regional Shoreline (Contra Costa County), Jersey Island, Grizzly Island.	Not likely to occur due to lack of suitable habitat in the project area.

Table 3.9-1. Special Status Species Potentially Occurring in the Project Area

Key:

Federal		**State**		**Other**	
D:	De-listed under the Federal Endangered Species Act	E:	State-listed Endangered	FP:	Fully Protected
E:	Federally-listed Endangered	R:	State-listed Rare	MF:	Fish managed under a federal fisheries plan
FSC:	Federal Species of Concern	T:	State-listed Threatened	MMPA:	Marine Mammal Protection Act
P:	Species Proposed for listing as threatened or endangered			1B:	California Native Plant Society List Category 1B
T:	Federally-listed Threatened				

Notes:
The species identified in **BOLD** are discussed further in this document.

Sources:
California Department of Fish and Game (2003a).
California Department of Fish and Game (2003b).
California Native Plant Society (2002).
California Natural Diversity Database (2003).
ENTRIX (1998).
Goals Project (2000).
United States Fish and Wildlife Service (2002).

3.9.2 Proposed Action

3.9.2.1 Factors for Evaluating Impacts

The methods used to evaluate impacts on habitats and wildlife were developed by the CEQ and are included in the Regulations for Implementing NEPA (40 CFR Section 1500-1508).

A project may impact biological resources if it would:

- Substantially affect a rare, threatened, or endangered species, or its habitat;
- Interfere substantially with the movement of any resident or migratory fish or wildlife species;
- Substantially diminish the habitat for fish, wildlife, or plant species; or
- Involve the production, use, or disposal of materials that pose a hazard to plant or wildlife populations in the affected area.

In addition, an underwater noise threshold was developed following discussions with the National Oceanic and Atmospheric Administration (NOAA) Fisheries specialists (personal communications, G. Stern 2003; T. Fahy 2003). The following criteria address underwater sound pressure levels and the tolerance of fish and marine mammals to steel pile installation using an impact hammer. The thresholds quoted below were obtained through pilot studies conducted for the Bay Bridge Seismic Safety Project (Caltrans 2001), and by NOAA Fisheries' evaluation of sound level monitoring reports that have been prepared for the Benicia-Martinez Bridge project (personal communications, G. Stern 2003; R. Rodkin 2003).

For marine mammals, noise measured by the root mean square (rms) method is considered the best predictor of adverse effects. The rms method, also referred to as the sound pressure level (SPL), is the square root of the energy in an impulse divided by the duration of the impulse. The rms and other noise measures are usually expressed in decibels (dB), a logarithmic scale, in reference to a standard pressure such as one micropascal (1 μPa). A sound pressure of 180 dB rms (re 1 μPa) has been identified by NOAA Fisheries as a guideline for establishment of the gray whale safety zone (BART et al. 2005f). NOAA Fisheries applies this guideline to all whale species, based on 180 dB rms as the sound level causing temporary threshold shift (TTS) in the hearing of whales in general (personal communication, T. Fahy 2003). NOAA Fisheries also indicated that any region where noise levels are greater than 180 dB rms would be designated safety zones, and would require work stoppage while whales were present in that zone. To avoid work stoppage, conservation measures to prevent noise levels of 180 dB rms or higher would have to be implemented. A harassment zone for whales is designated as a circular ring extending outward from the inner safety zone of 180 dB rms, to the outer limit of the 160 dB rms underwater NOAA guideline for harassment of marine mammals. If there is any likelihood that whales would stray into the harassment zone, NOAA Fisheries requires an Incidental Harassment Authorization (IHA).

The NOAA Fisheries TTS harassment threshold for seals and sea lions is 190 dB rms, 10 dB higher than for whales, which reflects the greater sensitivity of cetaceans (including whales) to underwater sound compared to pinnipeds, such as seals and sea lions. Any region where noise levels are greater than 190 dB rms would be designated safety zones for Steller sea lions and other pinnipeds, and would require work stoppage while pinnipeds were present in that zone. As discussed above, a harassment zone for all marine mammals is designated as a circular ring extending outward from the inner safety zone of 190 dB rms (for pinnipeds), to the outer limit of the 160 dB rms underwater NOAA guideline for harassment of marine mammals. Issuance of an IHA from NOAA Fisheries would be required depending on the potential for pinnipeds to stray into the harassment zone.

Noise impact thresholds for fish are less well understood than for marine mammals. For fish, noise measured as instantaneous peak pressure (in dB re 1 μPa) is considered the best predictor of adverse effects. For a given sound source, the peak pressure is typically 10 to 15 dB higher than the rms value. In ESA Biological Opinions completed for recent construction projects in San Francisco Bay (Benicia-Martinez New Bridge Project and Bay Bridge East Span Seismic Safety Project), NOAA Fisheries has identified a peak pressure of 204 dB re 1 μPa as capable of causing mortality of juvenile fish, and peak pressures of 180-190 dB as potentially causing physical injury in fish (NOAA Fisheries 2002a, 2001). Again, noise impact thresholds are not well understood for fish, so these peak pressure levels should be considered very approximate levels at which adverse effects could occur.

3.9.2.2 Impacts and Mitigation

In the following section, impacts on marine resources are presented first, followed by impacts on terrestrial resources. A general description of each type of impact is provided followed by a discussion of the types of communities and species, including protected species, which would be affected by that impact.

Marine Resources

Benthic Disturbances and Turbidity. Underwater construction methods (e.g., dredging, pile installation, vibro-replacement) would disturb the bottom of the Bay and would impact marine life. Impacts of dredging would include removal of the benthic community and increased levels of suspended solids and turbidity. Increased turbidity causes gill irritation in fish, reduces the level of dissolved oxygen (DO) in the water column, and reduces foraging efficiency of fish and marine mammals.

The vibro-replacement method, stitching the Tube, dredging, and pile installation at the San Francisco Transition Structure would resuspend sediment in the water column, and increase turbidity in localized areas. Micropile anchorage would occur from within the Tube, so there would be no disturbance of the Bay bottom or overlying water column.

Underwater construction may also lower DO concentrations depending on the reduced organic content of the suspended sediments. Any contaminants in the sediment would be introduced into the water column, although the bioavailability of these contaminants is likely to be low as contaminants are typically bound to sediment particles. These effects would be localized, and resuspended sediments would be diluted and dispersed by waves, currents, and tides. Although these construction efforts would be localized, they would occur for the duration of project activities.

At the San Francisco Transition Structure, it is expected that dredging, which would cause the most resuspension of sediments, would last only a few weeks. These effects would be intermittent because they would cease or dissipate at the end of each workday, but they would occur regularly over an extended period. The use of temporary steel sheet pilings around each construction area at the San Francisco Transition Structure would also isolate and contain dredged materials and construction spoils from entering the surrounding Bay water, and would limit the lateral spreading of suspended sediment plumes. For stitching the Tube, these effects would be shorter in duration at any given location, because construction would move from one location to another along the Tube alignment.

Benthic Community. Benthic flora and fauna have the greatest potential to be affected by dredging operations.

In areas that are dredged or heavily disturbed by construction, the benthic community would be lost or severely disturbed. The disturbance area at the San Francisco Transition Structure and the six locations where the Tube would be stitched would be approximately 8 acres. Minimal disturbance of the benthic community would also occur during vibro-replacement activities at the sites where the spud piles holding the template in place would be inserted into the Bay floor, and there would be deposition of particulates in areas adjacent to the larger construction areas. Rapid and deep deposition of suspended sediments (e.g., greater than 10 to 20 centimeters [cm]) may smother and kill less mobile invertebrates. However, areas experiencing this amount of deposition would likely be small. In other affected areas, invertebrates would likely burrow upward through the deposited material, or move laterally from the deposition, and survive.

Benthic community re-colonization after construction would generally occur by one of two ways: (1) larval recruitment or (2) immigration of benthic organisms from adjacent areas. Studies of re-colonization following construction indicate that re-colonization can be rapid due to the presence of opportunistic species in the area (USEPA 1993). A benthic community capable of providing a stable food source to bottom feeding fish, for example, is expected to develop within 1 year. As construction sites would not be repeatedly disturbed, the opportunistic species would be replaced over time by species that are more typically observed in later stages of colonization, until a diverse and mature community that is characteristic of the existing habitat develops. As such, impacts on the benthic community would be negligible.

No impacts to eelgrass beds (*Zostera marina*) would occur as there are no eelgrass beds near the project area or potential dredged material disposal sites.

Plankton. Potential effects of increased turbidity on planktonic organisms from dredging and construction activities include decreased phytoplankton primary productivity due to reduction of light penetration, entrapment, and sinking of plankton due to ingestion by or adhesion of particles to the plankton, and decreased survival, growth rates, and body weight of zooplankton resulting from clogged and damaged feeding appendages (USEPA 1993; O'Connor 1991; Pequegnat et al. 1978). However, the impact on plankton communities would be negligible since the turbidity increase would be localized and temporary (USEPA 1993). Because suspended material settles rapidly, reduction in light attenuation and associated reduction in primary productivity would be localized and short term, continuing only until the plume dissipates (USEPA 1993). Because the Central Bay Subregion is dynamic, with ocean currents dispersing new plankton populations, the effects are expected to be short term. As phytoplankton and some zooplankton mature to reproductive life stages within a few days and can remain viable for days to weeks, new communities would repopulate the water column every few days. As such, impacts on plankton would be negligible.

Fish. Bottom disturbance from dredging and construction activities could also affect the food resources of bottom-feeding fish. The affected area (8 acres) would be small relative to the total foraging area in the project vicinity and in the Bay (approximately 100,000 acres). In addition, water quality conditions in the construction area would likely temporarily discourage foraging by most fish in the construction area and the immediate vicinity. Once construction is completed, the benthic community would likely recover within several months to about 1 year (USEPA 1993); therefore, long-term effects on this community would be negligible.

Suspended solids in the water can impact water column-feeding fish by decreasing the visibility needed for foraging and by impairing oxygen exchange due to clogged or lacerated gills. This could occur if resuspended sediments contained high levels of reduced organic matter, which would result in localized areas of low DO levels. Suspended solids concentrations sufficient to cause adverse effects on fish are expected to occur only in the immediate construction area. Suspended solids concentrations exceeding 1,500 mg/L are considered a threshold for adverse effects on juvenile Chinook salmon (Noggle 1978). A study by the USACE on the water quality effects of a clamshell dredging project in San Francisco Bay showed that suspended solids concentration were generally below 200 mg/L at a location 50 meters down-current of the dredging site, and lower than this at greater distances (USACE 1976). This indicates that suspended solids effects on fish from project construction are likely to be negligible. The one possible exception to this is for Pacific herring. If construction occurs close to a site of herring spawning, the spawning could be adversely affected by suspended solids and related DO effects.

Mitigation Measure. Implementation of the following measure will avoid impacts to herring, during spawning season:

- *Seasonal Restrictions*. Between December 1 and February 28, a qualified observer shall monitor dredging when in proximity to potential Pacific herring spawning sites, the locations of which are well documented by the California Department of Fish and Game. Herring spawning sites are generally located in shallow water near the surface, and are visible as a large mass of herring eggs, which are adhesive, and attach most commonly on eelgrass or other algae. If herring spawning sites are observed within 200 meters of the work site by a qualified monitor stationed on a nearby boat, pier, or beach, all in-water dredging-related activities shall be stopped in the area for 2 weeks.

Effects on DO levels from dredging and construction activities on fish communities are also expected to be localized and very limited in extent. The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) DO standard for adverse biological effects is 5.0 mg/L. In the USACE (1976) dredging study in San Francisco Bay, DO levels decreased from 9.0 to 5.5 mg/L at a location 50 meters down-current of the dredging site, but increased to background levels within 10 minutes after dredging. In a study of the effects of dredging in Oakland Harbor, DO levels were reduced to 5.70-6.67 mg/L in the immediate dredging vicinity

(Hartman Consulting Group 1997). These studies indicate that the proposed construction would have negligible DO-related effects on fish.

If suspended sediments contain toxic chemicals, fish could be exposed to these chemicals in the water column. However, chemical contaminants are expected to be mostly bound to sediment particles, which would limit their bio-availability (Ludwig and Sherrard 1988; Pavlou 1978; Slotten and Reuter 1995; Thomann 1989; USEPA 1989). At the time of this writing, sediments in the project area have not been tested. Past testing of sediments near the San Francisco Ferry Terminal indicated the presence of common contaminants, including metals, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs), the latter two being common byproducts of waste oil from industrial processes (personal communication, L. Fade 2003). Although these contaminants are known to occur in a portion of the project area, sediments along this part of the San Francisco waterfront usually test suitable, in bioassay tests, for disposal at an open-water site such as the Alcatraz disposal site in San Francisco Bay (personal communication, J. Ach 2003). This indicates that contaminant levels in sediments in the project vicinity are not sufficient to cause acute toxicity. Considering this and the expectation that suspended solids would be high only in the immediate construction area, toxicity effects on fish are expected to be negligible.

Marine Mammals. Turbidity caused by dredging could impair foraging by marine mammals by reducing underwater visibility during dredging operations. These impacts would most likely affect harbor seals and California sea lions, which are common in the project area, as well as harbor porpoises, which have been observed in the project area but are not abundant. However, the impacts to marine mammals would be negligible given the extent of available foraging area in the project vicinity and the Central Bay. Based on their rare occurrence in the project area, humpback whales and Steller sea lions would not be affected by turbidity.

Marine Birds. Impacts on birds would result primarily from turbidity caused by the dredging and pile installation, noise disturbance from equipment, and indirect effects on food resources such as fish and invertebrates. Shorebirds may be startled by construction noise and equipment and personnel on the shoreline or on the water (i.e., during vibro-replacement) and may be prevented from perching or roosting in the vicinity during the construction period.

The direct effect of a turbidity plume is that it would alter the water clarity and potentially reduce foraging opportunities for the California brown pelican, the California least tern, and double crested cormorant (all visual predators) in the vicinity of the dredging operations for several hours each day. In addition, schooling fish may avoid plumes and cause these birds to forage in areas that are distant from the project site.

Depending on the construction approach for vibro-replacement and dredging associated with the San Francisco Transition Structure and stitching the Tube, foraging areas could be reduced in the project and turbidity plume area. However, the project area and available foraging habitat is small relative to the size of the Bay and impacts on foraging or other behaviors would be negligible. Although construction activities along the Transbay Tube and the transition structures are not expected to result in mortality or injury of birds, these activities would likely deter birds from foraging, roosting, or perching in the project area. The temporary reduction of roosting or perching sites along the Bay shoreline would have a negligible impact on these and other bird species.

Suspension of sediment that is suitable or unsuitable for aquatic disposal would occur during dredging operations, and may expose fish to contaminants. The use of temporary steel sheet pilings around each construction area during dredging operations would, however isolate and contain suspended sediment from entering the surrounding Bay water, and would limit the lateral spreading of a potential turbidity plume. As discussed above, toxic effects on fish are expected to be negligible. Although fish, the principal food of marine birds, may be present in the dredging area at the outset of construction and may be exposed to contaminants, most fish would likely avoid the dredging area, thereby reducing potential exposure to contaminants during construction. Birds would likely avoid the project area, thereby reducing exposure to potentially contaminated prey. As such, toxic effects resulting from exposure to contaminated sediments or prey would be negligible.

Noise. The construction operation with the greatest potential to cause noise impacts on marine species is pile installation, which would occur for stitching the Tube as well as for the pile array anchorage, and piles and collar anchorage at the San Francisco Transition Structure. Standard pile installation methods, such as pile driving using an impact hammer, would generate the highest noise levels and could affect hearing acuity, and cause physical injury or mortality in fish and marine mammals.

An oscillating or rotating pile installation method would be expected to generate considerably lower noise levels than the impact hammer method. This method does not generate strong impulsive noise and sound pressure waves, and the equipment would be staged from a barge so the noise would be airborne rather than underwater. Although no noise measurement data are available for this method, it is considered unlikely that the noise generated by this method would exceed the underwater NOAA guideline of 160 dB rms for harassment of marine mammals, or be sufficient to cause adverse effects on fish. However, geologic conditions in some locations may necessitate use of an impact hammer pile driver. Therefore, the assessment of biological impacts and development of mitigation measures presents a worst-case analysis in which the impact hammer pile driver would be used for pile installation.

The available data indicate that, without attenuation, impact hammer pile driving would generate potentially harmful underwater noise levels. For example, at the San Francisco-Oakland Bay Bridge and Benicia Bay Bridge construction projects, pile driving created peak pressures ranging from 227 dB re 1 μPa at a distance of 4 meters, to 173 dB at over 1,600 meters (BART et al. 2005c). Using the rms method, which is applicable to marine mammals, the observed levels were 210 dB rms re 1 μPa at 4 meters and 180 dB rms at over 320 meters.

Fish and marine mammals have the greatest potential to be affected by underwater noise. Invertebrates are much less sensitive to noise than fish and mammals, so reducing or preventing noise impacts on fish and mammals would also protect other marine species.

Underwater noise levels exceeding the TTS threshold of 180 dB rms (whales) would occur at a distance of at least 320 meters. The 190 dB rms TTS threshold (for pinnipeds) would be exceeded over a shorter distance. The NOAA Fisheries thresholds indicate that potential TTS in hearing, and injury or mortality, could occur in marine mammals within these distances. The marine mammal harassment threshold of 160 dB rms would be exceeded over greater distances. As discussed in section 3.9.2.1 above, if marine mammals are expected to occur within such a harassment zone, BART would need to obtain an IHA from NOAA and comply with the terms of this IHA.

If an impact hammer pile driver is used without attenuation, impacts would most likely affect California sea lions and harbor seals, as well as harbor porpoise, which have been observed in the project area but are not abundant. While similar impacts are expected for Steller sea lions, only a solitary male is known to occur seasonally in the waters near the project area. As a result, this solitary male is the only Steller sea lion expected to experience the same impacts as described for California sea lions and harbor seals. Based on their rare occurrence in the project area, humpback whales are not likely to be affected.

Although noise impact thresholds for fish are not well understood, it is possible that unattenuated noise from impact hammer pile driving could cause injury and harassment of fish over a distance of several hundred meters, and mortality, particularly of juveniles, over a much shorter distance. Underwater noise impacts could affect any fish species present in the project vicinity, including EFH species, such as the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, the Central Valley steelhead, and the Central California Coast steelhead. Due to the uncertainty associated with the presence/absence of these protected species in the Bay during construction activities, the following mitigation measures are identified. Additional details on managed (EFH) species are contained in the project BA and NES (BART et al. 2005f, 2005g).

Mitigation Measures. The following mitigation measures will be used, as warranted, to ensure that noise impacts on fish and marine mammals are kept within acceptable limits.

Based on available data from other Bay Area projects[1], the method that would protect all aquatic species is the Air Bubble Curtain (ABC) system, as this method can reduce noise levels considerably if properly designed, installed, and operated. In addition, this method would protect common and sensitive fish and mammal species regardless of migratory seasons. An IHA would likely be required to address general construction activities on the water that would disturb marine mammals in the project area regardless of the construction methods used.

- *Pilot Study, Noise Monitoring, and Contingency Control Measures.* BART shall measure noise levels generated by impact hammer and oscillation type equipment during a pile installation demonstration that will be completed before construction begins. Monitoring shall be conducted according to a work plan that shall be prepared by BART and approved by NOAA Fisheries. Noise levels shall be measured and described in appropriate units and at appropriate distances for comparison with NOAA Fisheries guidelines. Should these measurements indicate that adverse impacts on fish or marine

1 Several measurements to evaluate the effectiveness of ABC systems have been conducted. For the Benicia-Martinez Bridge project, both an unconfined ABC system and a confined ABC system were found to reduce peak sound pressure levels by 20 dB or greater. The unconfined ABC system included several vertically stacked rings to maintain a curtain of bubbles around the entire pile in strong currents. An isolation casing prevents currents from sweeping the bubble curtain away from the pile; therefore, it will provide the same effectiveness using less air. Reductions of about 5 to 20 dB have been measured for the unconfined ABC system used for the San Francisco-Oakland Bay Bridge East Span Seismic Safety Project. Reductions in sound pressure levels for other projects using ABC systems have also been between 5 and 20 dB. The amount of sound reduction provided by these systems is difficult to predict, however, due to the presence of complex noise sources that extend below the waterline.

mammals would occur, FHWA and NOAA Fisheries shall require BART to develop and implement a mitigation plan to reduce noise levels to below NOAA's impact thresholds by implementing the measure described below. Noise levels shall be monitored during construction to ensure that the control measures are effective in reducing noise to acceptable levels. Should the measurements during the pilot study indicate that noise thresholds would not be exceeded, mitigation measures would not be implemented.

- *Air Bubble Curtain (ABC) System.* Install an ABC system around the pile driver to attenuate underwater noise during pile driving activities. An ABC system, when properly installed, reduces underwater sound pressures by 5-20 dB; it can be either an unconfined curtain of bubbles, or a curtain of bubbles confined by either vinyl or other types of casings, such as an isolated pile. An isolated pile is a steel or vinyl tube lined with closed cell foam. Monitoring of pile driving at the Benicia-Martinez Bridge project showed that a multiple-ring unconfined ABC system can be as effective in reducing underwater noise levels as a confined ABC system. The design for the bubble curtain shall ensure a complete curtain of bubbles from the mud bottom to the water's surface in the current conditions anticipated during the seasons when pile driving would occur.
- *Incidental Harassment Authorization*. A harassment zone for marine mammals shall be established as a circular ring extending outward from the inner safety zone of 190 dB rms (180 dB rms for whales), to the outer limit of 160 dB rms. If there is any potential for marine mammals to occur in the harassment zone, FHWA shall obtain and BART shall comply with the conditions in an IHA from NOAA Fisheries.

Terrestrial Resources

Vegetation and Tree Removal. In the cities of Oakland and San Francisco, construction activities would remove non-native and ornamental vegetation from developed urban areas. In addition, trees may be removed from the City of Oakland, including Japanese maple and possibly California redwood. Because Japanese maples and redwoods require many years to reach maturity and the stature that is characteristic of the species, removal would be an impact because it would take many years of growth and care to replace these trees. Most other trees in the project area are sufficiently far from the construction and staging areas and would not be intentionally or accidentally removed or otherwise affected. While BART is not legally required to comply with local ordinances, including the City of Oakland Protected Trees Ordinance (Chapter 12.36 of the Oakland Municipal Code), BART adheres to these regulations to the greatest extent feasible. Accordingly, hardscape and landscape materials removed during construction will be replaced in-kind after project construction, ensuring the same type of tree is replaced at a 1:1 ratio (see section 3.8.2.2).

Construction and staging activities in the hillside surrounding the Berkeley Hills Tunnel may result in the removal of vegetation and trees; however, the wetland area adjacent to Chabot Road would be avoided. Removal of vegetation or trees would degrade the area for several years until vegetation has re-established. During the recovery period, the site would be susceptible to erosion, loss of topsoil, and weed invasion, which would substantially degrade the habitat over the long term unless the following measures are implemented to control erosion, and remove and control weedy species.

Mitigation Measures. Vegetation and tree removal impacts near the Berkeley Hills Tunnel will be controlled by implementing the following measures:

- *Avoid Tree Removal Specifically during the Nesting Season.* Trees that are retained in developed urban areas in the cities of San Francisco or Oakland, or the west portal of the Berkeley Hills Tunnel area, shall be avoided by establishing a buffer of at least 6 feet from the drip line. If tree removal is necessary, it shall be done outside the bird nesting season, which extends from March 1 through August 1.
- *Protect Wetlands.* The wetland in the Chabot Road area shall be avoided and protected by establishing erosion protection measures (e.g., silt fencing, straw bales, etc.) upslope from the wetland. These measures shall prevent disturbed soils in the project area from running off into this wetland during rainfall/runoff events.
- *Restore Construction Area.* A revegetation and/or seeding plan shall be developed for the Berkeley Hills Tunnel construction area and other areas that experience vegetation removal. The plan shall be implemented immediately following completion of construction activities at this site. The plan shall include a planting plan and plant palette; a planting, irrigation, and maintenance schedule; an erosion control plan; a weed control plan; a monitoring and reporting schedule; success criteria; and contingency measures if planting efforts fail to meet success criteria.

The Berkeley kangaroo rat is likely to occur in the project area, specifically at the Berkeley Hills Tunnel (CNDDB 2002). Construction activities associated with the Berkeley Hills Tunnel may affect remnant populations or individuals of this species. This is because this area remains densely vegetated with an understory of non-native grasses and weeds, and invasive ivy. Shrubs in this area include toyon and stands of non-native pampas grass along lower slopes. This site also supports mature and sapling trees including eucalyptus, Monterey pine, and California redwood. Noise associated with construction activities, personnel, and use of heavy equipment in this area may startle individual kangaroo rats if they are present in the work area. While construction noise is not likely to cause mortality or injury to individuals of this species, noise may cause them to disperse into unsuitable habitat nearby, a negligible impact on the species.

3.9.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

Dredged Material Reuse within the Project

Backfilling the various stitching holes using material excavated from adjacent holes would have water quality and biological impacts similar to those described for dredging (section 3.9.2.2). This material would be placed using a clamshell or tremie method, and would not be dumped from the water surface; this would reduce water quality and related biological impacts. Although material would be backfilled at most holes fairly soon (approximately 2-3 weeks) after being excavated, it is unlikely that any of the benthic organisms in the dredged material would survive for that amount of time on a dredge barge. Dredged material would be placed on top of any “ordinary backfill” placed directly on top of the Tube. Considering all factors, including the overall low percentage of Bay habitat and organisms that would be affected by dredging activities, negligible biological impacts would occur.

Dredged Material Reuse/Disposal Options outside the Project

The types of biological impacts that would occur from transport of the dredged material would be the same for all of the off-site reuse/disposal options, and so all of these options are addressed together here.

The barges transporting dredged materials will be filled with only the amount of material that can be entirely contained during transport, as described in Appendix A, section A.2.1. It is still possible, particularly in rough seas as might be encountered en route to the San Francisco Deep Ocean Disposal Site, for small amounts of dredged material to be spilled during transport from the dredging site to the reuse/disposal site(s). This would result in the same type of biological effects of turbidity as described in section 3.9.2.2. Such spills are expected to be small and infrequent, and the spilled material is expected to be quickly diluted and dissipated by waves and currents. Therefore, the biological impacts of such spills would be negligible.

Spills of fuel from the transport vessels will be controlled by implementing standard measures to minimize the frequency and size of such spills. Most commercial vessel companies operating in San Francisco Bay implement spill containment and cleanup plans. When a spill occurs, vessel operators are required to notify the National Response Center (NRC), U.S. Coast Guard, and the U.S. EPA On-Scene Coordinator. Small volumes of spilled fuel would dissipate fairly quickly. All fueling facilities are required to have a Spill Prevention Control and Countermeasure Plan (SPCC), which is implemented should a spill occurred during fueling.

Spills of dredged material could also occur from trucks along the upland portion of the transport route. Such spills will be cleaned up as soon as possible, and so would have little potential for adverse biological impacts. This potential would increase if the material were spilled or transported into a surface water body, where the same type of turbidity or contaminant impacts to marine species described in section 3.9.2.2 could occur. However, the likelihood of such a spill, and especially of transport to a water body, is low, and the volume is likely to be small.

3.9.2.4 Impacts on Threatened and Endangered Species

The impacts (effects) of the project on species protected by the ESA are addressed above in sections 3.9.2.2 and 3.9.2.3, along with other potentially affected species. For all ESA-protected and EFH species potentially occurring in the project area, including the Sacramento River Winter-run Chinook salmon (endangered), Central Valley Spring-run Chinook salmon (threatened), Central California Coast steelhead (threatened), Central Valley steelhead (threatened), Stellar sea lion (threatened), humpback whale (endangered), American peregrine falcon (endangered), California brown pelican (endangered), California least term (endangered), and western snowy plover (threatened), the analysis concludes that the project may affect, but is not likely to adversely affect, these species. The effects of the project on ESA-protected and EFH species are discussed in more detail in the BA prepared for the project (BART et al. 2005f).

3.10 AIR QUALITY

This section addresses the existing local and regional air quality conditions within the project area, and potential project impacts on this resource. Air pollutant emissions would be released directly by combustion emissions or indirectly as fugitive dust from the vehicles and equipment used during project construction and dredging activities. There would be no new emissions associated with operation of the BART system following construction.

3.10.1 Existing Setting

Air quality at a given location can be described by the concentrations of various pollutants in the atmosphere. Pollutants are defined as two general types: (1) "criteria" pollutants; and (2) toxic compounds. Criteria pollutants are pollutants for which national and/or state ambient air quality standards have been set. These include: ozone (O_3); carbon monoxide (CO); nitrogen dioxide (NO_2); sulfur dioxide (SO_2); respirable particulate matter with diameter less than 10 microns (PM_{10}); fine particulate matter with diameter less than 2.5 microns ($PM_{2.5}$); lead; visibility reducing particles; sulfates; vinyl chloride; and hydrogen sulfide.

Ozone is a secondary pollutant formed in the atmosphere by photochemical reactions of previously emitted pollutants (called precursors). These precursors are mainly nitrogen oxides (NO_x) and reactive organic gases (ROG). There are only state standards (no federal standards) for visibility reducing particles, sulfates, vinyl chloride, or hydrogen sulfide.

There are no federal or state ambient standards for toxic compounds. Toxic compounds, including those compounds identified as hazardous air pollutants (HAPs) by the federal government and/or as toxic air contaminants (TACs) by the State of California, are toxic air pollutants that have been determined to present some level of cancer, acute, or chronic health risk to the general public. The impact of toxic compounds is generally assessed using guidelines of exposure developed by the local air district. Units of concentration for both criteria pollutants and toxic compounds are generally expressed in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$).

Criteria Pollutants

Carbon Monoxide. Exposure to high concentrations of CO reduces the oxygen-carrying capacity of the blood and, therefore, can cause dizziness and fatigue, impair central nervous system functions, and induce heart attacks in persons with serious heart disease.

Ozone. O_3 can be harmful to the human respiratory system and to sensitive species of plants when it reaches elevated concentrations in the lower atmosphere. Short-term O_3 exposure can reduce lung function in children, make people susceptible to respiratory infection, and produce symptoms that cause people to seek medical treatment for respiratory distress. Long-term exposure can impair lung defense mechanisms, and lead to emphysema and chronic bronchitis.

Nitrogen Dioxide. The major health effect from exposure to high levels of NO_2 is the risk of acute and chronic respiratory disease. NO_2 is a combustion by-product, but it can also form in the atmosphere by chemical reaction.

Sulfur Dioxide. The major health effect from exposure to SO_2 is acute and chronic respiratory disease. Asthmatics are particularly sensitive. SO_2 can also react with water in the atmosphere to form acids (or so-called "acid rain") that can cause damage to vegetation and man-made materials. The main source of SO_2 is the combustion of fuels containing sulfur, chiefly coal and fuel oil.

Particulate Matter. Particulate matter is regulated as PM_{10}. More recently it was subdivided into coarse and fine fractions, with $PM_{2.5}$ constituting the fine fraction. Health effects range from repeated short-term respiratory distress to chronic respiratory disease like asthma from long-term exposure. Particulate matter also results in reduced visibility.

Hazardous Air Pollutants/Toxic Air Contaminants

As noted above, there are no ambient air quality standards for HAPs or TACs. When HAPs/TACs are identified, health effects data are evaluated on a case-by-case basis. For those TACs that have been evaluated as known or suspected carcinogens, the California Air Resources Board (ARB) has determined that there are no levels or thresholds below which exposure is risk free.

Individual HAPs/TACs vary greatly in the risk they present. The principal HAP/TAC associated with the project is diesel particulate matter, which would be emitted by diesel engines used in project construction and dredging. The U.S. Environmental Protection Agency (USEPA) currently designates diesel exhaust as a likely human carcinogen, but has not established a unit risk factor, i.e., a measure of the cancer risk associated with long-term exposure to a concentration of 1.0 $\mu g/m^3$. The USEPA's Clean Air Scientific Advisory Committee (CASAC) suggests that an annual national ambient air quality standard for $PM_{2.5}$ of 15 $\mu g/m^3$ would be adequately protective for long-term exposure to ambient diesel PM (CASAC 2000).

Conformity Determination

Areas with monitored pollutant concentrations that are lower than ambient air quality standards are designated as "attainment areas" on a pollutant-by-pollutant basis. When monitored concentrations exceed ambient standards, areas are designated as "nonattainment areas." Nonattainment areas for ozone and carbon monoxide are further classified based on the severity and persistence of the air quality problem, into categories such as "moderate," "serious," or "severe."

The Clean Air Act requires that most federally funded or approved transportation projects, plans, and programs in nonattainment areas must be shown to conform to state implementation plans for attainment of federal ambient air quality standards (referred to as "conformity determinations"). Typically, conformity for a federally funded transportation project is assessed by confirming whether the project is included in a conforming regional transportation plan (RTP) or transportation improvement program.

Under rule 40 CFR 93.126, this seismic retrofit program qualifies as an exempt project from preparing a conformity determination in two categories of the Table 2 listings of "Exempt Projects," i.e., it is (1) a "safety improvement program," and (2) a project involving "reconstruction or renovation of transit buildings and structures." In addition, this project has been included in the regional 2005 Transportation Improvement Plan (TIP), prepared and adopted by the Metropolitan Transportation Commission (MTC) on July 28, 2004, as well as MTC's RTP, *Transportation 2030 Plan for the San Francisco Bay Area*, adopted on February 23, 2005. See discussion of the Earthquake Safety Program in the 2005 TIP (MTC 2004, page 49) for further details.

3.10.1.1 The San Francisco Bay Area Air Basin

Baseline Air Quality

Table 3.10-1 summarizes the air emissions that occurred in the San Francisco Bay Area Air Basin (SFBAAB) during 2002 (ARB 2003a), and shows that the largest contributors to ROG, CO, and NO_x air pollutants in the SFBAAB are on-road vehicles. On-road motor vehicles account for approximately 40 percent of the ROG, 73 percent of the CO, and 53 percent of the NO_x emitted in the SFBAAB. The Petroleum Production & Marketing category is the largest source of SO_x emissions at 46 percent. The largest source of PM_{10} emissions (80 percent) is the miscellaneous processes category that includes sources such as residential fuel combustion, farming operations, construction/demolition activities, and road dust.

Table 3.10-1. Estimate of Average Daily Emissions by Major Source Category for the San Francisco Bay Area Air Basin – Year 2002 (Tons)

Source Category	*ROG*	*CO*	*NO_x*	*SO_x*	*PM_{10}*
Stationary Sources					
Fuel Combustion	3.4	42.3	82.8	9.2	4.3
Waste Disposal	3.7	0.1	0.3	0.2	0.1
Cleaning and Surface Coatings	37.8	0.0	0.1	0.0	0.0
Petroleum Production & Marketing	48.2	1.7	2.8	29.6	1.1
Industrial Processes	15.2	2.2	5.2	9.2	10.8
Total Stationary Sources	108.1	46.2	91.1	48.2	16.3
Area-wide Sources					
Solvent Evaporation	76.3	--	--	--	--
Miscellaneous Processes	15.0	172.2	22.0	0.7	156.9
Total Area-wide Sources	91.3	172.2	22.0	0.7	156.9
Mobile Sources					
On-Road Vehicles	182.9	1,795.8	330.4	2.6	9.4
Other Mobile Sources	74.0	452.8	178.2	12.7	13.2
Total Mobile Sources	256.9	2,248.6	508.6	15.2	22.6
Natural Sources					
Total Natural Sources	0.2	3.20	0.1	--	0.5
San Francisco Bay Area Air Basin Total	**456.6**	**2,470.2**	**621.8**	**64.0**	**196.2**
Source: ARB 2003a.					

Attainment Status

Federal Status. The SFBAAB is currently in attainment of the federal standards for CO, NO_2 and SO_2, in nonattainment for O_3, and unclassified for PM_{10} (ARB 2003b). On January 5, 2005, USEPA announced its determination that the SFBAAB is an unclassifiable/attainment area for the federal $PM_{2.5}$ standard. Due to limited available information on fine particulates, all areas not designated as "nonattainment" were designated as "unclassifiable/attainment" pending collection of additional data. In addition, on October 31, 2003, USEPA signed rulemaking proposing to determine that the SFBAAB had attained the federal 1-hour O_3 air quality standard. USEPA finalized this determination on April 1, 2004, and announced in the April 22, 2004 *Federal Register* that interim final action was being taken to stay and defer the imposition of offset and highway sanctions that would have been imposed based on the continued exceedance of the standard (FR Vol. 69; No. 78). On April 30, 2004, the USEPA then imposed a new designation on the Bay Area as a marginal nonattainment area for the new 8-hour O_3 standard (see 69 Fed. Reg. 23858, 23887). The Clean Air Act requirements for reasonable further progress, attainment demonstration, and contingency measures will therefore be applicable to the Bay Area for so long as the area continues to exceed the 8-hour O_3 standard. These requirements will be eliminated once the USEPA redesignates the area to attainment status.

State Status. The ARB designates areas of the state as either in attainment or nonattainment of the CAAQS. At present, the SFBAAB is in nonattainment of the CAAQS for O_3, PM_{10}, and $PM_{2.5}$, and in attainment of the CAAQS for CO, NO_2, and SO_2 (ARB 2003b). The SFBAAB is designated as a "serious" nonattainment area for O_3.

3.10.2 Proposed Action

3.10.2.1 Factors for Evaluating Impacts

A project would normally be considered to have an air quality impact if it would:

- Violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations;
- Conflict with adopted environmental plans or goals of the community where it is located; or
- Create a potential public health hazard or involve the use, production, or disposal of materials that pose a hazard to people, animal, or plant populations in the area affected.

However, the BAAQMD has determined that, although construction equipment emits CO and ozone precursors, these emissions have been included in the emission inventory that is the basis for regional air quality plans, and they are not expected to impede attainment or maintenance of ozone and CO standards in the Bay Area (BAAQMD 1999).

Furthermore, the factors for evaluating impacts would not be applicable to project operation activities because the project's operational emissions would be the same as existing emissions.

3.10.2.2 Impacts and Mitigation

The project consists of a variety of seismic retrofit construction activities. Air pollutant emissions would be released from the vehicles and equipment used during these activities. Air quality impacts from construction activities would occur from: (1) combustive emissions released during the use of fossil fuel-powered equipment and mobile sources, and (2) fugitive dust emissions (PM_{10}) generated during earth-moving activities and the operation of equipment and vehicles on bare soil.

Diesel particulate matter and PM_{10} would be the only construction-related emissions of concern from this project. Ozone precursor and CO emissions from project construction activities would not exceed the significance factors above. Construction-related particulate matter emissions are generally short term, but may still cause air quality impacts. Construction emissions of particulate matter can vary greatly and may cause substantial increases in localized concentrations depending on the level of activity, the specific operations taking place, the equipment being operated, local soils, weather conditions, and other factors.

The BAAQMD's approach to minimize construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions. Prior to commencement of construction, the construction contractor will be required to implement the BAAQMD's set of "Enhanced" control measures to reduce fugitive PM_{10} emissions from construction activities at all land-based construction sites during dry conditions. (The Enhanced control measures apply to sites larger than 4 acres.) In addition, BART's Standard Specifications – Section 01570, Part 1.08 requirements for dust control will be implemented (BART 2002d), and will supplement the BAAQMD measures. Implementation of these measures will reduce fugitive PM_{10} emissions from construction activities to acceptable levels. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005).

Mitigation Measures. Impacts associated with project emissions of diesel particulate matter will be reduced by implementing the following measures. Implementation of these measures also effectively reduces emissions of ozone precursors (ROG and NO_x).

- The BART District shall require the construction contractor(s) to use emulsified diesel fuel in project equipment, where feasible. Use of this alternative diesel fuel will reduce NO_x and diesel particulate matter emissions by 14 and 63 percent, respectively, compared to the use of conventional diesel fuel (ARB 2001).
- The BART District shall require the construction contractor(s) to use heavy-duty diesel-powered construction equipment manufactured after 1996 (with federally mandated "clean" diesel engines), whenever feasible. Use of newer equipment will result in lower emissions, compared to older equipment, due to the effects of the EPA/ARB off-road engine emission standards. For example, for the 176 to 250 horsepower range, NO_x emission standards are 43 percent lower for 2002-manufactured equipment compared to 1987-manufactured equipment.
- Emissions generated by construction equipment shall be reduced by application of the following equipment control measures:

a. The engine size of construction equipment shall be the minimum practical size.

b. Construction equipment shall be maintained in tune per the manufacturer's specifications.

c. Diesel-powered equipment shall be replaced by electric equipment, whenever feasible.

3.10.2.3 Dredged Material Reuse/Disposal Impacts and Mitigation

Dredged Material Reuse within the Project

The main source of construction-related emissions during backfilling activities onsite during the stitching operation would be combustion products from project dredging equipment and vessels (primarily diesel-powered clamshell dredges, tugboats that assist the dredges and position the dredged material barges, survey boats, and tender boats). The emissions of CO and ozone precursors from these construction sources have been included by the BAAQMD in the regional air quality plans and would, therefore, not have an air quality impact. Fugitive PM_{10} emissions would not be a concern for these water-based activities. However, combustion emissions would include diesel particulate matter emissions, which could result in an air quality impact.

In addition, diesel particulate matter emissions would be generated by the barges used to haul the leftover dredged material to the offsite reuse/disposal locations (31 total barge trips anticipated), and by the equipment used to unload the material at the sites. No unloading equipment would be required at the Alcatraz or SF-DODS disposal sites since the dredge material transport barges would be bottom dumped at these locations. At the upland disposal sites, diesel particulate matter emissions and fugitive PM_{10} emissions would also be associated with the spreading equipment and/or trucks used to move the material to its final placement location. Disposal at the landfill sites would similarly result in diesel particulate matter and fugitive PM_{10} emissions associated with truck trips between the dewatering facility at the Port of Oakland and the landfill site (assumed 28 per day total, during a consecutive 22-month dewatering period). The estimated maximum of 28 daily truck trips could result in as few as 2 truck trips per hour during a 16-hour day (no hauling would occur during peak hours), or as many as 8 truck trips per hour, which could result in an air quality impact.

Project PM_{10} and diesel particulate matter emissions associated with the dredging and reuse/disposal activity could create a public health hazard and result in a regional air quality impact. However, prior to commencement of construction, the construction contractor will be required to implement the BAAQMD's set of "Enhanced" control measures to reduce fugitive PM_{10} emissions, as well as BART's Standard Specifications – Section 01570, Part 1.08 requirements for dust control. Implementation of these measures will ensure fugitive PM_{10} emissions from construction activities are within acceptable levels. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005). The mitigation measures identified above are applicable, and their implementation will reduce diesel particulate matter emissions.

Dredged Material Reuse/Disposal Options Outside the Project

Similar to the scenario described above, diesel particulate matter emissions would be generated by the barges used to haul the material to the reuse/disposal locations (64 maximum barge trips anticipated) and by the equipment used to unload the material at the site. No unloading equipment would be required at the Alcatraz or SF-DODS disposal sites since the dredge material transport barges would be bottom dumped at these locations. At the upland disposal sites, diesel particulate matter emissions and fugitive PM_{10} emissions would also be associated with the spreading equipment and/or trucks used to move the material to its final placement location. Disposal at the landfill sites would similarly result in diesel particulate matter and fugitive PM_{10} emissions associated with truck trips between the dewatering facility at the Port of Oakland and the landfill site (also assumed 28 per day total, during a consecutive 22-month dewatering period). The estimated maximum of 28 daily truck trips could result in as few as 2 truck trips per hour during a 16-hour day (no hauling would occur during peak hours), or as many as 8 truck trips per hour, which could result in an air quality impact.

Project PM_{10} and diesel particulate matter emissions associated with the dredging and reuse/disposal activity could create a public health hazard and result in a regional air quality impact. However, prior to commencement of construction, the construction contractor will be required to implement the BAAQMD's set of "Enhanced" control measures to reduce fugitive PM_{10} emissions, as well as BART's Standard Specifications – Section 01570, Part 1.08 requirements for dust control. Implementation of these measures will ensure fugitive PM_{10} emissions from construction activities are within acceptable levels. For additional details, see the BART Seismic Retrofit Project Construction Standards Manual (BART 2005). In addition, the mitigation measures identified above are applicable, and their implementation will reduce diesel particulate matter emissions.

3.11 SOCIAL IMPACTS

Social impact assessment is a process for evaluating the effects of a proposed project on a community and its quality of life. The assessment generally discusses items of importance to communities, and specifically to certain social groups (e.g., elderly persons, disabled persons, transit-dependent individuals, and ethnic groups), such as mobility, safety, employment effects, relocation, isolation, and other community issues. This section follows the guidance in FHWA Technical Advisory T6640.8A, and Caltrans 2004 guidelines for a Community Impact analysis in an EA. In addition, this section summarizes the demographic information and conclusions of the Environmental Justice Technical Study (BART et al. 2005i), which evaluates potential project impacts on minority and low-income communities, as defined by Executive Order 12898 (see Appendix C, section C.11).

Because the project would not change the alignment, or otherwise increase the capacity of the BART system, changes in community cohesion such as splitting neighborhoods, isolating a portion of a neighborhood, generating new development, or otherwise separating residents from community facilities would not occur. In addition, social impacts to police and fire protection, churches, and businesses (e.g., loss of employment or patronage) are not evaluated further because households and businesses will not be affected as a result of project retrofit activities. See section 3.7 (Risk of Upset/Safety) for a discussion of project activities requiring police and fire agency input and coordination.

3.11.1 Community Character and Cohesion

3.11.1.1 Existing Setting

Community Boundaries

The project portion of the BART system passes through the City of Oakland (Alameda County) and the easternmost portion of the City and County of San Francisco. Within these cities, potentially affected areas correlate to the areas of impact analyzed in each environmental resource of this EA. Consequently, the definition of "potentially affected areas" differs for traffic, noise, air quality, and other resources.

City of Oakland. Oakland is located on the eastern shore of San Francisco Bay and is California's eighth largest city, with a population of approximately 399,484. Bordered on the north by the City of Berkeley, the east by the East Bay Hills, the south by the City of San Leandro, and the west by San Francisco Bay, Oakland occupies an area of 78.2 square miles. The project portion of the BART system passes through several communities in Oakland. The potentially affected areas are limited, however, to the immediate vicinity of the proposed work sites.

The eastern end of the project portion of the BART system, between the western portal of the Berkeley Hills Tunnel and Rockridge Station, is located in Oakland's predominantly residential Rockridge neighborhood. Project work sites located in this community include overpasses at Chabot Road, Golden Gate Avenue, Patton Street, Presley Way, Forest Street, and Claremont Avenue, as well as the aerial Rockridge Station. Most of this segment of BART is contained within the median of the elevated State Route 24, which follows major roadway alignments characterized by a mix of commercial and residential development.

West of Rockridge Station, BART remains elevated in the median of State Route 24, which passes through the MacArthur neighborhood of North Oakland, as it approaches downtown Oakland. The BART system follows major roadway alignments throughout this area, and BART work sites, including MacArthur Station and a number of overpasses, are located in predominantly commercial districts. North of downtown Oakland, single- and multi-family residential uses are located adjacent to the overpasses spanning Sycamore, 27th, and Jefferson Streets; 29th Street; 30th Street; MacArthur Boulevard; 42nd Street; 45th Street; Shattuck Avenue; and 55th Street.

West of MacArthur Station, between the downtown Oakland tunnel and the Aerial Transition Structure in the Port of Oakland, the BART aerial guideway passes through the community of West Oakland. West Oakland is a well-defined neighborhood bounded by Port of Oakland property and Interstates 580, 880, and 980. Land uses vary as the aerial guideway crosses different neighborhoods within West Oakland, but are uniformly urban. Land uses are predominantly industrial closer to the Oakland City Center/12th Street Station in downtown Oakland, transitioning to light industrial and commercial uses as BART approaches the junction of Interstates 880 and 980. East of the West Oakland Station, the surroundings are mixed commercial and residential. Between the West Oakland Station and Interstate 880 at the edge of the Port, the aerial guideway passes through neighborhoods supporting a mix of commercial and residential development. Immediately approaching the Port, the aerial guideway passes through an industrial area, developed with warehouses, which is associated with the Port.

The Oakland Transition Structure and Aerial Transition Structure are located on the waterfront within the Port of Oakland. The Port comprises a range of land uses, including container terminals, rail and intermodal facilities, public recreational facilities including parks and a segment of the regional San Francisco Bay Trail, and the Oakland Army Base. The Oakland Transition Structure is in the Port's interior between Berths 34 and 35. It is visible from 7th Street and a portion of the San Francisco Bay Trail where it parallels 7th Street.

The Aerial Transition Structure is located along 7th Street within the Port and is bordered by the San Francisco Bay Trail, which connects Port View Park and Middle Harbor Park on the west with Jack London Square and Estuary Park on the east. The surrounding area is dominated by industrial and Port-related development.

***City of San Francisco*.** The City of San Francisco occupies a geographic area consisting of 47 square miles on the northern tip of San Francisco Peninsula, between San Francisco Bay and the Pacific Ocean. The project portion of the BART system is underground and follows Market Street for about ¾ mile, from the San Francisco Ferry Plaza on the Northeastern Waterfront to the Montgomery Street Station. This route passes through the City's predominantly commercial and corporate downtown Financial District.

Community Facilities and Activity Centers

The project portion of the BART system includes work sites in proximity to heavily visited recreation centers, including (from east to west) Hardy Park, a Caltrans-owned facility in

Oakland's Rockridge neighborhood; a segment of the San Francisco Bay Trail within the Port of Oakland; and the San Francisco Ferry Building and Ferry Plaza. Each is discussed below.

HARDY PARK – OAKLAND

At Claremont Avenue and Hudson Street in Oakland, the BART line and State Route 24 pass over Hardy Park, a collection of recreational facilities including the recently built Hardy Park Playground (a "tot lot"), a basketball court, and an enclosed off-leash dog park located at the northern end of the Rockridge-Temescal Greenbelt. The greenbelt follows the Temescal Creek alignment, roughly paralleling Claremont Avenue for three blocks. A second playground, the Redondo Playground, was recently constructed at the southern end of the greenbelt. The BART line passes directly over the northern end of the predominantly packed-dirt dog run, which supports some lawn. Landscaping beneath and on either side of the BART line is limited to dense ivy along slopes and a single young, but established and healthy, Japanese maple tree (*Acer palmatum*) that appears to be an ornamental planting. Other mature park landscaping and recreational facilities associated with the Rockridge-Temescal Greenbelt are relatively far (i.e., 30 feet or more) from the BART tracks.

Hardy Park was established on state right-of-way and is subject to the terms and conditions of the lease executed on September 11, 1991, between the City of Oakland (lessee) and the California Department of Transportation (Caltrans). The lessee's rights to occupy the property can be revoked at any time "…when any portion… is required for State highway or other public transportation purposes as determined by the …Department of Transportation…" The terms of the lease make it clear that Hardy Park occupies state right-of-way on a temporary basis. Hardy Park is not a publicly-owned public park; the City of Oakland Office of Parks and Recreation does, however, operate and maintain the park.

SAN FRANCISCO BAY TRAIL – OAKLAND

A segment of the publicly accessible San Francisco Bay Trail parallels BART's Aerial Transition Structure along 7th Street within the Port of Oakland. The trail is part of a regional recreational corridor comprising 210 miles of existing bicycle and hiking trails ringing San Francisco Bay and connecting the nine Bay Area counties; 19 miles of the trail system are located in Oakland. Trail segments are owned and maintained by local jurisdictions in which they are located. The Port of Oakland owns and maintains the segments of the trail on its property.

The segment near the Aerial Transition Structure is designated on ABAG trail maps as an improved (asphalt-paved) and landscaped mixed-use trail that shares the 7th Street right-of-way in places. It provides public waterfront access by connecting Port View Park and Middle Harbor Shoreline Park, to the west, with inland trail segments and points of interest such as Jack London Square and Estuary Park (ABAG 2003). The trail is landscaped by the Port along 7th Street as far east as Adeline Street.

FERRY PLAZA – SAN FRANCISCO

The Northeastern Waterfront is the center of San Francisco's downtown waterfront area and a popular scenic and recreational destination. This area is the site of a revitalization program of urban improvements intended to replace the former double-decked Embarcadero Freeway, demolished in 1991 following the Loma Prieta earthquake, with public plazas, walkways, and waterfront access. The centerpiece of the Embarcadero waterfront is the Ferry Building Marketplace, housing a mix of permanent commercial and professional uses, and farmers markets on Tuesdays, Thursdays, Saturdays, and Sundays in open arcades and on the esplanade portion of the Ferry Plaza. The esplanade is open to pedestrians.

Roadways, Transit Services, and Bicycle and Pedestrian Circulation

The project would affect roadways, transit services, and bicycle and pedestrian facilities in the Oakland. There would be no impact on roadways in San Francisco, where the project portion of the BART system is underground; however, impacts to ferry services at the San Francisco Ferry Building could occur as a result of retrofit activities at the San Francisco Transition Structure.

City of Oakland. The Oakland portion of the BART system is surrounded by roads, transit services (e.g., bus stops, taxi stands, casual carpool, etc.), parking, and bicycle and pedestrian facilities. Construction at proposed retrofit locations would not impact area freeways, including State Route 24 and Interstates 880 and 980; however, some components of the construction work would impact specific freeway ramps and ramp intersections with local streets. In addition, there are 40 streets adjacent to, or that cross, the proposed retrofit construction areas.

Parking around the BART alignment includes both on-street and off-street parking areas. Retrofit activities would affect the total amount of parking available at and near the stations throughout the duration of construction. On-street parking spaces appear to be most fully utilized in areas closest to the Rockridge, MacArthur, and West Oakland Stations, as described in section 3.4 (Transportation).

With respect to public transit, Oakland is primarily served by BART; additionally Alameda-Contra Costa Transit District provides bus service in the project area and operates 17 routes. Many residents in Oakland depend on public transit for transportation (Pacific Institute 2002). In addition, bicycle routes, taxi stands, and a casual carpool location are designated in the vicinity of the BART alignment.

Bicycle and pedestrian facilities, including Caltrans-designated bikeways and sidewalks are also located throughout the project area, as described in section 3.4 (Transportation).

City of San Francisco. The San Francisco Ferry Building is located on the far eastern edge of San Francisco, in downtown San Francisco. The Ferry Building has three platforms (the North Terminal, Ferry Plaza, and South Terminal) providing six berths. The North Terminal is used by the Tiburon and Vallejo ferries, the Ferry Plaza is used by the Larkspur and Sausalito ferries, and the South Terminal serves ferries going to and from the East Bay/Alameda. Three ferry companies, with various routes, operate from the Ferry Building: Blue and Gold Ferry; Golden Gate Ferry; and Harbor Bay Ferry.

Construction activity at the San Francisco Transition Structure on the Ferry Plaza Platform would occur beyond the primary pedestrian portion of the Ferry Plaza Platform used by ferry passengers. The platform adjacent to the transition structure is, however, used by pedestrians viewing San Francisco Bay.

3.11.1.2 Proposed Action

3.11.1.2.1 Factors for Evaluating Community Character and Cohesion Impacts

The determination of impacts to community character and cohesion are based on FHWA and Caltrans guidance. Impacts would occur if the project resulted in changes (either beneficial or adverse) to neighborhoods or segments of a community that disproportionately affected elderly persons, disabled persons, transit-dependent individuals, and/or ethnic groups, including:

- Physically dividing or isolating a neighborhood or community;
- Inhibiting a community's growth; and/or
- Altering the quality of life for neighborhood residents or businesses due to:
  - separation of residences from community services and facilities (e.g., recreation areas, school districts, churches, businesses, police and fire stations);
  - increased or decreased public access (e.g., vehicular, commuter, bicycle, or pedestrian); and/or
  - introduction of public safety hazards, including traffic hazards.

3.11.1.2.2 Impacts and Mitigation

COMMUNITY BOUNDARIES

The proposed project would affect only existing BART system facilities in Oakland and San Francisco, would not introduce new facilities in locations where none currently exist, or otherwise displace or divide persons, businesses, or neighborhoods.

In Oakland, the proposed project would be entirely confined to the existing BART system, and therefore would not increase the division or isolation of neighborhoods or communities, inhibit a community's growth, or alter the quality of life for neighborhood residents or businesses.

In San Francisco, retrofitting activities would take place in a confined area around the Ferry Plaza, and would similarly not divide or isolate an existing neighborhood or community, inhibit a community's growth, or otherwise alter the quality of life for area residents or businesses.

COMMUNITY FACILITIES AND ACTIVITY CENTERS

FHWA has the responsibility to make a determination regarding the application of Section 4(f) to resources potentially affected by project actions, such as those at Hardy Park and the 7th Street segment of the San Francisco Bay Trail, per 49 USC 303 and 23 CFR 771.135(b). In support of FHWA's determination, BART conducted a Section 4(f) consultation with potentially affected agencies having jurisdiction over those resources. Letters were submitted to the City of Oakland and the Port of Oakland requesting concurrence that the project would not substantially or permanently impair use of park or trail amenities. Based on the results of this correspondence, FHWA determined there is no Section 4(f) use associated with the project (see Appendix D, Section 4(f) Correspondence).

Hardy Park. Project construction at the Claremont Avenue and Hudson Street BART/State Route 24 overpass would occur close to Hardy Park recreational facilities, which are owned by Caltrans and operated and maintained by the City of Oakland's Parks and Recreation Department. Project implementation at the Claremont Avenue/Hudson Street BART overpass would require foundation expansions, and new piling and pier cap retrofits on Pier (column) numbers 57 through 62; installation of new concrete shear keys atop the columns; and excavation for enlargement of column footings. Three of the piers (59 through 61) are located within Hardy Park or at the edge of the block containing the park; one of the three piers is located within the dog park. Retrofit activities at the remaining three piers (57, 58 and 62), which are located on the opposite side of Claremont Avenue (Pier 57), in the median of Claremont Avenue (Pier 58) and on the opposite side of Hudson Street (Pier 62), will not affect the dog park.

The need for construction access to the piers in Hardy Park, and the associated construction activity, would require closure of the dog park and basketball facilities for approximately 2 months for the retrofit of Piers 59, 60, and 61, which are located within those facilities. In correspondence regarding Section 4(f) issues, FHWA stated that Hardy Park is not a publicly-owned public park, and not a Section 4(f) resource; therefore, no Section 4(f) use would occur. However, project-related construction would result in noise, vibration, and localized air quality impacts (i.e., fugitive dust) generated by the operation of construction equipment, and would affect the park. Construction would require removal of existing landscaping, including grass at the dog park, ivy, an ornamental Japanese maple, and an ornamental sweet-gum tree. Construction would be temporary, and the project includes measures to ensure the adequate restoration of park amenities to pre-project conditions, including clean up, regrading, recompacting, repavement or relandscaping of the park, and replacement of any damaged fencing. No other park facilities would be affected.

Bay Trail. The project would require the seismic strengthening of the aerial guideway atop which the BART tracks leave the Transbay Tube portal and are carried 22 feet aboveground to the West Oakland Aerial Guideway. Six new footings (i.e., foundations) and external columns would be constructed adjacent to the existing footings and piles at Bent numbers 3, 4, and 5. Additional seismic improvements include retrofitting the Aerial Transition Structure's abutment with the West Oakland Aerial Guideway to the east (at Bent number 6), and installation of longitudinal restraints on the guideway structure.

The new columns would be located less than 3 feet from the edge of the San Francisco Bay Trail where it passes by the Aerial Transition Structure. Excavation for construction of expanded foundations for the columns could abut or extend into (beneath) the trail alignment. In addition, construction-related high noise levels, vibration, localized air quality impacts (i.e., fugitive dust), and potential safety hazards (i.e., from moving equipment, excavation) would preclude use of the trail in the vicinity of the construction work and constitute temporary occupancy. Other project impacts at this location include the reduction of visual quality (i.e., temporary blockage of visual sightlines along the trail, removal of landscaping). Because of the close proximity of the Aerial Transition Structure to the trail, construction access and activity would require temporary closure of the adjacent segment of the trail for approximately 2 months.

The project's occupancy of the trail segment would be temporary and would meet the terms of 23 CFR 771.137(p)(7) "Temporary Occupancy." Accordingly, there is no Section 4(f) use associated with this trail segment. The trail would be relocated during this time to the adjacent 7th Street right-of-way for the duration of construction (other segments of the trail are permanently located in the 7th Street right-of-way). The project also includes measures to ensure the adequate restoration of trail amenities to pre-project conditions, including clean up, regrading, recompacting, repavement or relandscaping of the trail segment, and replacement of any damaged fencing.

The Port of Oakland has indicated that the project would be consistent with the designated use of recreational areas within the Port's jurisdiction, and would not impact this segment of the San Francisco Bay Trail (see Appendix D, Section 4(f) Correspondence). The following mitigation measures are identified, however, to ensure coordination with the Port of Oakland throughout the duration of project construction.

Mitigation Measures. The following mitigation measures will be implemented to avoid impacts to the 7th Street Bay Trail segment in the Port of Oakland:

- The construction contractor will submit all construction plans for retrofit activities in the vicinity of the affected 7th Street Bay Trail segment, and will coordinate the construction schedule with the Port Engineering Design and Construction Departments.
- The construction contractor will also coordinate the alignment of the temporary detour of the trail, and the associated directional signage, with the Port Environmental Planning Department.

San Francisco Ferry Plaza. The project would result in the temporary removal of a portion of the San Francisco Ferry Plaza, which is a popular scenic destination open to the public. As part of project implementation, the Ferry Plaza would be restored to its pre-project condition. Moreover, this portion of the waterfront is not the sole publicly-accessible scenic destination on San Francisco's Northeastern Waterfront; there are numerous other opportunities for sightseeing in the immediate vicinity. For this reason, impacts related to use of this facility are considered negligible.

Other Community Facilities. Retrofitting piers at the Rockridge and MacArthur Stations would take place in proximity to public artworks, including the Firestorm Community Mural at Rockridge Station, and wall paintings and sculptures at MacArthur Station. The project includes protective measures that will ensure the preservation of the artworks during construction, so no impacts on the artworks are anticipated.

The Oceanus Mural on the State Route 24 underpass is more than 20 feet from Pier 57 at the Claremont Avenue and Hudson Street overpass location, which is the closest pier planned for reinforcement, and would not be affected by construction.

ROADWAYS, TRANSIT SERVICES, AND BICYCLE AND PEDESTRIAN CIRCULATION

Roadway Closures. Temporary closure of roadway segments in the project vicinity, including northbound Patton Street and the on-ramp from 52nd Street to State Route 24 and Interstate 580, may occur as a result of project construction activities, as described in section 3.4 (Transportation). A detour would be provided, which may temporarily affect traffic operations in the area, and increase travel time for drivers.

However, impacts to these roadway segments will be avoided because the construction contractor will be required to prepare and implement a construction phasing plan and traffic management plan (TMP) that specifically addresses accommodations for local street traffic at this location throughout the duration of retrofit activities. For additional details, see the Traffic Technical Study (BART et al. 2005h).

Public Transit. Construction would require relocation of several bus stops in Oakland, including those located at Rockridge, MacArthur, and West Oakland Stations. Taxi loading areas at the Rockridge and MacArthur Stations would also need to be temporarily relocated during construction. In addition, a casual carpool staging area located along Hudson Street approaching Claremont Avenue would be impacted by the temporary closure of the curb parking lane during construction, which would require temporary designation of an alternative location for queued vehicles waiting for riders.

Temporary impacts to transit-dependent individuals and non-drivers in the communities surrounding retrofit locations as a result of temporary closure of street lanes, as well as temporary relocation of bus and taxi loading areas and a casual carpool location, will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for traffic operations at the affected locations throughout the duration of retrofit activities.

Construction activities at the San Francisco Transition Structure could require closure of the northern berth of the Ferry Building's South Terminal for up to 1 year, as described in section 3.4 (Transportation). Golden Gate Berth 2 would also be unavailable for at least 3 months to 1 year. These closures would disrupt ferry service for approximately 5,500 daily ferry passengers. Measures to prevent impacts to ferry services as a result of project activities are described in Table 3.4-11, in section 3.4 (Transportation).

Parking Supply. Construction at the Rockridge and West Oakland Stations would temporarily close some parking spaces within the parking lots and temporarily eliminate some on-street parking, as described in section 3.4 (Transportation). Curb parking would also be temporarily removed at each location where on-street curb parking presently exists.

Impacts to parking, including the six handicapped parking spaces at Rockridge Station, will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for parking at these locations throughout the duration of retrofit activities. In addition, implementation of mitigation measures that would provide on- and off-site replacement parking, and temporary relocation of disabled parking spaces within Rockridge Station at a comparable location, would ensure impacts are avoided (see section 3.4 [Transportation]).

Bicycle and Pedestrian Circulation. There would be no permanent impacts on bicycle circulation in Oakland. However, retrofit construction would temporarily create narrowed curb lanes and could reduce bicycle safety on several routes. These include the existing Class III bike routes on College Avenue and Forest Avenue, as well as at several locations included in the City of Oakland recommended bikeway network, as described in section 3.4 (Transportation).

The project would also not permanently increase traffic hazards to pedestrians or impact pedestrian circulation. However, it may be necessary to temporarily close the sidewalk on at least one side of the street in two locations, including Chabot Road, which provides access to Chabot Elementary School, and at Martin Luther King Jr. Way off-ramp, as described in section 3.4 (Transportation). If project activities temporarily close the sidewalk on one or both sides of the street, pedestrians would need to detour to the opposite sidewalk or to adjacent streets, as warranted, including school children walking to Chabot Elementary School.

With implementation of project measures addressing introduction of public safety hazards on bicycle and pedestrian circulation, including preparation and implementation of a construction phasing plan and TMP that specifically addresses accommodations for bicyclists and pedestrians at these affected locations throughout the duration of retrofit activities, bicyclists using affected routes, and pedestrians walking to nearby schools, BART stations, or other transit locations will not be impacted.

3.11.1.3 Dredged Material Reuse/Disposal Impacts and Mitigation

Reuse of dredged material within the project, as well as disposal outside the project area, would not result in social impacts, such as increasing the division or isolation of neighborhoods or communities, inhibiting a community's growth, or otherwise altering the quality of life for neighborhood residents or businesses. Because of project measures that would restore affected areas to pre-project conditions and compliance with applicable regulatory requirements, reuse of dredged material would not change existing community characteristics or cohesion.

3.11.2 Environmental Justice

An Environmental Justice Technical Study (BART et al. 2005i) was prepared to analyze the environmental justice impacts associated with the project. The analysis is based on impacts on other resource areas analyzed in this document. Issue-specific analyses for the environmental resources applicable to environmental justice concluded that project construction would result in temporary and negligible impacts on those resources. Accordingly, project construction would not result in disproportionately high and adverse effects on minority or low-income populations in the Oakland and San Francisco project areas (BART et al. 2005i).

3.11.2.1 Existing Setting

The communities in Oakland and San Francisco that were evaluated for purposes of environmental justice correspond to areas of potential impact as defined in the analyses of individual environmental resources in this EA. Data characterizing the current demographic profile of the Oakland and San Francisco project areas were obtained from the U.S. Bureau of the Census (Census 2000).

Minority Population in the Project Area

City of Oakland. In the City of Oakland, Blacks (or African Americans) and Whites form the largest racial/ethnic groups, constituting 35.7 and 31.3 percent of the city's population, respectively. The other major racial/ethnic groups are Hispanic/Latino (21.9 percent) and Asian (15.2 percent). Approximately 68.7 percent of Oakland's population consists of minorities. The project area supports a relatively higher population of Blacks (African Americans), Latino-Black, and Latino-Asian populations than the rest of the City. White, Hispanic/Latino, Asian, and other minority populations (such as Native Hawaiian or Other Pacific Islander) each constitute a smaller percentage of the project area population than they do of the citywide population.

City and County of San Francisco. One of the most densely populated counties in the nation, San Francisco has a population of 776,733 and is the state's fourth largest city according to the 2000 census. Of this population, 49.7 percent is White, 30.8 percent is Asian, 14.1 percent is Hispanic, and 7.8 percent is Black (or African American). The project area, which is along the Northeastern Waterfront near the downtown Financial District, supports a relatively larger Asian population than the rest of the City. Other major ethnic groups are represented in relatively lower concentrations in the project area than citywide.

Low-Income Population in the Project Area

The U.S. Census Bureau's definition of poverty serves as the U.S. Government's official statistical definition of poverty. If a family's total income is less than the Census Bureau's poverty threshold, then that family is considered poor. Unlike low- and very-low income thresholds, which are often defined by a state or region, Census Bureau poverty thresholds do not vary geographically, but are updated annually for inflation using the Consumer Price Index (CPI-U). An average household size of three persons is assumed for both the cities of Oakland and San Francisco, based on Census 2000 data.[1] The most recent poverty threshold (2002) for three-person households is $14,072 per year (weighted average).[2]

City of Oakland. Assuming an average household of three persons, approximately 27.3 percent of households in the project area are estimated to live below the poverty level threshold of $14,072 per year, compared to 19.3 percent citywide. Thus, the percentage of persons in the project area who live below the poverty level threshold is relatively higher than throughout the City as a whole.

City and County of San Francisco. Assuming an average household of three persons, approximately 16.3 percent of households in the project area are estimated to live below the

1 For the purposes of this analysis, average household sizes in both cities were assumed to be three persons. This number was derived by identifying (1) the approximate median between the average household size of 2.3 and the average number of family members per household of 3.20 and rounding up (San Francisco); and (2) the approximate median between the average household size of 2.6 and the average number of family members per household of 3.38 (Oakland).

2 The FHWA has issued Interim Guidance entitled *Addressing Environmental Justice in Environmental Assessments/Environmental Impact Statements*, which implements DOT guidance, and therefore Executive Order 12898 and EPA guidance (FHWA 2001; EPA 1998; DOT 1997). FHWA's 2001 Interim Guidance directs that low-income populations be identified using Department of Health and Human Services poverty thresholds, which were used in this analysis. The Department of Health and Human Services bases its thresholds on those developed by the Census Bureau.

poverty level threshold of $14,072 per year, compared to 11.3 percent citywide. Thus, the percentage of persons in the project area who live below the poverty level threshold is relatively higher than throughout the City as a whole.

Existing Environmental Conditions

Health Risks. Oakland project area residents are subject to greater health risks from air and water pollution, and soil contamination than the rest of the City, as measured by the sum of toxics generated in Oakland (i.e., air emissions, surface water discharges, land releases, underground injections, and chemical transfers to off-site facilities) by facilities reporting to the Toxics Release Inventory (TRI) (Pacific Institute 2002). Other sources of pollution include diesel emissions from ship traffic, the freeways and roadways; small businesses such as gas stations and dry cleaners; and abandoned brownfield sites. Toxic releases are associated with cancers and respiratory problems such as asthma, which particularly affects young children and the elderly.

Ship and boat traffic along San Francisco's Northeast Waterfront, where the San Francisco Transition Structure is located, and in the Bay contribute to increased diesel emissions in the area, which are linked with cancer. The nearest (commercial) sensitive receptors include restaurants and shops at the Ferry Building, and nearby professional offices; no residential uses are located in the project vicinity.

Surface runoff from the Bay Bridge and Interstate 80 and urban runoff from adjacent streets, industrial sites, and open areas flows directly or indirectly into the Bay. Other input sources to the Bay include discharges from municipal wastewater treatment plants, discharges from dredging operations, discharges from other industrial processes, and atmospheric deposition. San Francisco Bay is an impaired water body, meaning it does not meet its designated uses because of excess pollutants. Urban runoff or spills of hazardous materials into or near open water along San Francisco's Northeast Waterfront can adversely affect the area's water quality.

Air Quality. The San Francisco Bay Area Air Basin (SFBAAB), which includes the entire project area, is classified by the U.S. Environmental Protection Agency (USEPA) and California Air Resources Board (ARB) as being in nonattainment of federal and state standards for ozone, respectively. The SFBAAB is unclassified by federal standards for particulate matter less than ten microns in size (PM_{10}), and in nonattainment of state standards for PM_{10}. Due to limited available information on fine particulate matter ($PM_{2.5}$), the SFBAAB was recently (January 5, 2005) designated by USEPA as "unclassifiable/attainment" pending collection of additional information; ARB has designated the area in nonattainment of state standards for $PM_{2.5}$.

The Oakland project area is crossed by four freeways (Interstates 580, 880, and 980 and State Route 24) and numerous major boulevards and roadways, and is east of the Port of Oakland, a source of pollutants associated with industrial facilities, tenants, shipping and cargo handling, and Port-related truck traffic.

Since prevailing winds generally blow from west to east, the San Francisco Peninsula typically has better air quality than the East Bay and inland locations. Ship and boat traffic along San Francisco's Northeast Waterfront, where the San Francisco Transition Structure is located, contributes heavily to air quality in the project area.

Noise and Vibration. The project areas can be divided into four noise environments: (1) near the west portal of the Berkeley Hills Tunnel; (2) BART tracks within State Route 24; (3) BART tracks on the West Oakland Aerial Guideway; and (4) the San Francisco Transition Structure. Sensitive noise receptors near the Berkeley Hills Tunnel include residences, the Chabot Recreation Center, and Anthony Chabot Elementary School. Along State Route 24, sensitive noise receptors are typically located at least 250 feet from proposed work locations, and are partially or fully shielded by intervening highway structures. Along the West Oakland Aerial Guideway, surrounding land uses are commercial and residential, with residences as close as 50 feet from work areas in some locations. Sensitive receptors near the San Francisco Transition Structure include commercial uses, such as the World Trade Center, located at the Ferry Plaza.

Destruction or Diminution of Aesthetic Values. The Oakland portion of the BART route traverses neighborhoods in Rockridge, downtown Oakland, West Oakland, and the Port of Oakland, which possess distinct visual characters and qualities. The viewing audience throughout the Oakland portion of the BART route includes motorists and pedestrians on nearby roadways; residences and businesses within sight of the BART right-of-way and stations; and people using Hardy Park in the Rockridge neighborhood of Oakland, and the San Francisco Bay Trail in the Port of Oakland.

The San Francisco portion of the BART route encompasses a portion of the Ferry Plaza on the Embarcadero along the Northeastern Waterfront, and also extends beneath the Bay to the east. The Ferry Plaza is a prominent architectural feature in the project area, and occupies a scenic location set against the backdrop of the downtown Financial District skyline to the west, and offering views of San Francisco Bay, the Bay Bridge, and Yerba Buena Island to the east. The landside viewing audience comprises patrons of the ferry terminal, World Trade Club, and the Ferry Building Marketplace; motorists, pedestrians, and sightseers on the Embarcadero and Ferry Plaza; and occupants of high-rise buildings to the west. The waterside viewing audience includes Bay Bridge motorists, boaters, and people aboard ships and barges.

Traffic Congestion. The Oakland portion of the BART system is surrounded by roads, transit services, parking, and pedestrian facilities. Level of service (LOS) is a measure of driving conditions and vehicle delays and ranges from A (best) through F (poorest); LOS A through LOS C indicates traffic moves freely. In Oakland, the Claremont Avenue/Hudson Street intersection was determined to operate at LOS D during the A.M. peak hour, and drivers experience delays consistent with LOS D and F during A.M. and P.M. peak hours, respectively, at the stop sign at 53rd Street at Shattuck Avenue. The remaining Oakland study intersections operate at LOS C or better during A.M. and P.M. rush hours, measured in terms of average delays for all vehicles.

With respect to public transit, Oakland is served by BART; additionally Alameda-Contra Costa Transit District provides bus service in the project area and operates 17 routes. Many residents in Oakland depend on public transit for transportation (Pacific Institute 2002). In addition, taxi stands are located near the three BART stations proposed for retrofit, and a casual carpool location is designated near the Rockridge Station.

Parking around the three BART stations includes both on-street and off-street parking spaces. Retrofit activities would affect the total amount of parking available at and near the stations throughout the duration of construction.

The project would not affect traffic in the San Francisco project area because all BART facilities are underground in this area; traffic in San Francisco is not considered further.

3.11.2.2 Public Participation, Outreach and Informational Access

The proposed action is subject to public participation as required under the NEPA. A public information meeting was held on January 28, 2003, in Oakland, California; on October 23, 2003, in Rockridge, California; and January 18, 2005, in San Francisco, California. During these meetings, BART presented information on the project and solicited public input on issues of concern. A public hearing will also be held to address the public's comments on the Draft EA, anticipated to occur in September 2005.

3.11.2.3 Proposed Action

3.11.2.3.1 Factors for Evaluating Environmental Justice Impacts

The determination of Environmental Justice impacts is based on FHWA guidance. Impacts would occur if the project resulted in:

- Disproportionately high adverse human health or environmental effects on minority or low-income populations in the project area, taking into account mitigation.

3.11.2.3.2 Impacts and Mitigation

Health Risks. Project implementation would result in negligible air quality health risk impacts on minority and low-income members of communities in Oakland and San Francisco (see *Air Quality,* below), including from diesel emissions, as a result of conformance with applicable regulatory requirements and implementation of standard BART practices.

Potential impacts to water quality could affect subsistence fishing practiced by local Asian communities living near the Northeast Waterfront area, including at the San Francisco Transition Structure and Ferry Plaza. Spills into or near open water of gasoline or other petroleum products required for operation of motorized equipment (e.g., dredge or tug), could occur during retrofit operations, as well as during transport of dredged material. Although unlikely, large oil spill volumes could degrade water quality, with the potential for toxicity and contaminant bioaccumulation in aquatic organisms. Spill containment and cleanup protocols specified in the spill response portions of the dredging operation plan will be implemented by the dredging contractor. Dredging operations could also remove or severely disturb the benthic organisms and juvenile fish on which this community depends; however, the area subject to disturbance is approximately 8 acres (including the six stitching sites and the site of the San Francisco Transition Structure), a relatively small area given the size of the San Francisco Bay (100,000 acres). Therefore, impacts to subsistence fisherman would be negligible. Furthermore, other waterfront locations would remain undisturbed around the Bay throughout the duration of project activities.

Air Quality. Project construction activities throughout the project area would release combustive emissions generated by fossil fuel-powered equipment and mobile sources, such as diesel emissions, and fugitive dust emissions (PM_{10}) generated during earth-moving and operation of equipment and vehicles on exposed soil. Construction-related emissions would be short term but could impact the minority and low-income populations living in close proximity to the retrofit locations in Oakland, including in the Rockridge, downtown, and West Oakland neighborhoods. Because the project will conform with applicable regulatory requirements for dust control (BAAQMD Enhanced Control Measures), will implement standard BART measures, and will adhere to diesel mitigations, fugitive dust emissions from construction activities and construction-related diesel particulate matter emissions will not adversely affect these low-income and minority residential populations.

Noise and Vibration. Project construction would not result in noise levels above acceptable BART limits (see section 3.2 [Noise]). Nearby sensitive receptors, including schools (Chabot Elementary School), hospitals (Children's Hospital Oakland), and minority and low-income residential populations in the Oakland neighborhoods, would not be adversely affected.

Destruction or Diminution of Aesthetic Values. Project implementation would result in the temporary disturbance of hardscape and landscaping at Hardy Park in the Rockridge neighborhood, at several Oakland work sites, at the Bay Trail segment in the Port of Oakland, and at the Ferry Plaza in San Francisco (see section 3.8 [Visual Resources]). Scenic views would not be permanently obstructed, and spillover light and glare would not increase as a result of project retrofits. All work sites would be restored to pre-project conditions as part of project implementation; therefore, minority and low-income populations living in proximity to the project work sites would not be adversely affected.

Increased Traffic Congestion. Project construction would result in short-term traffic impacts at the College Avenue and Keith Avenue intersection, and the Claremont Avenue and Hudson Street intersection. Project construction could also result in short-term impacts on some street segments, transit routes, and relocation of transit (bus) stops, taxi stands, and a casual carpool location near Rockridge Station. Parking supply at stations and nearby street parking would be reduced for the duration of construction. The construction contractor will be required to prepare and implement a traffic construction management and phasing plan, however, which would ensure impacts to the minority and low-income communities near the retrofit locations, who are generally non-drivers and transit-dependent, are avoided (see section 3.4 [Transportation]).

3.11.2.4 Dredged Material Reuse/Disposal Impacts and Mitigation

Reuse of dredged material within the project, as well as disposal outside the project area, would not result in disproportionately high adverse impacts to minority or low-income populations in the project area. Impacts from dredging activities would be negligible with implementation of project measures that would restore affected areas to pre-project conditions, and ensure compliance with applicable regulatory requirements.

3.12 NO-ACTION ALTERNATIVE

Under the no-action alternative, extensive earthquake damage may occur to the Transbay Tube, stations, and aerial guideways, requiring widespread repair and construction work. Disruption of this portion of the BART system could severely affect local transportation and circulation, especially across the San Francisco Bay. BART currently carries more than 150,000 persons daily across the Bay, with more than 30,000 persons during peak hours, which is as many passengers accommodated by the San Francisco-Oakland Bay Bridge during weekday rush hour (FHWA and Caltrans 1998; BART 2004a). The Alameda-Contra Costa Transit District offers 654 daily bus trips over the San Francisco-Oakland Bay Bridge and has a current ridership of approximately 13,000 persons, with up to 3,000 persons during rush hour (FHWA and Caltrans 1998). The San Francisco-Oakland Bay Bridge is currently operating at capacity (FHWA and Caltrans 1998) and adding additional vehicles would create severe congestion and delay.

Seismic retrofit studies (BART 2002a, 2002b) suggest that, without the project, substantial damage to the Transbay Tube, aerial guideways, aerial stations, and other facilities would occur from a major earthquake. Recent USGS statistical analysis indicates a 62 percent probability that a major earthquake will affect the Bay Area before the year 2030 (USGS 2003c). As part of these BART studies, several earthquake scenarios were considered. It was determined that the most likely seismic event would occur on the Hayward fault with a magnitude of 6.9 on the Richter scale. The probability of such an earthquake occurring within the next 30 years is approximately 8.5 percent (USGS 2003c). The likely damage scenario discussed below would be associated with such an event. This scenario is based on the *BART Seismic Vulnerability Study* (BART 2002a) and the *Seismic Risk Analysis* (BART 2002b).

Damage to the Rockridge, MacArthur, and West Oakland Stations would render them inoperable. Approximately 36 aerial structures would be a total loss, another six would be damaged to the extent that trains could not travel at full speed over them, and 77 would sustain minor damage. Temporary shoring would be employed to bring some of these structures back to service quickly, but permanent repairs are estimated to require approximately 15 months to complete. The Transbay Tube would be rendered inoperable and would require 2 years or more to be restored to service.

Repairs to the BART system would involve extensive construction operations. Some possible repairs for aerial structures and stations include jacking columns to restore them to a vertical position, followed by grouting beneath the column footings to strengthen the soil. Train tracks and electric third rails would require straightening or replacement to allow trains to operate. Staircases and escalators at stations may be damaged to an extent that they would require replacement. Repairs to the Transbay Tube could require dredging to remove liquefied material, pumping of floodwater from the Tube, repairing damaged joints or the concrete lining of the Tube, or jacking the Tube to return it to its pre-earthquake alignment.

Ferry service across the Bay is expected to be available in the event of a future earthquake (WTA 2002). Combined, all current ferries in service have a capacity of 5,000 persons per hour (WTA 2002). It is anticipated that if commercial dining and excursion vessels were converted to ferry service, hourly capacity would be approximately 14,500 persons (WTA 2002). It is estimated that the combined ferry service and transbay bus service (if bridges were still operable) could only accommodate about half of the peak hour ridership currently served by BART.

It is not certain what other types of transportation BART riders would use, since other transportation modes would also be damaged during the earthquake, but BART studies assumed that most would attempt to drive to work. Others may be able to use non-BART public transportation or telecommute. However, it is unlikely that other modes of transportation, even with an expanded ferry service, could fully accommodate displaced BART riders, potentially resulting in up to 300,000 additional trips competing for space on a damaged roadway system. The additional trips would contribute to increased delays during peak traffic hours, estimated to be 60 to 80 minutes along the State Route 24 corridor (BART 2004a).

Potential consequences to each resource that would result from implementation of the no-action alternative are discussed below. In general, the magnitude of impacts on all identified resource areas are expected to be much greater, affecting a larger geographic area, and for a longer period, under the no-action alternative than the proposed project.

Water Resources

Damage to the Transbay Tube could require dredging liquefied sediments and/or pumping Bay waters from flooded portions of the Tube. These dredging and disposal activities could result in formation of turbidity plumes and dispersion of contaminated sediments. In upland portions of the project area, seismic damage could affect stormwater flows and increase the potential for debris runoff into surface waters.

Noise

Because construction activities would occur on an emergency basis, it is likely that work would have to occur 24 hours per day. This would substantially increase construction noise impacts at sensitive receptors in the area. Scheduling limitations proposed to mitigate noise impacts resulting from the project would likely be deemed unreasonable or infeasible.

Cultural Resources

Archaeological Resources

Some of the repairs needed following a major earthquake would require ground disturbances at the existing aerial guideways and BART stations. This excavation would most likely occur in previously disturbed soils, such that no new impacts on archaeological resources would occur. Impacts on archaeological resources would be equivalent to those associated with the seismic retrofit project.

Historic Architectural Resources

In response to a seismic event, it is reasonable to assume that vibration activity associated with reconstruction of failed facilities would be much more extensive under this alternative than would occur during the seismic retrofit project.

Transportation

Traffic/Ground Transportation

The damage to the BART system would require BART riders to seek other means of transportation for an extended period. It is estimated that only 27 percent of the 310,000 daily BART riders would be able to use the system immediately after the earthquake, and that additional capacity would not begin to become available for approximately 6 months. Capacity would not reach 50 percent of the pre-earthquake ridership until approximately 15 months after the earthquake event. As repairs to the Transbay Tube would take over 2 years, BART would not support travel across the Bay until several years after a major earthquake event (BART 2002a, 2002b). During this time, travelers would have to use alternate travel modes to cross the Bay.

More streets would be affected than under the proposed action because extensive construction would be necessary following a major earthquake. Construction would result in lane closures, decreased level of service at intersections and street segments, and could lead to dangerous circulation conditions. In addition to construction-related impacts, transportation and circulation would be impacted by former BART riders using personal vehicles or other modes of transit while the BART system is under repair.

Vessel Transportation

Repair activities to the Tube could involve dredging, replacing damaged tube joints, and jacking the tube into alignment. Based on the nature and extent of these construction activities, it is reasonable to assume that there would be substantial interference with vessel passage through the Port of Oakland Outer Harbor Entrance Channel and substantial conflicts between construction barges and vessels trying to use the Outer Harbor Entrance Channel. Similarly, repair work could block access to Berth 34 and the adjacent terminal yard. These impacts would be more extensive and occur for a longer period than impacts of the project.

Geology/Seismicity

Structural damage from a severe earthquake would likely require extensive excavations and dredging in association with foundation repair work, temporarily resulting in changes in topography/bathymetry and potentially unstable cut slopes.

Hazardous Materials

Structural damage would likely require extensive excavations, dredging, and dewatering in association with foundation repair work, resulting in potential exposure of onsite workers to unexpected contaminated soil and/or groundwater. In addition, excavated and dewatered material could pose impacts to the surrounding environment if not handled and disposed of in accordance with applicable state and federal hazardous materials regulations (see Appendix C, section C.6).

Risk of Upset/Safety

The breadth of the repair work associated with extensive earthquake damage to BART facilities would expose BART passengers, BART workers, construction workers, and the general community to a broad range of construction activities and would increase the risk of upset and safety-related concerns. Because of the likelihood of major damage to the BART system without seismic retrofit following a major earthquake, there is a greater likelihood that construction work under this alternative would interfere with emergency response equipment or prevent implementation of emergency procedures.

Besides increasing the amount of construction related to BART system repair, this alternative also has a greater risk of upset than the proposed project. Without seismic retrofit, it is likely that the BART system could sustain major damage, increasing risk to BART patrons, BART workers, and persons and structures in the vicinity of the BART alignment.

Visual Resources

Aerial guideways, aerial stations, and other facilities could suffer damage ranging from minor to major, and some facilities could be total losses. Following such an event, repairs would necessitate lengthy construction at most or all facilities in the project portion of the system. Consequently, visual character, visual quality, and light and glare conditions associated with the project area would be subject to increased impacts under the no-action alternative.

Biological Resources

There would be impacts on the marine environment in the event of damage to the BART system from a major earthquake. Repairs to the Transbay Tube would likely require dredging to remove liquefied material, pumping and discharge of floodwater from the Tube, repairing damaged joints or the concrete lining of the Tube, or jacking the Tube to return it to its pre-earthquake alignment. These actions would result in substantial disturbance of the Bay bottom and increased turbidity, resulting in the same types of impacts described for the project but on a larger scale. Dredged material would also be disposed of, resulting in the same types of impacts described for the project. Underwater noise impacts on marine species associated with repair of the Transbay Tube would depend primarily on the need for pile driving, which cannot be known at present. Repairs to upland portions of the system would cause the same types of biological impacts, such as vegetation removal and erosion potential, as the project.

Air Quality

The amount of equipment required to repair major earthquake damage during the emergency construction period would be much greater than what is needed to complete the project. Combustive emissions and fugitive dust emissions would be greater and last longer. In addition, a large number of displaced riders would likely use personal transportation during the period of repair. The combustive emissions from these personal vehicles would add an additional unmitigable air quality burden to the Bay Area.

Social Impacts

Earthquake-related reconstruction of the BART system under this alternative, as well as the associated loss of availability of public transportation, would not result in impacts that fall disproportionately on the elderly, handicapped, or transit-dependent individuals, or on minority or low-income populations. However, the transit-dependent and low-income populations tend to be more reliant on public transportation for mobility as compared to the general (i.e., citywide) population. Therefore, the loss of BART services could result in potential isolation of these populations from the broader community.

4.0 CUMULATIVE IMPACTS

CEQ regulations (40 CFR Section 1508.7) stipulate that the cumulative effects analysis in an EA should consider the potential environmental impacts resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions," commonly referred to as "cumulative effects." Cumulative effects can result from individually minor, but collectively significant projects occurring over the lifetime of the project under consideration. This section evaluates the cumulative effects of the project with other reasonably foreseeable projects.

4.1 DESCRIPTION OF CUMULATIVE PROJECTS

Cumulative effects occur when there are interactions between a proposed action and other actions in close proximity or during an overlapping time period. Actions geographically overlapping or close to the proposed action would likely have more potential for interaction than those farther away. Similarly, actions coinciding in time with the proposed action would have a higher potential for cumulative effects.

The analysis of cumulative impacts must include regional effects in addition to cumulatively substantial localized effects. The region considered in this analysis includes: Oakland west of the Berkeley Hills Tunnel, including West Oakland; the Port of Oakland; San Francisco Bay in the vicinity of the Transbay Tube; and the vicinity of the San Francisco Ferry Building Platform. The timeframe considered in this analysis includes projects that would be under construction during the same timeframe as the project, i.e., from 2005 through 2011.

The methodology used to develop this cumulative analysis included contacting the following organizations to identify reasonably foreseeable future projects:

- Association of Bay Area Governments;
- California Department of Transportation, District 4;
- City of Oakland;
- City/County of San Francisco;
- East Bay Municipal Utility District;
- East Bay Regional Park District;
- Port of Oakland;
- Port of San Francisco; and
- Water Transit Authority.

Information obtained from these agencies was used to compile a list of ongoing and proposed programs and projects near the project alignment that could contribute to cumulative impacts. A list of the projects considered in the cumulative impact analysis is presented in Table 4-1 and their locations are shown on Figure 4-1.

Table 4-1. Plans and Projects to Consider in the Cumulative Impact Analysis for the BART Seismic Retrofit EA — Berkeley Hills Tunnel to Montgomery Street Station

(Page 1 of 6)

Project No.	***Plan or Project Name*[1, 2]** *Agency*	*Description*	*Status (Project Timeframe)*	*Relevant Cumulative Environmental Factors*
		Plans		
NA	**West Oakland Cumulative Growth Scenario Update** City of Oakland	Update of existing and future economic and land use assumptions for more than 50 area planned projects.	Update completed January 2002	Transportation Air Quality
NA	**Projections 2002** Association of Bay Area Governments	Demographic projections for nine Bay area counties through 2025.	Published 2001	Transportation Air Quality
NA	**San Francisco Waterfront Land Use Plan, Ferry Building Waterfront Element** Port of San Francisco	Land Use designations for the project area within the San Francisco Waterfront.	Final EIR certified in 1996	Water Resources
NA	**West Oakland Action Plan** City of Oakland, BART, and the Oakland Housing Authority	Redevelopment and renewal of the West Oakland BART station area.	Undetermined future	Transportation Air Quality
NA	**Implementation and Operations Plan** Water Transit Authority[3]	Expand existing ferry routes and create new ones. Build new terminals and add to existing ones. (This is a different project than the **San Francisco Ferry Terminal Project** proposed by the Port of San Francisco, which is listed below.)	Ongoing; construction has not started	Noise Transportation Air Quality

Table 4-1. Plans and Projects to Consider in the Cumulative Impact Analysis for the BART Seismic Retrofit EA — Berkeley Hills Tunnel to Montgomery Street Station

(Page 2 of 6)

Project No.	***Plan or Project Name*[1, 2]** *Agency*	*Description*	*Status (Project Timeframe)*	*Relevant Cumulative Environmental Factors*
Projects				
East Bay				
1	**Oakland Army Base Redevelopment Area** City of Oakland	Redevelopment of approximately 1,730 acres of industrial, urban land. Business, industrial, transportation, live/work, recreation, and public access uses proposed. The 1,730 acres in the Redevelopment Area includes 1,000 acres of terminal on Port property to be redeveloped /reconfigured by 2020 — including some of the old FISCO property and 29 acres of fill for New Berth 21 — to have capacity to meet regional cargo throughput goals (per the San Francisco Seaport Plan). The Redevelopment Plan also includes a relocated rail yard and a center for ancillary maritime support (truck parking, repair, storage, etc).	Draft EIS released September 1999; EIR certified July 2002. Projected project completion by 2010.	Biology (beneficial impact) Cultural Resources Vessel Transportation Geology Hazardous Materials
2	**Fleet and Industrial Supply Center Oakland (FISCO)/Port of Oakland, Vision 2000 Program** Port of Oakland	Change to civilian use and provide major port and rail expansion; includes habitat restoration, a public park, and terminal realignments. Site will become one of the three largest port facilities in the western U.S.	EIS/EIR completed August 1997. Terminals in operation, park constructed; projected project completion by 2007.	Biology (beneficial impact) Transportation Hazardous Materials Water Resources
3	**Alameda Point** City of Alameda	Mixed-use development; proposed aerial gondola to provide a link to the West Oakland BART station.	Feasibility study is underway. Projected project completion by 2010.	Cultural Resources Geology Hazardous Materials Risk of Upset
4	**-50-foot Navigation Improvements** U.S. Army Corps of Engineers and Port of Oakland	Dredge Oakland Outer and Inner harbors to -50 feet mean lower low water.	EIS/EIR completed May 1998. Construction approximately 2001-2008, depending on Congressional funding.	Biology Vessel Transportation Geology Risk of Upset Water Resources

Table 4-1. Plans and Projects to Consider in the Cumulative Impact Analysis for the BART Seismic Retrofit EA — Berkeley Hills Tunnel to Montgomery Street Station

Project No.	***Plan or Project Name***[1, 2] *Agency*	*Description*	*Status (Project Timeframe)*	*Relevant Cumulative Environmental Factors*
		Projects (continued)		
East Bay (continued)				
5	**Berths 32/33 Wharf Rehabilitation** Port of Oakland	Project includes a 75 ft. wharf extension; 36,860 sq. ft. of new wharf deck (including demolition of an old partial wharf structure); deepening the berths to –50 feet; replacement of old cranes with newer, bigger ones; and installation of riprap for wharf strengthening	Projected project completion by end of 2005.	The Initial Study and Negative Declaration indicate no significant impacts for this project. Potential cumulative impacts on: Vessel Transportation Geology Water Resources
6	**NAS Alameda/Fleet and Industrial Supply Center (FISC) Annex** U.S. Navy transferring property to City of Alameda	Reuse property for civilian residential and nonresidential purposes. Alameda Point General Plan Amendment, covering redesignation of land uses and adoption of General Plan policies for 1,444 acres, prepared for this project. Note that as part of the closure of NAS Alameda/FISC Annex, the USFWS granted 900 acres (565 upland acres + 413 submerged acres) — the Alameda Point Wildlife Refuge — for use as part of the San Francisco Bay National Wildlife Refuge Complex.	Final EIS completed October 1999; Draft EIR on the Amendment published November 2001. Projected project completion by 2020.	Biology (beneficial impact) Cultural Resources Vessel Transportation
7	**West Oakland Redevelopment Project** City of Oakland (Redevelopment Agency; Department of Housing and Community Development)	Rehabilitation of blighted areas, including new construction. One element is development of affordable housing, including various projects in the vicinity of the West Oakland BART station. Website available at: http://www.oaklandnet.com/government/hcd/projects/underwaylist.html.	Ongoing, projected 20 year planning horizon.	Biology Cultural Resources Geology Hazardous Materials Risk of Upset Visual (beneficial impact)

Table 4-1. Plans and Projects to Consider in the Cumulative Impact Analysis for the BART Seismic Retrofit EA — Berkeley Hills Tunnel to Montgomery Street Station

Project No.	***Plan or Project Name***[1, 2] *Agency*	*Description*	*Status (Project Timeframe)*	*Relevant Cumulative Environmental Factors*
		Projects (continued)		
East Bay (continued)				
8	**Uptown Project** City of Oakland	Residential development near the 19th Street BART station.	EIR completed 2004. Construction approximately 2005-2010.	Cultural Resources Noise Environmental Justice Air Quality
9	**MacArthur Station Development Project** City of Oakland/BART	New construction of a mixed-use transit village on BART and privately owned parcels. Residential, retail, medical office, and public space. BART parking structure. Enhanced access to the station.	Environmental review process initiated in 2003; construction approximately 2005-2008.	Noise Transportation Risk of Upset Visual Resources Environmental Justice Air Quality
10	**Rockridge Greenbelt Phase II Development** City of Oakland/Friends of the Rockridge-Temescal Greenbelt (FROG)	Resurfacing of basketball courts within Hardy Park and the addition of certain ADA-accessible play elements under the freeway; construction of a gate along Claremont Avenue; minimal improvements to the dog park fence. Website http://www.frogpark.org/	Design plans finalized early 2005; finalization of construction plans expected by August 2005; Projected construction completion date of winter 2005.	Biology Noise Visual Resources Air Quality
11	**Main Wastewater Treatment Plant Improvement** East Bay Municipal Utility District (EBMUD)	Part of the East Bay Shore Recycled Water Project. Expansion of treatment plant facilities, capacity, and administration facilities.	Construction approximately 2005-early 2006.	Biology Noise
12	**New Water Distribution System** EBMUD	Part of the East Bay Shore Recycled Water Project. Extension of existing pipelines and construction of new pipes in the West Oakland area.	First phase under construction; intermittent construction between 2003- 2006.	Biology Risk of Upset
13	**Mandela Parkway Improvement Project** California Department of Transportation (Caltrans) District 4	Construct a landscaped, tree-lined parkway and arboretum on Mandela Parkway between 8th Street and 32nd Street. The project would modify and realign portions of Mandela Parkway; widen 8th Street; relocate and retrofit existing traffic signals; and provide new Bay Trail alignment.	Projected project completion by Fall of 2005.	Water Resources Noise Transportation Air Quality

Table 4-1. Plans and Projects to Consider in the Cumulative Impact Analysis for the BART Seismic Retrofit EA — Berkeley Hills Tunnel to Montgomery Street Station
(Page 5 of 6)

Project No.	***Plan or Project Name*[1, 2]** *Agency*	*Description*	*Status (Project Timeframe)*	*Relevant Cumulative Environmental Factors*
Projects (continued)				
East Bay (continued)				
14	**Caldecott Improvement Project** Caltrans District 4	Roadway improvements and transit improvements along State Route 24; improvements to the Caldecott Tunnel.	Project approvals expected summer 2006; construction expected to begin approximately 2007.	Water Resources Noise Transportation Air Quality
San Francisco Bay				
15	**Replacement of the East Span of the San Francisco-Oakland Bay Bridge** Caltrans District 4	Replacement of the Bay Bridge from Yerba Buena Island to Oakland.	EIS completed in 2001. Projected project completion by 2012.	Biology Geology Water Resources
16	**Base Realignment and Closure (BRAC) of Treasure Island** U.S. Navy, Southwest Division	Naval Station Treasure Island (NSTI) closed in 1997; reuse property for civilian residential and nonresidential purposes.	Final EIS in preparation; City/County of San Francisco is preparing a separate EIR. Projected project completion by 2010.	Biology Cultural Transportation Geology & Soils Hazardous Materials Water Resources
San Francisco				
17	**San Francisco Ferry Terminal Project** Port of San Francisco	New ferry terminals, waterfront promenade, pier refurbishment, new breakwater.	First phase under construction; Projected project completion by 2006.	Biology Cultural Resources Noise Visual Resources Environmental Justice Air Quality Water Resources
18	**Pier 1½, 3 & 5 Project** Port of San Francisco	Rehabilitation of historic bulkhead buildings with ground floor restaurants, upper floor office, public access walkways, and guest boat dock.	Mitigated Negative Declaration completed in 2003. Projected project completion by 2005.	Biology Cultural Noise Hazardous Materials Risk of Upset Visual Resources Water Resources
19	**San Francisco-Oakland Bay Bridge West Approach Replacement Project** Caltrans District 4	Demolishing and rebuilding the existing bridge, reconstruction of a portion of Interstate 80, and alternation of the Transbay Terminal ramps.	Projected project completion by 2009.	Biology Noise Transportation Geology

Table 4-1. Plans and Projects to Consider in the Cumulative Impact Analysis for the BART Seismic Retrofit EA — Berkeley Hills Tunnel to Montgomery Street Station

Project No.	***Plan or Project Name*[1, 2]** *Agency*	*Description*	*Status (Project Timeframe)*	*Relevant Cumulative Environmental Factors*

Notes:
1. Projects listed in the Table would occur between 2005 through 2011, the expected duration of the Seismic Retrofit Project.
2. Projects are organized into three geographic groups: East Bay, San Francisco Bay, and San Francisco.
3. Note from BART meeting with Ferry Operators on 1/22/03: Steve Morrison (Water Transit Authority) mentioned that the 10-year Master Plan for the Water Transit Authority envisioned that seven new ferry routes would be directed to the San Francisco Ferry Building Plaza. Additional expansion from the existing 14 ferries to 44 ferries is planned from 2005 to 2015, contingent on funding. Proposed increases in ferry service are still in the planning stage, and no formal project reviews and/or approvals have been conducted. Due to the speculation associated with implementation of the new ferry service, proposed expansion of ferry services are provided for informational purposes only.

NA Not applicable as this item is a plan, not a project.

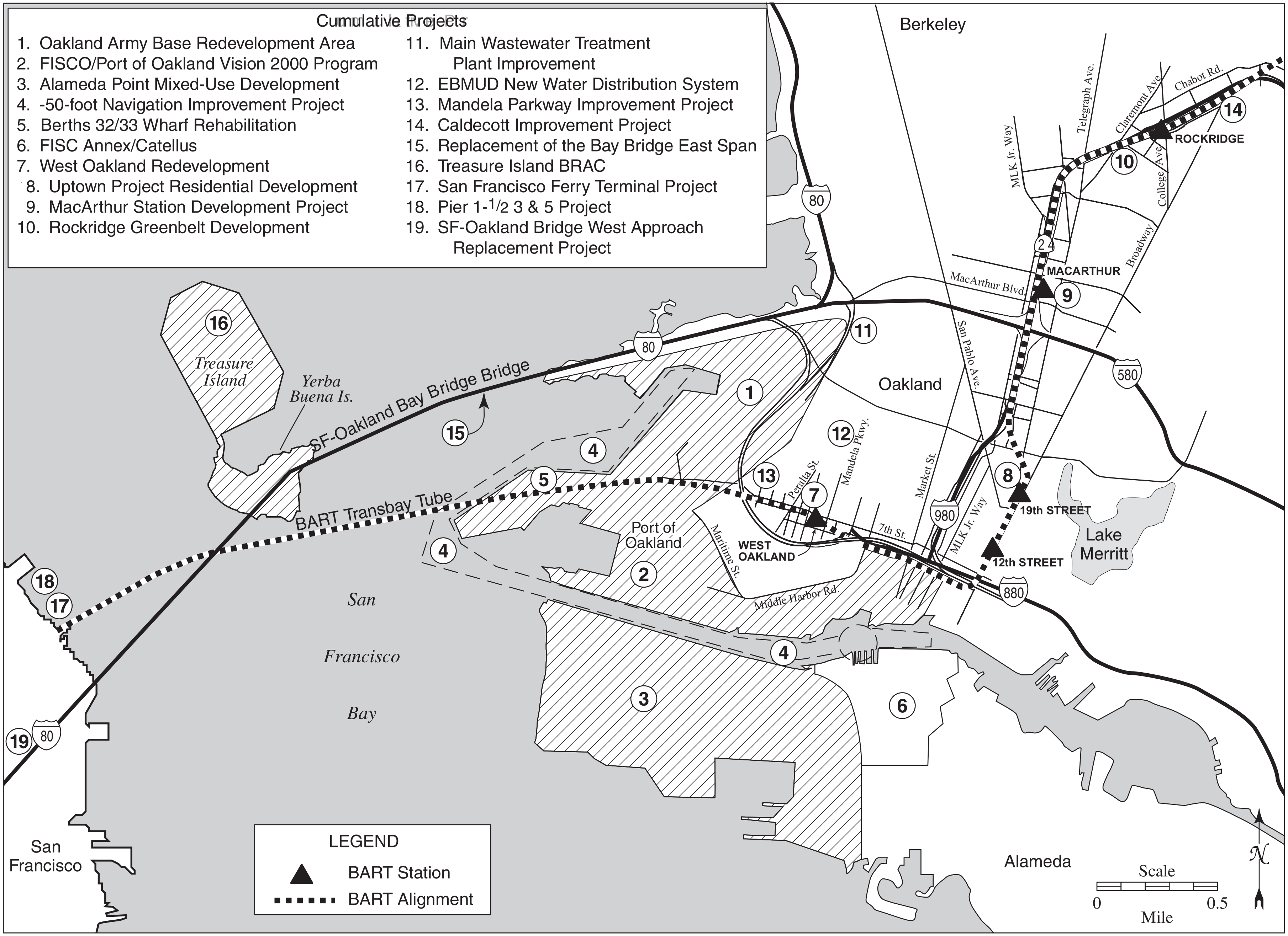

Figure 4-1. Location of Projects Considered for Cumulative Impact Analysis

4.2 CUMULATIVE IMPACT ANALYSIS

Three technical studies prepared for the project evaluate the cumulative impact of the project with other foreseeable projects: the Biological Assessment (BART et al. 2005f), the Natural Environment Study (BART et al. 2005g), and the Traffic Technical Study (BART et al. 2005h). The description of cumulative impacts for Biological Resources (section 4.2.9) and Ground Transportation (section 4.2.4.1) is a summary of the more detailed analysis in these technical studies. Based on the analysis of project impacts in Chapter 3, if the project was determined to have no impact on a specific resource area (e.g., flooding), the project will not contribute to a cumulative impact on that resource, and therefore, is not discussed further below.

4.2.1 Water Resources

Similar to the project, channel dredging for certain cumulative projects, including the Port of Oakland -50-foot Navigation Improvements Project, Berths 32/33 Wharf Rehabilitation, Replacement of the East Span of the San Francisco-Oakland Bay Bridge, Base Realignment and Closure of Treasure Island, and the San Francisco Ferry Terminal Project could result in elevated suspended sediments and turbidity levels, higher oxygen demands, and remobilization of sediment-associated contaminants at the project sites and at aquatic disposal sites (if used for disposal of project dredged material). Impacts from these projects are expected to persist for the duration of their respective construction phases. Cumulative impacts on water quality are expected to be negligible because the impacts would only occur within the immediate vicinity of the respective project sites, with some dispersion of turbidity/suspended sediment plumes due to currents. In addition, these projects would be conducted in accordance with dredging and disposal permits that include BMPs and other measures to mitigate any water quality impacts to negligible. To the extent that the cumulative projects dredge contaminated sediments from the Bay for upland disposal or re-use, a beneficial impact on sediment quality could occur.

The project has the potential for temporary, but cumulative impacts on surface water quality associated with stormwater runoff. A number of the cumulative projects, including the Caldecott Improvement Project, NAS Alameda/Fleet and Industrial Supply Center (FISC) Annex, EBMUD New Water Distribution System Project, West Oakland Redevelopment Project, Mandela Parkway Improvement Project, Oakland Army Base Redevelopment, Fleet and Industrial Supply Center/Port of Oakland, and the San Francisco-Oakland Bay Bridge West Approach Replacement involve construction in upland areas that may also be affected by the project. These projects have the potential to cumulatively affect the quality and/or flow of stormwater runoff. However, similar to the project, the above projects would be covered by construction Stormwater Pollution Prevention Plans to reduce potential stormwater runoff impacts. Therefore, potential cumulative impacts related to stormwater would be negligible.

4.2.2 Noise

Cumulative noise impacts would result only if construction noise associated with another project affected the same sensitive receptors as the project during the same timeframe. The project's contribution to cumulative underwater noise impacts on the marine environment is discussed in section 4.2.9.

Cumulative noise impacts could affect sensitive receptors in the vicinity of:

- the MacArthur Station due to the project and the MacArthur Station Development Project;
- the BART alignment near the 19th Street/Oakland Station due to the project and Uptown Project Residential Development; and
- the San Francisco Transition Structure due to the project and the San Francisco Ferry Terminal Project.

To ensure the project's contribution to cumulative construction noise impacts are within acceptable BART limits, standard procedures will be implemented as part of the project, including installation and maintenance of temporary noise barriers; scheduling of construction activities, such as pile driving; mufflers on construction equipment; and public notification (see Chapter 2 [Project Alternatives]).

The project's contribution to cumulative noise impacts associated with transportation of dredged materials from the project by either barge (for in-Bay or upland disposal options) or truck (for landfill disposal options) would be negligible. Existing noise levels both within the Bay, and along freeways and local streets that would be accessed by truck traffic, would experience no discernible increase in noise as a result of these 20 daily additional trips. Furthermore, noise impacts on sensitive receptors near the freeways and local streets in the project area that would experience any combined truck trips associated with other projects would be negligible as these other cumulative projects would be required to implement measures to ensure noise levels are reduced to within acceptable limits.

4.2.3 Cultural Resources

The majority of the projects listed in Table 4-1 would have the potential to disturb either a known or previously unidentified archaeological site or a maritime historic resource during construction. Although no significant archaeological or maritime historic sites are recorded within the APE of the project, it is possible that previously unidentified archaeological deposits may be uncovered during construction. If an unidentified, potentially significant archaeological deposit is discovered during project construction, an adverse effect on this property would contribute to a cumulative effect. However, adherence to applicable National Historic Preservation Act requirements will ensure the project's contribution to this cumulative effect is negligible.

The project's potential adverse effect on six properties eligible for National Register of Historic Places (NRHP) listing would contribute to a cumulative effect. Specifically, the Uptown Project Residential Development, NAS Alameda/FISC Annex, West Oakland Redevelopment Project, Oakland Army Base Redevelopment Area, Alameda Point Mixed Use Development, Base Realignment and Closure of Treasure Island, the San Francisco Ferry Terminal Project, and the San Francisco-Oakland Bay Bridge West Approach Replacement all have the potential to impact structures over 50 years old that could be eligible for NRHP listing. Individual review of each of these projects under NEPA (or when under the jurisdiction of a local or state lead agency, under CEQA) likely resulted in the identification of any potentially eligible archaeological, historic, or maritime resources and provided mitigation to address adverse effects. It is not certain, however, that all cumulative adverse effects could be completely mitigated, given the potentially large amount of ground disturbance involved with these projects. However, the mitigation measure in section 3.3.2.2 will avoid the project's contribution to this cumulative effect.

4.2.4 Transportation

4.2.4.1 Ground Transportation

Cumulative impacts on ground transportation were evaluated for project construction, and from hauling dredged material to disposal sites. Assuming traffic would be greatest in the later years of retrofit activity, the maximum cumulative traffic effects would occur during the final stages of project construction. According to the project construction schedule, the final construction work would occur 6 years after project commencement, or approximately in the year 2011. Therefore, cumulative traffic effects are evaluated based on regional traffic changes that are projected to occur by 2011. These cumulative effects would be expected to influence intersection operations and street segment operations. However, this analysis also recognizes that construction of other projects could result in lane closures and other temporary impacts similar to the project, including impacts to parking, transit operations, and bicycle and pedestrian circulation.

Freeway Segment Operations due to Traffic Growth

Project construction would not impact any of the mainline freeways in the study area; however, hauling of dredged material could utilize regional freeways. Cumulative traffic forecasts for freeways in year 2011 were based on the Alameda Countywide Transportation Model. Hauling of dredged material to the Altamont or Vasco Road Landfills (up to 28 trucks per day, each with a capacity of 12 cy) could result in substantial impacts to four freeway segments expected to operate at LOS F during the A.M. and P.M. peak hours:

1. Interstate 880 South of Interstate 980, northbound in A.M. peak hour, southbound in P.M. peak hour;
2. Interstate 880 North of Interstate 238, northbound in A.M. peak hour, southbound in P.M. peak hour,
3. Interstate 580 East of Interstate 238, westbound in A.M. peak hour, eastbound in P.M. peak hour, and
4. Interstate 580 Ramps at Vasco Road Interchange, eastbound off ramp and westbound on ramp in both A.M. and P.M. peak hour.

The project's contribution to cumulative impacts at these four freeway segments will be avoided, however, because the construction contractor will be required to transport dredged material from the Port of Oakland to landfill disposal sites outside of peak hours, as described in section 3.4.1.2.3. For additional details, see the Traffic Technical Study (BART et al. 2005h).

Intersection Operation Impacts due to Traffic Growth

PROJECT CONSTRUCTION

With Cumulative Year 2011 levels of traffic, the maximum potential lane closures related to project construction would cause three intersections to operate at peak hour LOS E or F during one or more peak periods:

1. Broadway/Patton Street and Miles Avenue (A.M. peak hour);
2. College Avenue and Keith Avenue (P.M. peak hour); and
3. Claremont Avenue and Hudson Street (A.M. and P.M. peak hours).

The project's contribution to cumulative impacts at these three intersections will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and traffic management plan (TMP) that specifically addresses accommodations for cumulative traffic operations throughout the duration of retrofit activities. For additional details, see the Traffic Technical Study (BART et al. 2005h).

DREDGED MATERIAL HAULING

The addition of 28 truck trips (if landfill disposal) could result in impacts to one intersection (Southfront Road and Interstate 580 eastbound ramp), which is anticipated to operate at LOS F during the P.M. peak hour under cumulative traffic conditions. The project's contribution to cumulative traffic conditions at this intersection will be avoided, however, because the construction contractor will be required to transport dredged material from the Port of Oakland to landfill disposal sites outside of peak hours, as described in section 3.4.1.2.3. For additional details, see the Traffic Technical Study (BART et al. 2005h).

Street Segment Operation Impacts due to Traffic Growth

With Cumulative Year 2011 levels of traffic, if through traffic is limited to a single lane during project construction, traffic volumes would exceed the LOS F threshold criteria on Telegraph Avenue (Location 8, southbound) during the Year 2011 scenario, assuming no prior mitigation. The project's contribution to this cumulative impact at Telegraph Avenue will be avoided, however, because the construction contractor will be required to prepare and implement a construction phasing plan and TMP that specifically addresses accommodations for this street segment, as described in section 3.4.1.2.2.

Cumulative Impacts due to Other Construction in the Study Area

The MacArthur Station Development Project (at the MacArthur Station) and the West Oakland Redevelopment Project (near the West Oakland Station) could result in construction adjacent to project locations. Potential cumulative construction-related impacts could occur at either the MacArthur or West Oakland Stations if these cumulative projects were scheduled at the same time as the project. However, the project's contribution to cumulative construction impacts will be avoided because the project construction phasing plan and TMP will specifically addresses accommodations for cumulative construction operations at these two stations. The following mitigation measure is also identified to avoid scheduling conflicts.

Mitigation Measure. Cumulative construction-related impacts due to schedule overlaps will be avoided by implementing the following mitigation measure:

- Schedule project retrofits at the West Oakland Station and construction of the West Oakland Redevelopment Project to occur at different times; schedule project retrofits at the MacArthur Station and construction of the MacArthur Station Development Project to occur at different times.

4.2.4.2 Vessel Transportation

During project construction, vibro-replacement barges could be present in the Outer Harbor Entrance Channel for up to 3 months. Fill undertaken as part of the Oakland Army Base Redevelopment Area, dredging associated with the -50-foot Navigation Improvements Project, and Berths 32/33 Wharf Rehabilitation could also introduce construction equipment into the Outer Harbor Entrance Channel. Should fill, dredge, and wharf rehabilitation actions occur at the same time as project vibro-replacement, the construction equipment for these projects could block access to, and increase the risk of vessel conflicts within, the Outer Harbor Entrance Channel. The following mitigation measure is identified for this cumulative impact.

Mitigation Measure. Vessel conflict impacts related to cumulative construction in the Outer Harbor Entrance Channel will be prevented with implementation of the following measure:

- Vibro-replacement shall be scheduled for a 3-month period when fill, dredging, and wharf rehabilitation actions associated with other approved projects are not planned, to the extent feasible.

Vibro-replacement and stitching at the Oakland end of the Transbay Tube is expected to take approximately 1 year and would occur within the yard area of Berths 32 to 34 at the Port of Oakland. During vibro-replacement and stitching, access will be maintained between the yard area and berths (as described in the mitigation measures in section 3.4.2.2.2).

Project actions at the San Francisco Ferry Building could close the northern berth of the South Terminal for up to 1 year, and Golden Gate Berth 2 for 3 months to a year. As described in section 3.4.2.2.2, the existing ferry services will be accommodated with only minor adjustments (about 15 minutes or less) in schedules. However, should the frequency of ferry service increase or new ferry routes be added per the Implementation and Operations Plan of the San Francisco Bay Water Transit Authority, it may not be possible to maintain these new and expanded services at the Ferry Building during project construction activities. This is further complicated by the Pier 1½, 3 & 5 Project, which could limit access to the emergency pier and further decrease the available berths at the Ferry Building. The following mitigation measure is identified for this cumulative impact.

Mitigation Measure. Impacts to vessel infrastructure related to cumulative construction on the San Francisco Ferry Terminal will be prevented with implementation of the following measure:

- Retrofit activities at the San Francisco Transition Structure shall be scheduled to occur before or after completion of the Pier 1½, 3 & 5 Project (estimated completion in 2005).

Expanded ferry service can only occur upon completion of the Pier 1½, 3 & 5 Project, thus scheduling retrofit activities to occur before or after completion of the Pier 1½, 3 & 5 Project avoids cumulative impacts related to expanded ferry service.

4.2.5 Geology/Seismicity

Project activities would temporarily modify the bottom topography of the Bay. The project's contribution to this cumulative impact would be negligible, however, because no regional, long-term depositional disruptions would occur in the project area, as described in section 3.5.2.2. Similar to the project, several offshore and shoreline projects (e.g., -50-Foot Navigation Improvements, Berths 32/33 Wharf Rehabilitation, Replacement of the East Span of the Bay Bridge) would involve dredging, pile driving, and associated changes to bottom topography. Although the bathymetry would be modified in association with each of the cumulative projects, these areas of dredging are located in industrial, predominantly disturbed area, where previous dredging has occurred. Depositional processes would be temporarily disrupted during construction of each of these projects; however, impacts would be localized and short term, and depositional equilibrium would be reestablished within a short period. Because no regional disruption of submarine depositional processes would occur, the project, in combination with other offshore and shoreline projects, would not result in cumulative impacts due to dredging.

Project dredging activities would potentially result in unstable geologic conditions within the Bay Mud deposits, which consist of soft silty clay that is highly compressible. However, the project's contribution to cumulative impacts would be negligible, as impacts will be localized and standard geotechnical engineering measures will be implemented (see section 3.5.2.2). Dredging for the cumulative projects would also potentially result in unstable geologic conditions within the Bay Mud deposits. However, the project, in combination with other cumulative projects, would not result in cumulative impacts due to the localized nature of these potentially unstable submarine slopes that will be mitigated with standard geotechnical engineering.

4.2.6 Hazardous Materials

The project would result in excavation of known contaminated soil and potential excavation of unknown contamination. Such contamination would be subject to assessment, segregation, and disposal at an appropriate waste disposal facility, in accordance with applicable laws and regulations. The project's contribution to cumulative impacts would be negligible, as potential health and safety impacts to construction workers will be localized, and implementation of a site-specific Health and Safety Plan and Soil Management Plan will ensure proper handling and disposal procedures are followed, as described in section 3.6.2.2. The majority of the cumulative projects onshore in the East Bay (e.g., West Oakland Redevelopment Project, Oakland Army Base Redevelopment Area, FISCO/Port of Oakland, and Alameda Point Mixed-Use Development) would similarly result in ground disturbance and potential uncovering of known or previously unknown soil and/or groundwater contamination. Each of these projects would also be subject to federal, state, and local regulations requiring site assessment and remediation. Therefore, the project, in combination with other cumulative projects, would not result in cumulative impacts, as potential health and safety impacts to construction workers will be localized, and standard procedures will be followed.

4.2.7 Risk of Upset/Safety

The project would involve construction in several areas open to the general public, including the Rockridge, MacArthur, and West Oakland Stations, and the San Francisco Ferry Building. Other projects which could result in construction in the vicinity of these BART stations and/or the Ferry Building include the West Oakland Redevelopment Project, EBMUD New Water Distribution System Project, Alameda Point Mixed-Use Development, San Francisco Ferry Terminal Project, and Pier 1½, 3 & 5 Project. Compliance with general construction procedures and regulations will prevent the public from being exposed to substantial risk from either individual projects or the projects cumulatively.

A second source of risk comes from construction in the vicinity of the Transbay Tube. Both the project and the –50-foot Navigation Improvements would introduce construction equipment in the immediate vicinity of the Transbay Tube. While patrons and BART personnel would not have direct contact with these activities, the Tube would be exposed to construction and increased risk for damage. As part of environmental documentation for the -50-foot Navigation Improvements, the USACE and Port of Oakland determined that the portion of the Tube in the proposed dredge area is below the dredging limits, which are 42 to 50 feet below mean lower low water (USACE and Port of Oakland 1998). The USACE and Port of Oakland determined that the cathodic protection system of the Tube would be seriously damaged by dredging and would have to be replaced (USACE and Port of Oakland 1998). The cathodic protection system, however, will not be affected by seismic retrofit construction because dredging activities will not occur near the system. Furthermore, adherence to the California Public Utilities Commission requirements for preparation of a Safety Certification Plan, which identifies any potential hazards to BART patrons and employees and applicable mitigations, will ensure the project's contribution to cumulative risks from construction in the vicinity of the Tube is negligible. Implementation of mitigation measures for the -50-foot Navigation Improvements Project, replacement of the cathodic protection system, as needed, as well as adherence to general construction procedures, and compliance with USCG regulations will reduce to negligible the cumulative risks from construction in the vicinity of the Transbay Tube.

4.2.8 Visual Resources

The appropriate geographic area for evaluating cumulative impacts on visual resources is normally relatively localized, and not regional, because of the nature of aesthetic features and views. Accordingly, the geographic scope of cumulative visual resource impacts varies with each portion of the BART system, depending on its context. As certain project work sites (e.g., Rockridge Station, West Oakland Station, Chabot Road and Golden Gate Avenue overpasses, Oakland Transition Structure, etc.) would have no other projects occurring concurrently with proposed construction activities, the project would not contribute to cumulative impacts on visual resources there; accordingly, they are not discussed further below.

Project impacts on visual resources at the MacArthur Station will be negligible due to implementation of project measures, as described in section 3.8.2.2. Although the MacArthur Station Development Project would occur in the vicinity of the project work sites, it is unlikely to affect the specific visual resources (artworks) at the station that are potentially affected by the project. Therefore, no cumulative impacts to visual resources in this project area would occur.

Cumulative impacts on visual resources associated with the San Francisco Bay Trail, near the Aerial Transition Structure at the Port of Oakland, would be limited to the Port. Although the Port proposes to implement a number of redevelopment projects, some are located offshore or affect only marine terminals, and the remainder would not affect any portion of the San Francisco Bay Trail. Project impacts will be negligible with implementation of project restoration measures, as described in section 3.8.2.2, so the project would not contribute to cumulative impacts.

The project would have temporary and negligible impacts on visual resources at Hardy Park due to implementation of project restoration measures, as described in section 3.8.2.2. Although the Rockridge Greenbelt Development Project could also temporarily affect Hardy Park, the two projects would not affect the same visual resources, and therefore, no cumulative visual impacts would occur.

Impacts associated with seismic retrofit of the San Francisco Transition Structure and Transbay Tube would occupy relatively small areas in relation to their surroundings and larger visual settings, would be temporary, and would not result in permanent changes in the Ferry Plaza or to the surface water or visibility in the Bay. Several related projects have been identified in this area (San Francisco Northeastern Waterfront), including the San Francisco Ferry Terminal Project and the Pier 1½, 3 & 5 Project. These projects would likely result in the permanent removal and/or reconfiguration of waterfront piers and pedestrian walkways. However, because project impacts would be negligible with implementation of project measures, as described in section 3.8.2.2, the project would not contribute to cumulative visual impacts here.

The project's contribution to cumulative visual impacts associated with offsite disposal of dredged materials would be negligible. Because barges are a common sight throughout San Francisco Bay, barge transport of dredged material to locations outside the project would also result in negligible impacts on visual character and visual resources, including visual qualities of vividness, intactness, and unity, either at the project work sites or along the barge routes.

4.2.9 Biological Resources

Marine Resources

The impacts that are shared by other projects with in-water construction include:

- Temporary disruption and/or loss of the benthic community;
- Increased suspended particulates and turbidity, and the resulting biological effects described in section 3.9.2.2; and,
- Underwater noise impacts on mammals and fish.

Project impacts on the benthic community in the Bay would be localized, and would disrupt only a relatively small area (up to 8 acres). Other projects in the area would similarly result in disruption/loss of the benthic community, including the Port of Oakland –50-foot Navigation Improvements Project, the Replacement of the Bay Bridge East Span, and the San Francisco Ferry Terminal Project. The area of the benthic community that would be disrupted by the other projects is not known, but considering that mitigation measures will be implemented for any project that adversely affects benthic communities, cumulative impacts are expected to be negligible. Overall, the project's contribution to cumulative impacts on the benthic community in the Bay would be negligible because only a small area would be affected, and as no area would be repeatedly disturbed, re-colonization would be expected to occur relatively quickly.

Project turbidity effects would be contained to the immediate construction area and would dissipate once construction ends each day. For most aspects of in-water construction, turbidity effects would not occur over an extended period at a given location, because the construction activity would move along the Transbay Tube alignment. Similar to the project, other dredging and/or in-Bay projects would increase suspended particulates and turbidity, although turbidity would also be localized and dissipate at the end of construction each day. The project's contribution to cumulative turbidity impacts on biological resources in the construction area would be negligible for all species occurring in the area, with the exception of herring. For impacts to herring, the project includes a mitigation measure to avoid any potential impact during spawning season, as described in section 3.9.2.2.

The greatest potential for cumulative impacts on marine resources in the Bay would be from underwater noise associated with potential pile installation for the project, combined with that for the Replacement of the Bay Bridge East Span. Standard pile driving techniques (i.e., use of an impact hammer) have the potential to cause adverse effects on fish and marine mammals, including physical injury and mortality. The Bay Bridge East Span Project would also use standard pile driving techniques, but mitigation has been developed in consultation with NOAA Fisheries to reduce underwater noise and sound pressure levels so as to prevent impacts on marine species. For the project, as for the Bay Bridge East Span Project, mitigation measures will be implemented, as described in section 3.9.2.2, to reduce project pile driving noise to prevent impacts to fish and marine mammals. Considering all these factors, the combined impacts of the project with the Bay Bridge East Span Project are negligible.

The project's contribution to cumulative biological impacts from dredged material disposal would be negligible. A dredging operation plan for barges traveling to upland and in-Bay sites will be implemented as part of the dredging permit approval process for the project, and will include conditions for spill control measures, proper dredged material handling, use of hydraulic fuel, loading requirements, etc. The impacts of disposal for the multiple dredging projects located within the project area have been also been addressed through their dredging permit approval processes to reduce impacts to negligible levels. For this reason, the project, combined with other dredging projects that dispose of dredged material at designated sites, would not cumulatively impact biological resources.

Terrestrial Resources

In upland areas, the project would potentially affect terrestrial biological resources due to the temporary removal of trees and vegetation, although these resources are already degraded because these areas are highly urbanized. Other projects in Oakland, including the EBMUD New Water Distribution System and the Main Wastewater Treatment Plan Improvement Project, would similarly impact trees and vegetation in these highly urbanized areas. The project's contribution to cumulative impacts on terrestrial biological resources would be negligible, however, as the project would return project worksites to pre-project conditions through replacement in-kind of hardscaping and landscaping materials affected by construction. Further, although vegetation removal associated with the project would potentially degrade the habitat in the Berkeley Hills Tunnel area, mitigation measures described in section 3.9.2.2 would prevent impacts, and would reduce the project's contribution to the cumulative degradation of habitat in this area to negligible.

The project, in combination with other projects, including the Oakland Army Base Redevelopment Area, FISCO/Port of Oakland, NAS FISC Annex, and the Treasure Island Base Realignment and Closure would also result in a cumulative beneficial impact to terrestrial biological resources in Oakland, as these projects include mixed-use redevelopment that typically includes public open spaces and vegetated areas, as well as dedication of land that would either be restored to native habitat or developed with public park facilities including vegetation. Overall, beneficial and synergistic impacts on East Bay biological resources over the long-term would be expected from implementation of these projects.

4.2.10 Air Quality

The San Francisco Bay Area Air Basin (SFBAAB) is currently in nonattainment of the federal and state air quality standards for O_3, and the state standards for PM_{10} and $PM_{2.5}$. Air emissions of these pollutants generated by construction activities associated with the project would cumulatively contribute to existing adverse conditions. However, the Bay Area Air Quality Management District (BAAQMD) has considered O_3 precursor emissions from region-wide construction activities in the emission inventory that is the basis for regional air quality plans. Emissions of these pollutants are, therefore, not expected to impede attainment or maintenance of O_3 standards in the Bay Area (BAAQMD 1999). In addition, because the project includes standard measures for reducing PM_{10} emissions from dust during dry conditions, project construction emissions of PM_{10} would not be cumulatively considerable. For project-related diesel particulate matter, mitigation measures described in section 3.10.2.2 will be implemented to reduce emissions. Emissions of diesel particulate matter and PM_{10} would primarily affect sensitive receptors in close proximity to each construction site. Substantial cumulative air quality impacts would potentially result if concurrent diesel particulate matter and PM_{10} emissions from construction of another nearby project affected the same sensitive receptors.

Cumulative air quality impacts could affect sensitive receptors in the vicinity of:

- the MacArthur Station due to the project and the MacArthur Station Development Project;
- the San Francisco Transition Structure due to the project and the San Francisco Ferry Terminal Project; and
- dredged material reuse/disposal areas near other active projects.

Measures to mitigate the project's contribution to cumulative construction and dredged material disposal impacts will be carried out, and are identified in section 3.10.2.2. Implementation of these measures will reduce the project's contribution to negligible levels.

4.2.11 Social Impacts

The project would have no social impacts, as described in section 3.11 and, therefore, would not contribute to a cumulative social impact on neighborhoods and communities surrounding the proposed work sites, including any disproportionately high and adverse impacts on minority or low-income populations (i.e., Environmental Justice).

5.0 CONSULTATION AND COORDINATION

5.1 AGENCY CONSULTATION

5.1.1 Meetings and Teleconferences

This section identifies the agencies that were consulted during preparation of this EA to solicit their input on the project, and describes the topics discussed with those agencies.

BART held an interagency coordination meeting at the U.S. Army Corps of Engineers (USACE) — San Francisco District office on August 14, 2002, to describe the project and solicit the participating agencies' input on the project's permitting/approval requirements involving water and marine resource issues. The following agencies participated in this meeting:

- USACE,
- National Oceanic and Atmospheric Administration (NOAA) Fisheries (or National Marine Fisheries Service),
- San Francisco Bay Conservation and Development Commission (BCDC), and
- San Francisco Bay Regional Water Quality Control Board (SFBRWQCB).

BART conducted three meetings with various agencies to discuss potential vessel transportation issues associated with the project. The first meeting was held on January 22, 2003, with the San Francisco Bay Water Transit Authority, the City of Vallejo, and the City of Alameda. The purpose of the meeting was to give a brief presentation of the retrofit concepts to the ferry operators and to obtain information on potential impacts on ferry service operations during project construction. A second meeting was held on February 6, 2003, with the U.S. Coast Guard, the California Department of Boating and Waterways, the San Francisco Bar Pilots, and the San Francisco Harbor Safety Committee to discuss potential impacts related to project construction and navigation in the San Francisco Bay, underneath the San Francisco-Oakland Bay Bridge, and within the Port of Oakland. The third meeting, held on February 18, 2003, with the City of Alameda and Port of San Francisco served as a forum to develop mitigation measures for potential impacts to ferry service operations.

BART gave a presentation on the project at a regularly scheduled meeting of the Dredged Material Management Office (DMMO) on April 2, 2003. Representatives from the following agencies were at this meeting: USACE, California Environmental Protection Agency (Cal-EPA), BCDC, and the SFBRWQCB. The purpose of the meeting was to solicit agency input on dredging and disposal issues associated with the project.

BART held several teleconferences with regulatory agencies. BART held two teleconferences with NOAA Fisheries on January 30 and February 6, 2003, to discuss noise issues associated with in-Bay construction techniques on fish and marine mammals. BART held a teleconference with the BCDC on March 6, 2003, to discuss the BCDC's permitting requirements for the project, including its consistency determination process. BART held a teleconference with the SFBRWQCB on March 13, 2003, to discuss water quality issues related to the project, including the SFBRWQCB's water quality certification process.

BART conducted a Section 4(f) consultation in support of FHWA, which per the requirements of 49 USC 303 and 23 CFR 771.135(b) has the responsibility to make a determination regarding the application of Section 4(f) to a proposed project. Letters were submitted to the Port of Oakland regarding a segment of the San Francisco Bay Trail adjacent the 7th Street right-of-way within the Port of Oakland, and to the City of Oakland regarding Hardy Park, a Caltrans-owned facility in Oakland's Rockridge neighborhood (operated by the City of Oakland Office of Parks and Recreation), both of which would be temporarily affected by project construction activities (see Appendix D, Section 4(f) Correspondence).

5.1.2 Permits and Approvals Required for the Project

The following permits and approvals will likely be required for the seismic retrofit project.

5.1.2.1 Federal Permits/Approvals

U.S. Army Corps of Engineers

- Rivers and Harbors Act (RHA) Section 10 permit for *work* (including dredging) or *structures* (e.g., retrofit of the San Francisco Vent Structure) in navigable waters.
- Clean Water Act (CWA) Section 404, RHA Section 10, and Marine Protection, Research and Sanctuary Act (MPRSA) Section 103 permit if *dredging, transport,* or *aquatic disposal* (e.g., in-Bay or San Francisco Deep Ocean Disposal Site) of dredged material is required.

U.S. Coast Guard

- Anchorage Waiver permit for construction activities that would require anchoring construction barges in the San Francisco Bay and Oakland Harbor regulated navigation areas.

U.S. Fish and Wildlife Service

- Consultation under Section 7 of the federal Endangered Species Act (ESA) for terrestrial biological resources and birds.

NOAA Fisheries

- Consultation under Section 7 of the federal ESA for fish and marine mammals.
- Consultation under the federal Magnuson-Stevens Fishery Conservation and Management Act for Essential Fish Habitat (EFH).
- Incidental Harassment Authorization (IHA) for species covered by the Marine Mammal Protection Act (MMPA) if it is determined that marine mammals would be harassed by the project (e.g., potentially by conventional impact-hammer pile driving in the Bay).

5.1.2.2 State Permits/Approvals

California Department of Fish and Game

- California Endangered Species Act (CESA) permit authority (PRC Section 2080.1) if a state-listed species would be adversely affected. There are several state-listed species that may occur in, or migrate through, the project area. Section 2080.1(c) states that if any person obtains from the U.S. Fish and Wildlife Service (USFWS) or NOAA Fisheries an incidental take statement pursuant to Section 1536 of the federal ESA that authorizes the taking of a listed endangered or threatened species, and such species are also endangered, threatened or candidate species pursuant to CESA, no further authorization or approval is necessary under this Section provided the recipient of the incidental take statement does the following:

- Notifies the director in writing that an incidental take statement has been received pursuant to the federal ESA, and
- Includes a copy of the incidental take statement with the notification.

Regional Water Quality Control Board

- CWA Section 401 Water Quality Certification in connection with the Section 404 permit for pollution prevention if dredged material is disposed of in waters of the United States.
- Coverage under the General Permit for Stormwater Discharges Associated with Construction Activities. Dewatering effluent discharges, if needed, would be covered under a CWA Section 402 National Pollutant Discharge Elimination System (NPDES) permit or waste discharge requirement.

San Francisco Bay Conservation and Development Commission

- Major Permits. BCDC permits are required for any project that involves filling, dredging, shoreline projects, and other projects that involve construction along the shoreline. Major Permits are required for work that is more extensive than minor repair or improvement; these permits require a public hearing.
- Coastal Zone Management Act (CZMA) Federal Consistency Determination. This determination does not result in a permit, but rather a review that the project is consistent with the provisions of the federal CZMA.

State Historic Preservation Officer (SHPO)

- Completion of the National Historical Preservation Act (NHPA) Section 106 process for cultural resources.

5.1.2.3 Regional Permits/Approvals

Bay Area Air Quality Management District

- Permit to Operate for dredges but only if the dredges are moored to a stationary dock for their operation (i.e., they are not mobile).

5.1.2.4 Local Permits/Approvals

City of Oakland

- Encroachment permit from Public Works Agency, Traffic Engineering and Parking Division, for construction activities that require closure of roads, elimination of parking, enforcement of parking restrictions, and/or diversion of traffic within the City of Oakland.

Port of Oakland

- A Right of Entry permit would be needed for any project work on Port of Oakland property.

Port of San Francisco

- A Right of Entry permit would be needed for any project work on Port of San Francisco property.

5.2 PUBLIC OUTREACH

BART conducted three public information meetings: one on January 28, 2003, in Oakland, California; the second on October 23, 2003, in Rockridge, California; and the third on January 18, 2005, in San Francisco, California. During these meetings, BART presented information on the project and solicited public input on issues to be addressed in the EA. A public hearing will be held during the public review period of this report; this is expected to occur in September 2005. The Final EA will address comments received from the public and from public agencies during the public review period.

1 # 6.0 LIST OF PREPARERS

2 ## 6.1 LEAD AGENCIES

3 ### U.S. Department of Transportation Federal Highway Administration

Steve Healow, P.E.	Senior Project Development Engineer (District 4)
Joan Bollman	Senior Environmental Specialist (North)

4 ### State of California Department of Transportation (District 4)

Chuck Morton	Branch Chief, Biological Resources
Elizabeth McKee	Branch Chief, Archaeology
Elizabeth Krase	Branch Chief, Architectural History
Meg Scantlebury	Environmental Planner, Architectural History
Thad Van Bueren	Branch Chief, Historic Archaeology
Wingate Lew	Senior Transportation Planner

5 ### San Francisco Bay Area Rapid Transit District (BART)

Tom Horton	Seismic Group Manager
Janie Layton	Manager of Environmental Compliance
Shirley Ng	Deputy Project Manager, Seismic Retrofit Program
Hassen Beshir	Principal Engineer
Eric Fok	Principal Engineer

BART Seismic Retrofit Engineering Team

Bechtel

Balram Bhandari	Deputy Engineering Manager
Clay Claassen	Construction Manager
Ching Wu	Project Manager

HNTB

Chip Mallare	Deputy Engineering Manager-Aerial structures
Lillian Yan	Civil Support Manager

Other BART Consultants

Vicki Reynolds	Wetlands Biologist
CDM	Randall Smith, Project Manager
Ward & Associates	Benjamin Ananian, Anthropologist/Archaeologist

6.2 EA PREPARERS

Name	*Title or Expertise*	*Years of Experience*	*Role in Preparing EA*
Science Applications International Corporation (SAIC)			
EA Authors			
Jessica Benson	Planner	3 Years	Dredged Material Disposal Scenario
Meredith Clement	Planner	8 years	Ground and Vessel Transportation; Risk of Upset/Safety
Maia Coladonato	Environmental Planner	10 years	Hazardous Materials; Risk of Upset/Safety
Anne Doehne	Senior Planner	12 Years	Visual Resources; Environmental Justice; Section 4(f) Resources
Karen Foster	Senior Archaeologist	16 years	Project Description; Archaeological Resources
Chris Hunt	Biologist	6 years	Marine Biological Resources
Bill O'Brien	Senior Water Resource Engineer	22 Years	Water Resources, including Location Hydraulic Study
Charlie Phillips	Senior Scientist	25 years	Water Resources
Perry Russell	Senior Geologist	18 years	Geology/Seismicity; Hazardous Materials
Theresa Stevens	Senior Biologist	14 Years	Terrestrial Biological Resources
David Stone	Cultural Resources Manager	26 years	Historic Resources
Ted Turk	Senior Scientist	24 years	Marine Biological Resources
Stephen Ziemer	Senior Air Quality Specialist	24 years	Air Quality
EA Project Management			
Alison Malkin	Planner	5 years	Current Project Manager
Deborah Pontifex	Senior Program Manager	22 years	Previous Project Manager; QA/QC
Garrett Turner	SAIC Program Manager	20 years	Contractual Issues

Subcontractors to SAIC			
G. Borchard & Associates	Gayle Borchard, Principal	21 years	Project Description; Local NEPA Liaison
Dowling Associates, Inc.	Mike Aronson, P.E., Principal Mike Carroll, Senior Transportation Planner	20 years 11 years	Ground Transportation
Illingworth & Rodkin	Rich Rodkin, Principal	29 years	Noise
Monte Kim	Architectural Historian	6 years	Architectural History
William Self Associates	James Allan, Principal Heather Price, Senior Archaeologist	34 years 22 years	Historic and Prehistoric Archaeological Resources

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8.0 ACRONYMS AND ABBREVIATIONS

ABC	air bubble curtain
ACHP	Advisory Council on Historic Preservation
AC Transit	Alameda Contra Costa Transit District
AIRFA	American Indian Religious Freedom Act
APE	Area of Potential Effect
ARB	California Air Resources Board
ARPA	Archaeological Resources Protection Act of 1979
ASR	Archaeological Survey Report
BA	Biological Assessment
BAAQMD	Bay Area Air Quality Management District
BART	San Francisco Bay Area Rapid Transit
Bay Bridge	San Francisco-Oakland Bay Bridge
BCDC	San Francisco Bay Conservation and Development Commission
BMP	best management practice
BPTCP	Bay Protection and Toxic Cleanup Program
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal-EPA	California Environmental Protection Agency
Cal-OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CASAC	Clean Air Scientific Advisory Committee
CCAA	California Clean Air Act
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology

CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cm	centimeter
CMA	Alameda County Congestion Management Agency
CMP	Congestion Management Plan
CNDDB	California Natural Diversity Data Base
CNEL	community noise equivalent level
CO	carbon monoxide
CPI-U	Consumer Price Index
CWA	Clean Water Act
cy	cubic yards
CZMA	Coastal Zone Management Act
dB	decibel
dBA	A-weighted decibel
dBC	C-weighted decibel
DDT	dichloro-diphenyl-trichloroethane
DMMO	Dredged Material Management Office
DO	dissolved oxygen
DOT	U.S. Department of Transportation
DTSC	California Department of Toxic Substances Control
EA	Environmental Assessment
EB	eastbound

EDR	Environmental Data Resources, Inc.
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FEMA	Federal Emergency Management Administration
FHWA	Federal Highway Administration
FISC	Fleet and Industrial Supply Center
FISCO	Fleet and Industrial Supply Center — Oakland
FOE	Finding of Effect
HAP	hazardous air pollutant
HCM	Highway Capacity Manual
HPSR	Historic Property Survey Report
HRER	Historical Resources Evaluation Report
Hz	Hertz
ICBO	International Conference of Building Officials
IHA	Incidental Harassment Authorization
km	kilometer
L_{dn}	day-night equivalent noise level
L_{eq}	energy equivalent noise level
L_{max}	maximum A-weighted noise level
L_{min}	minimum A-weighted noise level
LOS	level of service
LTMS	Long-Term Management Strategy
LUST	leaking underground storage tank
MBTA	Migratory Bird Treaty Act

mcy	million cubic yards
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MHTL	mean high tide line
mm	millimeter
mm/sec	millimeters per second
MMPA	Marine Mammal Protection Act
MPRSA	Marine Protection, Research and Sanctuary Act
ms	millisecond
msl	mean sea level
MTC	Metropolitan Transportation Commission
MTS	Metropolitan Transportation System
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NES	Natural Environment Study
NGVD	National Geodetic Vertical Datum
NHPA	National Historical Preservation Act
nmi	nautical mile
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	National Response Center
NRHP	National Register of Historic Places

O_3	ozone
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
PM_{10}	particulate matter smaller than 10 microns in diameter
ppm	parts per million
ppv	peak particle velocity
PRC	Public Resources Code
PRG	Preliminary Remediation Goal
RBSL	risk-based screening level
RHA	Rivers and Harbors Act
RMP	Regional Monitoring Plan
rms	root-mean square
ROD	Record of Decision
ROG	reactive organic gas
RTP	Regional Transportation Plan
RTIP	Regional Transportation Improvement Program
RWQCB	Regional Water Quality Control Board
§	symbol for "Section"
SFBAAB	San Francisco Bay Area Air Basin
SF-DODS	San Francisco Deep Ocean Disposal Site
SFEI	San Francisco Estuary Institute
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide

SPCC	Spill Prevention Control and Countermeasure Plan
SPL	sound pressure level
SWPPP	Stormwater Pollution Prevention Plan
TAC	toxic air contaminant
TEA-21	Transportation Equity Act for the 21st Century
TIP	Transportation Improvement Plan
TMDL	total maximum daily load
TMP	traffic management plan
TPHd	total petroleum hydrocarbons (diesel)
TRI	Toxics Release Inventory
TSS	total suspended solids
TTS	temporary threshold shift
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
VTS	Vessel Traffic Service
WDR	waste discharge requirement
WTA	San Francisco Bay Water Transit Authority
$\mu g/m^3$	micrograms per cubic meter
μPa	micropascal

Appendix A

Dredged Material Reuse/Disposal Options

APPENDIX A

Dredged Material Reuse/Disposal Options

A.1 DREDGED MATERIAL REUSE WITHIN THE PROJECT

A.1.1 Conceptual Construction Sequence

If the dredged material meets the requirements for in-Bay disposal, some of the dredged material could be reused within the stitching operation by backfilling the stitching holes after the installation of the pile and pile caps. During reuse of dredged material within the stitching operation, the ordinary backfill (a special mix of sand and gravel) would be removed during dredging to ensure that the frame for the stitching piles sits directly over the Transbay Tube. Due to constraints associated with dredging, segregation of the ordinary backfill from the silt and sediment would not be feasible. Therefore, up to 11,000 cubic yards (cy) of additional material would have to be imported to replace the existing ordinary backfill directly over the Tube; all imported ordinary backfill would be placed into the six stitching holes. Filling the holes with the imported ordinary backfill would potentially displace up to 11,000 cy of dredged material, which could exceed the capacity of the six holes. Although it is impossible to closely balance cut and fill volumes during dredging operations due to sediment settling and other factors, such as ocean currents, the possibility remains that up to 11,000 cy of dredged material may be leftover following completion of dredging activities.

In the description below, the six stitching holes are numbered 1 through 6, with 1 being closest to the San Francisco Transition Structure (see Figure 2-20).

1. Hole #6, the hole farthest away from the transition structure, would be excavated first. The excavated material (approximately 8,800 cy) would be stored on two barges that would be temporarily stored offsite. The Port of San Francisco maintains a wharf south of China Basin that is specifically arranged for barge storage, and would be the likely storage location.

2. The barge supporting the clamshell excavator would be moved away from the site to allow for construction of the stitching piles and cap at Hole #6 (this part of the operation is necessary whether dredged material is reused on site or disposed of elsewhere). After this construction is complete, but before beginning excavation of Hole #5, the contractor would import and place 1,800 cy of new ordinary backfill over the Tube at Hole #6.

3. The contractor would then move his excavation operation back on site. Excavated material from Hole #5 (approximately 8,500 cy) would be used to fill Hole #6. The contractor would use one barge to support the clamshell excavator and a second barge for placement of the excavated material. The excavated material would be placed into Hole #6, using a clamshell bucket, a tremie system, or some method other than dumping. Two barges are necessary because the distance between the two holes is too great to allow the excavator to swing material directly between them. After excavation

and disposal is complete, the two barges would be moved offsite to allow for construction of the stitching piles and cap at Hole #5.

4. After construction of the stitching piles and cap and placement of new ordinary backfill over the Tube at Hole #5 (approximately 1,800 cy), the contractor would excavate Hole #4 (approximately 9,100 cy) and place it in Hole #5 in the fashion described above. The small excess of material here should sufficiently fit within Hole #5.

5. After construction of the stitching piles and cap and placement of new ordinary backfill over the Tube at Hole #4 (approximately 1,800 cy), the contractor would excavate Hole #3 (approximately 16,700 cy) and place a portion of the dredged material into Hole #4. The remainder would be placed on two barges and taken to the same storage area where the first two storage barges were located.

6. The contractor would continue in a similar fashion for Hole #2 (approximately 29,000 cy), this time generating enough excess material to fill three barges. These barges would also be stored at the piers south of China Basin.

7. The contractor would excavate Hole #1 (approximately 54,000 cy) and place some of the material into Hole #2. The remainder would be placed temporarily on five barges. Since this material is to be returned to Hole #1 immediately after completion of the stitching piles, it may be possible to maintain these barges at the site for a short period and simply place the material back in the hole. If this is not possible, then these barges would join the others at the piers south of China Basin.

After completion of the stitching piles and cap at Hole #1 and the placement of ordinary backfill, the contractor would bring all stored material back to Hole #1 and place it there. If any dredged material exceeds the capacity of the six stitching holes, it will be disposed offsite at one of the permitted reuse/disposal sites (described in section A.2.5), along with the additional, up to 95,900 cy of leftover dredged material associated with the Isolation Walls Retrofit Concept at the San Francisco Transition Structure. Transport of the total maximum 106,900 cy of dredged material leftover after reuse within the stitching holes would require a maximum of 31 barge trips (each containing approximately 3,500 cy of material).

A.2 DREDGED MATERIAL REUSE/DISPOSAL OPTIONS OUTSIDE THE PROJECT

A.2.1 Dredge Equipment

The following assumptions are made for the dredge, tug, and barge equipment that would be used for dredged material reuse/disposal options outside the project:

- One 1,800-Horsepower (Hp) clamshell dredge operating at an average load factor of 0.8,
- Three 1,800-Hp tugs with the following tug disposition-specific load factors: 0.8 (with loaded barge), 0.2 (with empty barge), and 0.05 (during idle/barge loading/barge unloading conditions), and

- Three 5,000-cy barges.

It is assumed that each 5,000-cy barge would have an effective material loading capacity of 70 percent, because approximately 30 percent of the capacity would be taken up by water and material bulking, which is the volume of the material that expands upon excavation. This 30 percent reduction in barge capacity would also accommodate the need to not load the barges beyond the extent to which they can fully contain the dredged material during transport to the disposal site. Therefore, each barge load would carry about 3,500 cy of material. Sixty-four (64) barge trips would be required to transport the worst-case volume of 222,000 cy of dredged material. The round trip travel time required for each reuse/disposal site, the number of barge trips by dredging location, and the frequency of barge trips to each reuse/disposal site is described below.

A.2.2 Round Trip Travel Time Required for Each Reuse/Disposal Site

Travel times associated with each potential reuse/disposal site outside the project are provided in Table A-1. The tug/barge speed going from the dredge site out to the disposal site is slower by 2 knots than the speed of the tug/barge returning from the disposal site because the barge is loaded going out, and empty on the return.

Table A-1. Travel Times Associated with Dredged Material Reuse/Disposal Options outside the Project

Alternative Disposal Site	*Travel Time to Disposal Site*	*Travel Time from Disposal Site*	*Idle/Load/Unload Time (a) Per Round Trip*	*Total Round Trip Time*
Alcatraz	0.54 hour (b)	0.41 hour (c)	13.5 hours	14.5 hours
SF-DODS	9.86 hour (d)	7.67 hour (e)	13.5 hours	31.0 hours
Hamilton	3.37 hour (f)	2.58 hour (g)	22.5 hours	28.5 hours
Montezuma	6.20 hour (h)	4.74 hour (i)	22.5 hours	33.4 hours
Winter Island	6.02 hour (j)	4.60 hour (k)	22.5 hours	33.1 hours
Alameda	0.71 hour (l)	0.54 hour (m)	22.5 hours	23.8 hours
Port of Oakland (Berth 10) (n)	0.89 hour (o)	0.68 hour (p)	22.5 hours	24.1 hours

Notes:

a) Assumes 11.5 hours of load time, 1 hour of dump time for aquatic sites (or 10 hours of unloading time at a rehandling facility for upland sites), and 1 hour of idle time per round trip. Load time based on an average clamshell dredge rate of 5,000 cy of material per 16-hour day.
b) 3.5 nautical miles (nmi) @ 6.5 knots.
c) 3.5 nmi @ 8.5 knots.
d) 69.0 nmi @ 7.0 knots.
e) 69.0 nmi @ 9.0 knots.
f) 21.9 nmi @ 6.5 knots.
g) 21.9 nmi @ 8.5 knots.
h) 40.3 nmi @ 6.5 knots.
i) 40.3 nmi @ 8.5 knots.

Table A-1 (cont'd). Travel Times Associated with Dredged Material Reuse/Disposal Options outside the Project

Notes (cont.):
- j) 39.1 nmi @ 6.5 knots.
- k) 39.1 nmi @ 8.5 knots.
- l) 4.6 nmi @ 6.5 knots.
- m) 4.6 nmi @ 8.5 knots.
- n) Berth 10 at the Port of Oakland is the assumed rehandling facility for the East Bay landfills.
- o) 5.8 nmi @ 6.5 knots.
- p) 5.8 nmi @ 8.5 knots.

A.2.3 Number of Barge Trips by Dredging Location

The six stitching locations shown on Figure 2-20 would be dredged in reverse numerical order, i.e., starting with Location 6 and ending with Location 1. The number of barge trips necessary to transport the dredged material from each of these locations is listed in Table A-2.

Table A-2. Number of Barge Trips Needed to Transport Dredged Material from Stitching Operation

Stitching Location	*Volume of Dredged Material (cy)*	*Capacity per Barge (cy)*	*Number of Barge Trips*
Location 6	8,800	3,500	3
Location 5	8,500	3,500	3
Location 4	9,100	3,500	3
Location 3	16,700	3,500	5
Location 2	29,000	3,500	9
Location 1	54,000	3,500	16
Total Number of Barge Trips			39

For retrofit activities at the San Francisco Transition Structure, the number of barge trips necessary to transport the dredged material associated with either Retrofit Concept (i.e., Steel Piles Retrofit Concept or Isolation Walls Retrofit Concept) is listed in Table A-3. Total dredged material (26,200 cy) associated with the Steel Piles Retrofit Concept, including pile array, pile and collar anchorage, containment structures, and sacrificial walls would require 8 barges, assuming all activities occur at the same time. Total dredged material (95,000 cy) associated with the Isolation Walls Retrofit Concept, including isolation and support walls, containment structures, and sacrificial walls would require 28 barges, assuming all activities occur at the same time.

Table A-3. Number of Barge Trips Needed to Transport Dredged Material from San Francisco Transition Structure Retrofits

Retrofit Activity	*Volume of Dredged Material (cy)*	*Capacity per Barge (cy)*	*Number of Barge Trips*
STEEL PILES RETROFIT CONCEPT			
Pile Array	--	--	--
Pile and Collar Anchorage	10,000	3,500	3
Containment Structures and Sacrificial Walls	16,200	3,500	5
		Total Number of Barge Trips	8
ISOLATION WALLS RETROFIT CONCEPT			
Isolation and Support Walls	80,000	3,500	23
Containment Structures and Sacrificial Walls	15,000	3,500	5
		Total Number of Barge Trips	28

The total volume of dredged material requiring reuse/disposal is expected to be 152,300 cy if the Steel Piles Retrofit Concept is implemented at the San Francisco Transition Structure, or 221,100 cy if the Isolation Walls Retrofit Concept is implemented (see Table 2-1). The environmental analysis, however, is based on 222,000 cy of dredged material to provide a worst-case analysis and to allow for a cushion in case some of the areas to be dredged result in more dredged material than estimated. Therefore, 64 barge trips would be required to transport the worst-case volume of 222,000 cy of dredged material.

A.2.4 Frequency of Barge Trips to Each Reuse/Disposal Site

It is assumed that the crew of the tug/barge would work up to a 16-hour day. From Table A-1 (footnote a), it takes almost 12 hours to load one barge with dredged material. This table also indicates that the time required to make a round trip from the dredge site to the disposal site and back (including the time to load the dredged material onto the barge) is more than 16 hours for each site considered except the Alcatraz site. All of the disposal sites except Alcatraz would thus require 2 days for each round trip, with the tug/barge going to the site one day and returning the next day. During periods when dredging is occurring for the project, there would be three tug/barge combinations operating, with the assumption that on any given work day, including:

- one tug/barge would be onloading material at the dredge site,
- one tug/barge would be traveling to the disposal site, and
- one tug/barge would be returning to the dredge site from the disposal site that it visited the previous day.

This dredging and barging activity would last up to 4 years (see Table 2-1). Assuming this work occurred only during weekdays, this activity would last up to 1,040 days (208 weeks x 5 work days/week = 1,040 days). Since most of the disposal sites would require 2 days for a complete round trip, including the dredging, and there would be up to 64 barge trips necessary for 222,000 cy, the barge trips if occurring consecutively could last for at least 128 days, or approximately 4.5 months.

A.2.5 Description of the Eight Reuse/Disposal Sites

A.2.5.1 Alcatraz (SF-11)

The Alcatraz disposal site (known as SF-11) is a 2,000-foot-diameter circle located 0.3 miles south of Alcatraz Island (centered at 37°49’17”N, 122°25’23”W) (see Figure A-1). Both federal and non-federal dredgers have used the Alcatraz site since 1894. Alcatraz receives the most use because of its strong currents as well as proximity to the ocean and all major ports that require extensive dredging.

Beginning in 1975, monitoring of the conditions at SF-11 showed decreasing water depths (from –160 to –95 feet), suggesting that dredged material was not being dispersed from the site. In the mid-1980s, as a result of frequent disposal at this site, a mound developed at its eastern portion, posing a hazard to navigation. In order to address this problem, the USACE started to conduct quarterly bathymetric surveys, and issued PN *93-3-Proposed Change in Corps Policy on Alcatraz Dredged Material Disposal Site Management*, which sets limits on the volume and timing of disposal activities at Alcatraz in an effort to minimize mounding by maximizing dispersion from the site. Currently, there is a yearly disposal volume limitation of 4 million cy (mcy) for this site, with a monthly restriction of 400,000 cy from October to April, and 300,000 cy from May to September (USACE et al. 1998).

Recent monitoring of the Alcatraz Disposal Site has shown that the mounding of dredged material is still occurring. The mound covers about 2/3 of the site, but appears to be decreasing in both area and volume above the –40 foot level. Currently, this site allows clamshell dumping. The dredged material that is disposed at Alcatraz is from maintenance dredging and is mainly composed of silt, which disperses well. Sandy material, which often comes from new work dredging, is not allowed at Alcatraz so, if aquatic disposal is desired, it often goes to the San Francisco Deep Ocean Disposal Site (SF-DODS).

A.2.5.2 San Francisco Deep Ocean Disposal Site

SF-DODS is the deepest ocean dredged material disposal site in the United States. It is located off the Continental Shelf in approximately 8,200 to 9,800 feet (2,500 to 3,000 meters) of water, approximately 55 nautical miles (100 kilometers) offshore San Francisco (Figure A-2). SF-DODS can accept a maximum of 4.8 mcy per year; therefore, SF-DODS could potentially accept all material suitable for unconfined aquatic disposal that would be dredged from the project (USACE et al. 1998).

A.2.5.3 Hamilton Wetland Restoration

The Hamilton Wetland Restoration Project would restore the former Hamilton Army Airfield and the adjacent State Lands Commission Antennae Field to tidal and non-tidal wetlands. The Hamilton restoration site is located on the northwestern edge of San Pablo Bay in the San Francisco Estuary (Figure A-3).

The site, totaling over 900 acres, consists of the 619-acre former Hamilton Army Airfield plus the continuous 20-acre Navy ballfields and the 250-acre State Lands Commission Antennae Field. Wetland restoration would be implemented on a portion of the airfield parcel and the abandoned antennae field.

In addition, a Conceptual Wetland Restoration Plan (Plan) is under preparation for the Bel Marin Keys Unit V property, located in southeast Novato, Marin County (see Figure A-3). The Plan evaluates the potential restoration of the property as an expansion of the adjacent Hamilton Wetlands Restoration Project. The addition of the Bel Marin Keys parcel would add 1,610 acres along San Pablo Bay, for a total area of 2,598 acres (CCC 2003).

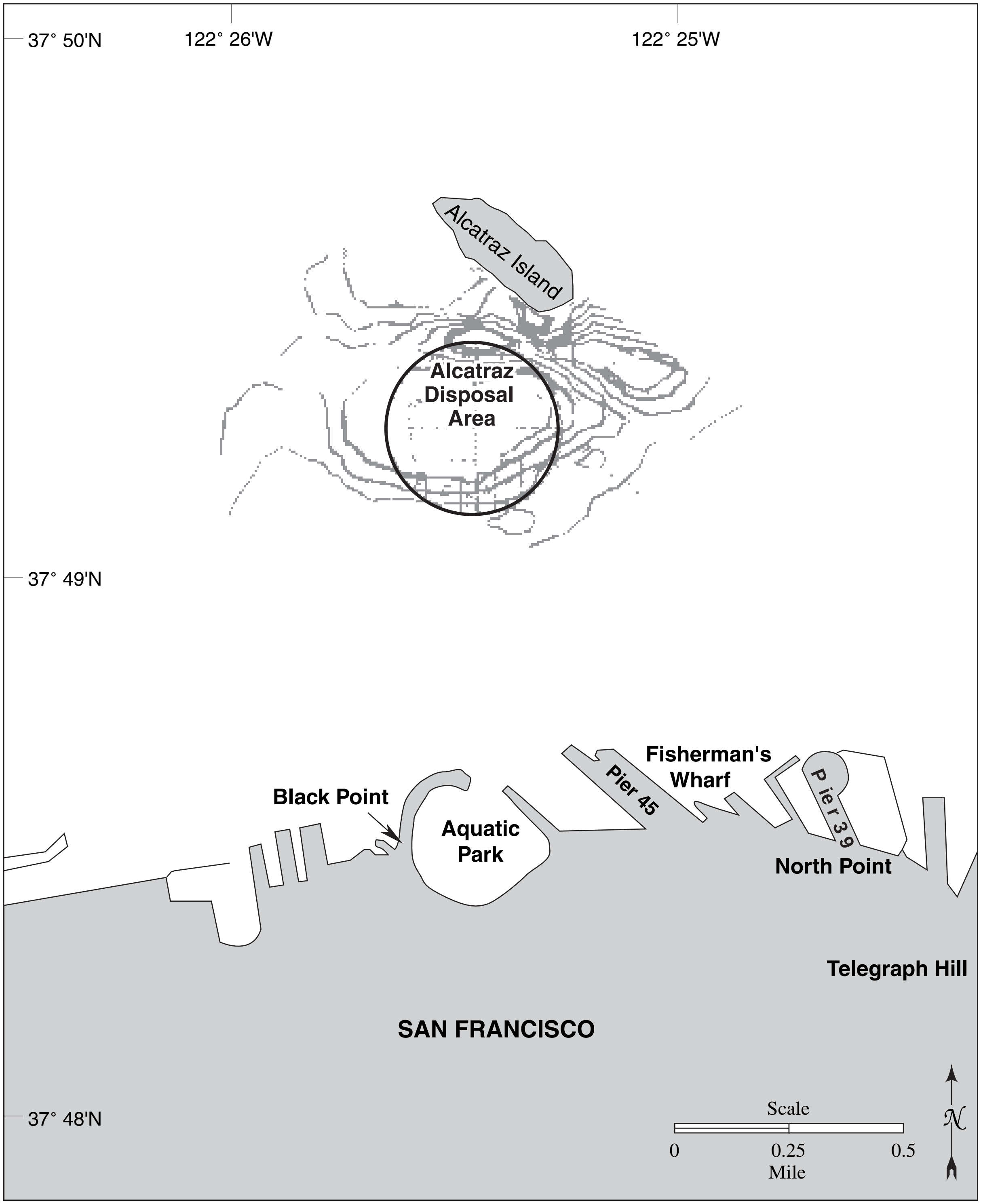
The Hamilton Wetland Restoration Project provides the opportunity to beneficially reuse dredged material from Bay maintenance dredging and new dredging projects to raise the elevation of subsided diked lands. Work on the Hamilton site began in 2005. The site would have the capacity to accommodate a total of 10.6 mcy of dredged material (CCC 2003). Only clean "cover" material would be accepted at the Hamilton site.

A.2.5.4 Montezuma Wetland Restoration

The Montezuma Wetland Restoration site is located in Solano County, California (Figure A-4). The project will restore 1,720 acres of tidal wetlands and create 109 acres of managed wetlands, establishing a tidal marsh habitat environment essential to the survival of two endangered species and other fish and wildlife species.

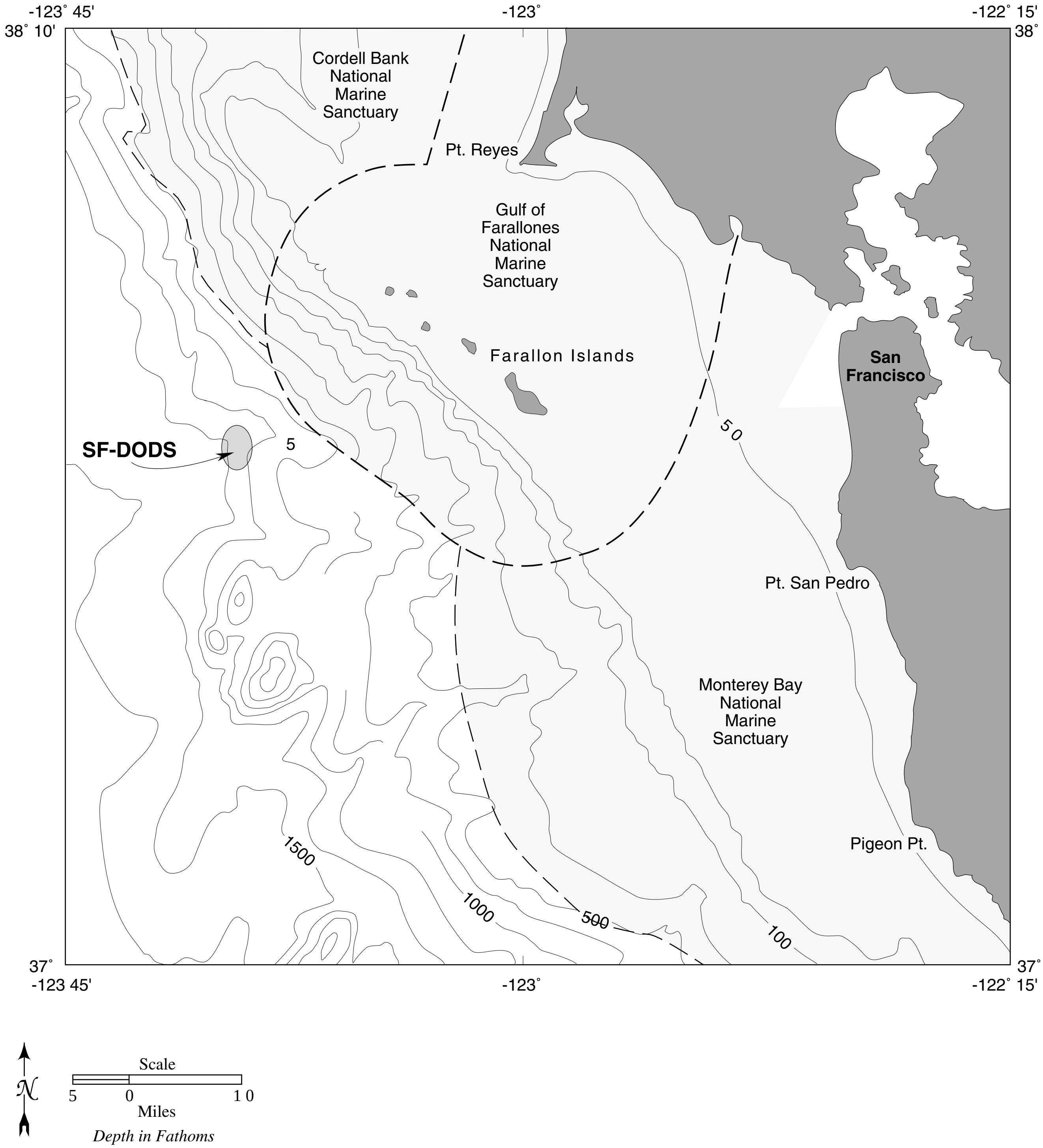
The project advances the beneficial use of dredged material from San Francisco Bay, minimizing in-Bay disposal and maximizing the beneficial reuse of dredged material. Restoration of the tidal marsh habitat would potentially utilize 17 mcy of dredged material from the San Francisco Bay Area (Solano County 2001). A commercial dredged sediment offloading and rehandling facility has also been constructed to handle saline dredge material for fresh water aquatic disposal in the Delta.

The Montezuma site is currently in use and has the capacity to accept a total of 20 mcy. The site accepts both "cover" and "non-cover" material. The RWQCB defines "cover" and "non-cover" material based on sediment tests: cover material contains pollutants below specified RWQCB criteria and can be used for wetland restoration; non-cover material contains pollutants in concentrations above cover sediment criteria, but does not exceed RWQCB non-cover sediment criteria. Up to 20 percent of the dredged material received at the site could be classified as non-cover material and the remaining 80 percent would need to be classified as cover material (Solano County 2001).



Source: COE 1992. Appendix D - Finding of No Significant Impact (FONSI) and Environmental Assessment, Oakland Inner Harbor 38-Foot Separable Element of the Oakland Harbor Navigation Improvement Project, June.

Figure A-1. Alcatraz Open Water Disposal Site SF-11



Source: EPA 1993a

Figure A-2. San Francisco Deep Ocean Disposal Site (SF-DODS)

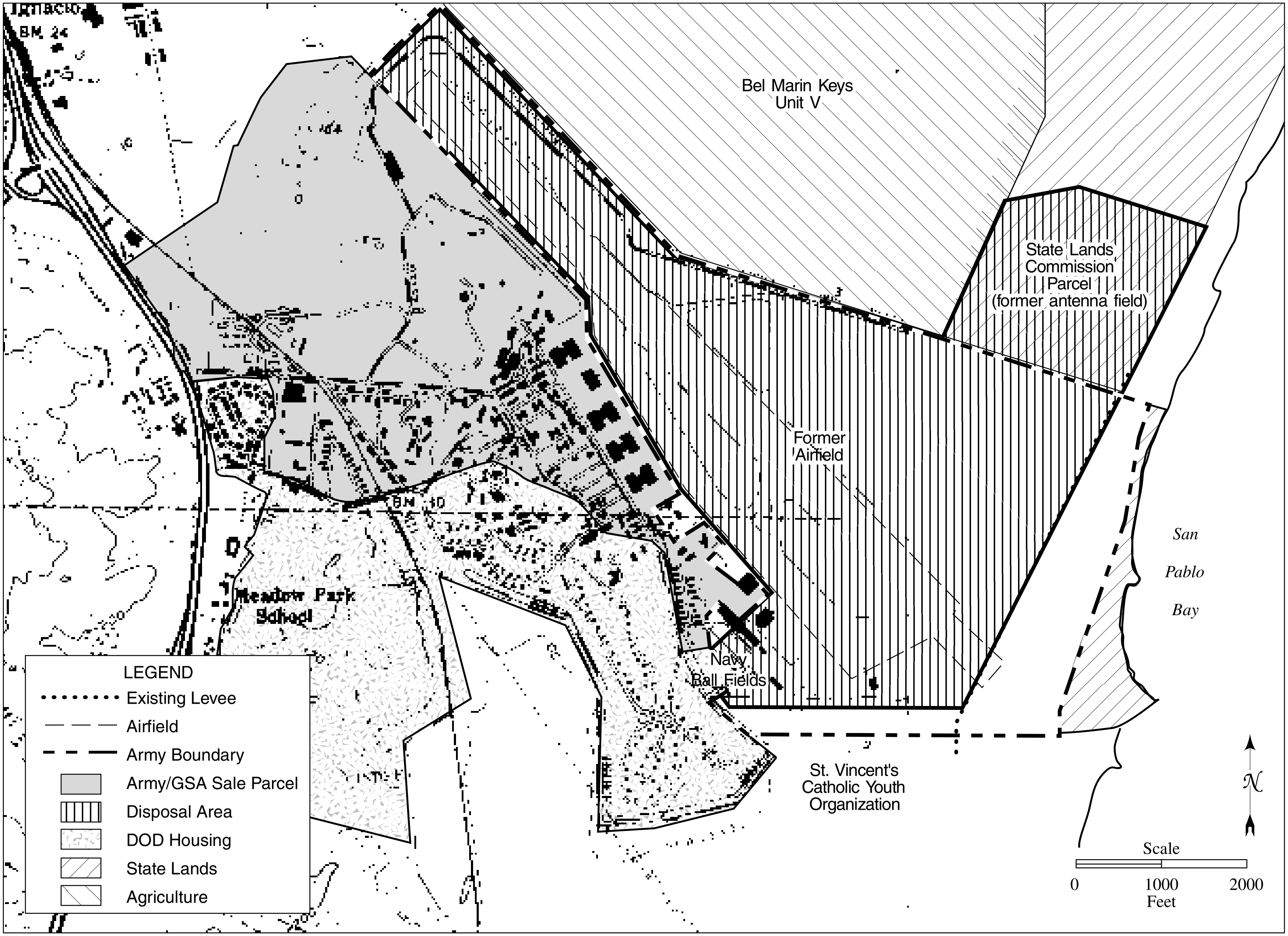


Figure A-3. Hamilton Wetland Restoration Site

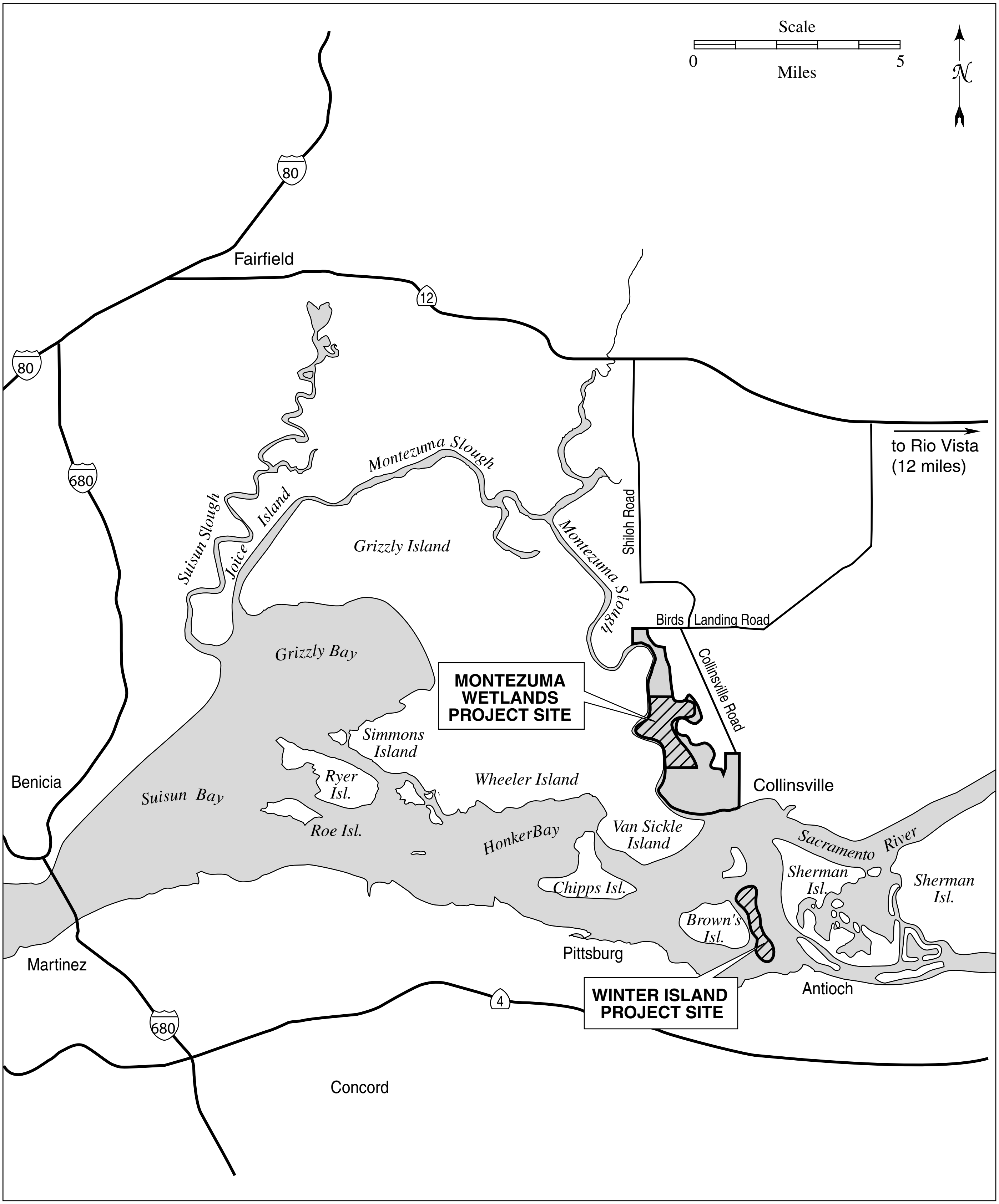


Figure A-4. Location of Montezuma Wetlands Site and Winter Island Site

A.2.5.5 Winter Island

Winter Island is a privately owned 453-acre island located on the extreme western edge of the Sacramento-San Joaquin Delta, north of the Stockton Deepwater Ship Channel, and 5.4 miles west of the Antioch Bridge, near the City of Pittsburg, Contra Costa County, California (see Figure A-4). The island is comprised of 400 acres of freshwater marsh, 15 acres of open water habitat consisting of scattered ponds and the main water canal, 2 acres of riparian habitat along the levees, 33 acres of upland habitat made up of open sandy soils and upland vegetation, and approximately 5 acres of developed facilities (USFWS 2000).

This island provides important habitat to numerous species of waterfowl, and the interior of the island has been managed as a waterfowl habitat and hunting area (e.g., duck club) for over 50 years. Dredged material has been used for levee rehabilitation on the perimeter of Winter Island for approximately 20 years.

The Winter Island Reclamation District No. 2122 is the project sponsor for the Winter Island Levee Rehabilitation Project. The Winter Island Reclamation District holds a USACE dredged material disposal permit, PN 22033S59, issued under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act, authorizing disposal of up to 800,000 cy of dredged material over a 10-year period at Winter Island. This permit expires September 1, 2006. In addition, disposal of dredged material at Winter Island must also comply with Section 401 of the Clean Water Act. Therefore, on June 19, 2001, the San Francisco Bay Region of the California Regional Water Quality Control Board's (SFRWQCB) adopted the "Final Waste Discharge Requirements and Water Quality Certification for levee rehabilitation operations at Winter Island in Contra Costa" as Order No. 01-061, which also expires September 1, 2006.

All permits will be reviewed and renewed prior to the next dredging episode, as required. Any dredged material placed at Winter Island would have to be in compliance with the SFRWQCB Waste Discharge Requirements, Order No. 01-061, adopted on June 19, 2001.

A.2.5.6 Alameda Point Golf Course

The Alameda Point Golf Links project would construct a public golf course on the former Alameda Naval Air Station. Alameda Point, formerly the Alameda Naval Air Station, encompasses approximately 1,800 acres and occupies approximately one-third of the island city of Alameda in Alameda County.

The proposed golf course would consist of an 18-hole links style golf course, a 9-hole executive (short) course, a clubhouse with a pro-shop, a hotel/conference center, associated infrastructure (i.e., domestic water supply and irrigation system, water recycling system, lighting) and public open space on approximately 215 acres at Alameda Point. Approximately 2 mcy of dredged material from various areas within San Francisco Bay would be used to cap the existing fill material at the site and construct topographic relief and drainage for portions of the golf course. It is anticipated that the site would begin accepting dredged material in January 2006 and continue through 2008. Regular operation of the golf course is anticipated to begin in 2010 (City of Alameda 2004).

A.2.5.7 Altamont Landfill

The Altamont Landfill and Resource Recovery Facility is a Class II and Class III facility in northern Alameda County. The landfill is owned by the Waste Management Company. It is located on Altamont Pass Road approximately 35 miles from Oakland northeast of the City of Livermore (Figure A-5). The site accepts up to 125,000 cy per year; 11,150 tons/day of non-hazardous, non-petroleum contaminated Class III waste, and 2,000 tons/day of nonhazardous, petroleum contaminated soils and other nonhazardous, petroleum contaminated Class II waste (Alameda County 2000).

A.2.5.8 Vasco Road Landfill

Vasco Road Sanitary Landfill is a Class III facility in northern Alameda County located on Vasco Road northeast of the City of Livermore, just west of Altamont Landfill (see Figure A-5). The Vasco Landfill is permitted to accept up to 300,000 cy per year of nonhazardous, non-petroleum contaminated Class III waste (Alameda County 2003).

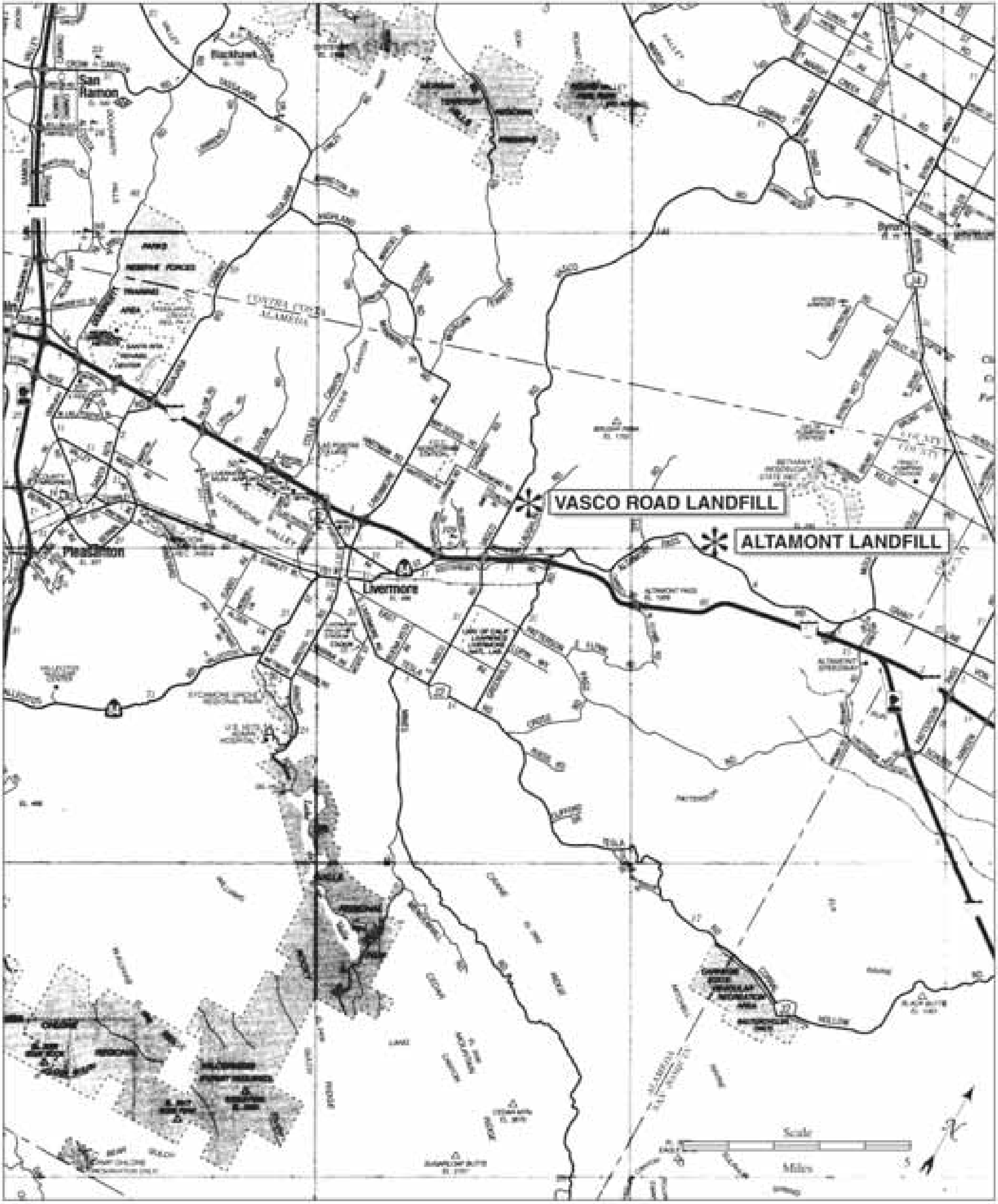


Figure A-5. Location of Altamont Landfill and Vasco Road Landfill

Appendix B

Title VI Policy Statement

APPENDIX B

Title VI Policy Statement

The Title VI Policy Statement, dated July 26, 2000, and signed by Jeff Morales, Director of Caltrans, states:

> *[Caltrans] under Title VI of the Civil Rights Act of 1964 and related statutes, ensures that no person in the State of California shall, on the grounds of race, color, sex and national origin be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity it administers.*

This statement is excerpted from the Caltrans' document *EA-IS Template.dot,* dated March 13, 2002.

Appendix C

Regulatory Environment

APPENDIX C
REGULATORY ENVIRONMENT

This appendix summarizes the regulatory environment, including all applicable federal, state, and local plans, policies, and regulations for the following resource areas: water resources; noise; cultural resources; transportation; geology/seismicity; hazardous materials; risk of upset; visual resources; biological resources; air quality; and social impacts.

C.1 WATER RESOURCES

This section describes current laws and regulations relevant to water resources that could be affected by the project. The U.S. Army Corps of Engineers (USACE), U.S. Coast Guard (USCG), San Francisco Bay Conservation and Development Commission (BCDC), and San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) would all be involved in permitting the project.

Federal Laws and Regulations

Floodplain Encroachment. Per federal regulation 23 CFR 650A, the Federal Highway Administration (FHWA) requires preparation of a Location Hydraulic Study for project work that lies within the base (100-year) floodplain, which includes the 100-year high tide.

The FHWA floodplain encroachment analysis policies are designed to encourage a broad and unified effort to prevent uneconomic, hazardous, or incompatible use and development of the Nation's floodplains; minimize impacts of the highway agency's actions that adversely affect base floodplains; and restore and preserve the natural and beneficial floodplain values that are adversely impacted by highway agency actions.

Clean Water Act. The federal Clean Water Act (CWA) was enacted as an amendment to the federal Water Pollution Control Act of 1972, which outlined the basic structure for regulating discharges of pollutants to waters of the United States. The CWA includes programs addressing both point source and nonpoint source pollution, and empowers the states to set state-specific water quality standards and to issue permits containing effluent limitations for point source discharges. The U.S. Environmental Protection Agency (USEPA) has adopted water quality standards for certain toxic pollutants in California (the California Toxics Rule).

Section 401 – Water Quality Certification. Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States, including discharges of dredged or fill material, must obtain certification from the state in which the discharge would originate. The project's disposal of dredged material would require a Water Quality Certification by the SFBRWQCB. This certification is required by USACE before a Section 404 permit (see below) can be issued.

Section 402 – Permits for Stormwater Discharge. Section 402 of the CWA, administered by the Regional Water Quality Control Board (RWQCB), regulates the discharge of pollutants to waters of the Unites States from any point source. This program regulates construction-related stormwater discharges to surface waters through USEPA's National Pollutant Discharge Elimination System (NPDES) program. An NPDES permit is required for: (1) any proposed point source wastewater or stormwater discharge to surface waters from municipal areas with a population of 100,000 or more; and (2) construction activities disturbing 0.4 hectares (1 acre) or more of land. A stormwater pollution prevention plan (SWPPP) would be required for the project pursuant to the general permit for construction-related discharges.

Section 404 – Permits for Fill Placement in Waters and Wetlands. Section 404 of the CWA prohibits discharges of dredged or fill material into jurisdictional "waters of the United States" without a permit issued by the USACE. "Waters of the United States" are broadly defined in USACE regulations (33 CFR §328.3) to include navigable waters[1], their tributaries, and adjacent wetlands. The USACE regulates, through the issuance of a Section 404 permit, the discharge of dredged or fill material in waters of the United States. Therefore, the project's dredged material disposal would require a Section 404 permit. The USACE has the authority to combine all authorizations into one permit action; for example, the USACE would likely issue a comprehensive CWA Section 404/Rivers and Harbors Act Section 10 permit (see below).

Rivers and Harbors Act. Permits are required from the USACE under Section 10 of the Rivers and Harbors Act (RHA) for all structures and/or work in or affecting navigable waters of the United States (§322.3[a]). Because the project is in an area bisected by a navigation opening (San Francisco-Oakland Bay Bridge) under the jurisdiction of the U.S. Coast Guard, Section 10 of the RHA would apply to the project. An RHA permit would be required for this project because it involves work in navigable waters.

Marine Protection, Research and Sanctuary Act. The Marine Protection, Research and Sanctuary Act (MPRSA) regulates dredged material disposal at ocean disposal sites. A permit from the USACE is required for disposal of dredged material at designated sites. An MPRSA Section 103 permit would be required if dredged material from the project was disposed at the SF Deep Ocean Disposal Site, a designated ocean disposal site.

Coastal Zone Management Act. The Coastal Zone Management Act (CZMA) requires project applicants to submit a Coastal Consistency Determination to demonstrate that the proposed project is consistent with the California Coastal Act. BCDC has the authority to make state consistency determinations for coastal zone projects in the San Francisco Bay Area.

State Laws and Regulations

Porter-Cologne Water Quality Control Act. This Act is the primary state regulation addressing water quality, and waste discharges (including dredged material disposal) on land and in waters of the state. The Act's requirements are implemented by the RWQCB pursuant to the provisions of the San Francisco Bay Region Basin Plan (SFBRWQCB 1995). Impacts on Beneficial Uses as described in the Basin Plan would be addressed by the RWQCB during the Section 401 Water Quality Certification process of the CWA. Construction activities would be regulated under a general construction permit to comply with NPDES stormwater regulations. Separate NPDES permits or waste discharge requirements (WDRs) could be required for

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[1] Navigable waters of the United States, as defined by 33 CFR 329.4, are those 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. A determination of navigability, once made, applies over the entire surface of the water body, regardless of later actions or events that may impede or destroy navigable capacity.

dewatering effluent discharges. In the State of California, the State Water Resources Control Board (SWRCB) has the ultimate authority under this Act over state water rights and water quality policy. The NPDES program in California is implemented by the SWRCB through its nine RWQCBs, which were also established under the Porter-Cologne Act. The project is within the jurisdiction of the SFBRWQCB.

McAteer-Petris Act. On the regional level, the BCDC administers the McAteer-Petris Act, which was enacted by the state legislature in 1965. The McAteer-Petris Act recognizes San Francisco Bay as a significant economic, environmental, and recreational resource, and established the BCDC to address indiscriminate filling of San Francisco Bay. BCDC has jurisdiction over all areas of the Bay that are subject to tidal action. BCDC's jurisdiction includes subtidal areas, intertidal areas, and tidal marsh areas that are between mean high tide and 1.5 meters (5 feet) above mean sea level. In addition, BCDC has jurisdiction over a 30.5-meter (100-foot) wide shoreline band surrounding the Bay from the mean high tide line (MHTL).

As defined by BCDC, bay fill is any solid material, including any pile-supported, floating, cantilevered, or suspended material, that is placed bayward of the MHTL, which is approximately +0.82 meters National Geodetic Vertical Datum (NGVD) (+2.68 feet) at Yerba Buena Island or the +1.5-meter (5.0-foot) contour line where marshlands are present.

A BCDC permit is required for any project that involves filling, dredging, or construction along the shoreline as described in section 5.1.2.2.

C.2 NOISE

Federal Noise Regulations

The Noise Control Act of 1972, as amended by the Quiet Communities Act of 1978, requires compliance with applicable state and local noise laws and ordinances. Project consistency with these acts is evaluated in terms of consistency with state and local noise laws and ordinances.

Federal Highway Administration Standards for Noise

These standards for noise do not apply to the project for the reason explained below; this information is included here for informational purposes because FHWA is the lead agency on this EA. FHWA has adopted noise abatement regulations for highway projects (23 CFR 772). Pursuant to FHWA regulations, noise abatement must be considered for Type 1 highway projects when the project results in a substantial noise increase, or when the predicted noise levels approach or exceed the Noise Abatement Criteria. A Type 1 project is defined by 23 CFR 772 as follows: "proposed federal or federal aid highway project for the construction of a highway on a new location, or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment, or increases the number of through traffic lanes." The BART Seismic Retrofit Project is not a Type 1 project as defined by 23 CFR 772, so this noise regulation is not applicable.

BART Construction Standards for Noise and Local Noise Ordinances

BART and the cities of Oakland and San Francisco have established regulations, plans, and policies that are designed to limit construction noise impacts at noise-sensitive land uses. These include: (1) BART Construction Standards for Noise (BART 1991); (2) the City of Oakland Noise Ordinance (City of Oakland 1996); and (3) the City of San Francisco Noise Ordinance (City of San Francisco 1972). Under State law, BART is not required to comply with certain local ordinances, including noise standards. Consequently, the Oakland and San Francisco Ordinances do not define the standards by which impacts are evaluated.

BART has adopted construction noise control criteria that apply to noise-sensitive buildings (BART 1992). These standards are specified in terms of the temporal nature of construction noise (i.e., "continuous" or "intermittent"), the time of day, and the sensitivity of the affected receptor. The BART construction noise criteria for sensitive receptors exposed to continuous and intermittent construction noise and mobile equipment noise are shown in Table C-1. These limits apply 200 feet from the construction limits or at the nearest affected building, whichever is closer. These limits are not based on defined noise metrics (e.g., L_{eq}, L_{max}). The "continuous" limits are interpreted to be based on the energy equivalent noise level (L_{eq}) metric. The "intermittent" limits are interpreted to be the maximum (L_{max}) level measured using the "slow" response setting on a standard sound level meter.

Table C-1. BART Limits for Continuous and Intermittent Construction Noise

	Maximum Allowable Continuous Noise Level, dBA[1]		Maximum Allowable Intermittent Noise Level, dBA[2]	
Affected Residential Area	*Daytime*[3]	*Nighttime*[4]	*Daytime*[3]	*Nighttime*[4]
Single family residence	60	50	75	60
Along an arterial or in multi-family residential areas, including hospitals	65	55	75	65
In semi-residential/commercial areas, including hotels	70	60	80	70
Affected Commercial Area	*At Any Time*		*At Any Time*	
In semi-residential/commercial areas, including schools	65		80	
In commercial areas with no nighttime residency	70		85	
Affected Industrial Area	*At Any Time*		*At Any Time*	
All locations	80		90	

Notes:
1. Objective: Prevent noise from stationary noise sources, parked mobile sources, or any source or combination of sources producing repetitive or long-term noise lasting more than a few hours from exceeding the following limits.
2. Objective: Prevent noise from stationary noise sources, parked mobile sources, or any source or combination of sources producing repetitive or long-term noise lasting more than a few hours from exceeding the following limits
3. Daytime refers to the period from 7 a.m. until 7 p.m. local time daily except Sundays and legal holidays.
4. Nighttime refers to all other times including all day Sundays and legal holidays.

Source: BART Extension Program System Design Criteria (1992)

BART has also adopted construction noise limits for individual pieces of equipment. All equipment other than highway trucks, including hand tools and heavy equipment, acquired before 1986, shall generate maximum noise levels of 90 dBA (A-weighted decibel) or less as measured at a distance of 50 feet. Equipment acquired after January 1, 1986 shall be limited to a maximum noise level of 85 dBA measured at a distance of 50 feet. Highway trucks in any operating load or location acquired before January 1, 1986 are limited to a maximum noise level of 83 dBA at 50 feet, and trucks acquired after January 1, 1986 are limited to 80 dBA at 50 feet. Peak noise levels due to impact pile drivers may exceed the above noise emission limits by 10 dBA. People shall not be exposed to noise levels exceeding 125 dBC (C-weighted decibel).

C.3 CULTURAL RESOURCES

Cultural resources "are tangible or observable traces of past human activity, regardless of their significance, in direct association with a geographic location, including properties possessing intangible traditional cultural values" (Caltrans 2001). These include any property important for scientific, traditional, religious or other purposes, such as archaeological resources (both prehistoric and historic remains), historic architectural resources (physical properties, structures, or built items), and Native American resources (those important to living Native Americans for religious, spiritual, ancestral, or traditional reasons).

The National Historic Preservation Act (NHPA) of 1966 establishes national policy for protecting substantially important cultural resources that are defined as "historic properties." NHPA Section 106 (16 U.S.C. §470f) and its implementing regulations at 36 CFR §800 requires that federal agencies consider and evaluate the effect that federal projects may have on historic properties under their jurisdiction, or those that would be affected by federally funded or federally approved undertakings. The NHPA provides for the National Register of Historic Places (National Register) a listing of historic properties throughout the nation. Section 106 analyses performed by archaeologists, historians, and ethnologists are done for every federal undertaking to determine if there are any historic properties within an undertaking's Area of Potential Effect (APE). The Section 106 process also requires that the lead federal agency consult with the State Historic Preservation Officer (SHPO), Native American tribes, and other appropriate agencies and parties and, when appropriate, with the Advisory Council on Historic Preservation (ACHP) in identifying the presence and treatment of historic properties.

To qualify as an eligible "historic property" under the NHPA, a cultural resource must meet specific criteria established in its implementing regulations (36 CFR §60.4). These criteria state that a resource must be at least 50 years old; possess integrity of location, design, setting, material, workmanship, feeling, and association; and meet one or more of the following:

A. Is associated with events that have made a significant contribution to the broad patterns of history;

B. Is associated with the lives of persons significant in the past;

C. 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; or

D. Has yielded, or may be likely to yield, information important in prehistory or history.

In addition to the NHPA, cultural resources are protected by the Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. §§ 469-469c), the American Indian Religious Freedom Act of 1978 (AIRFA) (42 U.S.C. §§ 1996-1996a), and the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 U.S.C. §§ 3001-3013).

C.4 TRANSPORTATION

Traffic/Ground Transportation

The FHWA is the agency of the U.S. Department of Transportation (DOT) responsible for the federally funded roadway system, including the interstate highway network and portions of the primary state highway network. FHWA funding is provided through the Transportation Equity Act for the 21st Century (TEA-21). Federal funding under TEA-21 can be used to fund local transportation improvement projects, such as projects to improve the efficiency of existing roadways, traffic signal coordination, bikeways, and transit system upgrades. The project would be funded by federal and other sources.

The California Department of Transportation (Caltrans) is the agency responsible for the planning, design, construction, and maintenance of all state highways. Caltrans is the owner/operator of the state and interstate highway system in California. Caltrans and the California Transportation Commission review federally funded transportation improvements and incorporate them into transportation plans and programs.

The Metropolitan Transportation Commission (MTC) is the regional organization responsible for prioritizing transportation projects in a Regional Transportation Improvement Program (RTIP) for federal and state funding. The Metropolitan Transportation System (MTS) is the focus of MTC's regional transportation planning, system operations and investment decisions. The MTS is the multi-modal transportation system of regional importance -- those facilities that are crucial to the freight and passenger mobility needs of the nine-county San Francisco Bay Area. The MTS in the study area includes the following facilities:

- Freeways
  - Interstate 580
  - Interstate 880
  - Interstate 980
  - State Route 24
- Local Streets
  - 5th Street
  - 7th Street
  - 52nd Street
  - Adeline Street
  - Broadway
  - Claremont Avenue
  - College Avenue
  - MacArthur Boulevard
  - Maritime Street
  - Martin Luther King Jr. Way
  - Shattuck Avenue
  - Telegraph Avenue

The Alameda County Congestion Management Agency (CMA) is responsible for ensuring local government conformance with the Congestion Management Plan (CMP), which is a 7-year program to reduce traffic congestion. The CMA has review responsibility for proposed development actions expected to generate 100 or more P.M. peak-hour trips than otherwise would occur. The CMA maintains a Countywide Transportation Model, and has approval authority for the use of any local or subarea transportation models.

The cities of Oakland and San Francisco have responsibility for constructing and maintaining city streets within their respective city limits. Lane closures and detours within public streets, alterations to public parking, and alterations to public transit stops related to project retrofit construction activities on aerial guideways and stations would all occur within the City of Oakland.

Vessel Transportation

Under the Ports and Waterways Safety Act of 1972, the USCG is authorized to establish, operate, and maintain vessel traffic services for ports, harbors, and other waters subject to congested vessel traffic. Shortly after passage of the Ports and Waterways Safety Act, the USCG established the Vessel Traffic Service (VTS) San Francisco. The VTS monitors and coordinates vessel transit in the Bay by designating traffic lanes for vessel traffic, specifying separation zones between vessel traffic lanes, requiring sailing plans, and requiring regular reporting of vessel position while in route (USCG 1999; USACE and Port of Oakland 1998). The USCG also regulates how vessels in San Francisco Bay can moor or anchor.

In addition to these actions, the USCG has also designated Regulated Navigation Areas within the Bay. Within San Francisco Bay, there are specific areas where anchoring is allowed and other areas where anchoring is disallowed without prior approval of the USCG. Generally anchoring is prohibited in any designated traffic lanes of a regulated navigation area, any designated channels, and any areas within a tunnel, cable, or pipeline area.

C.5 GEOLOGY/SEISMICITY

State Laws and Regulations

Alquist-Priolo Special Studies Zone Act. The criteria used to estimate fault activity in California are described in the Alquist-Priolo Special Studies Zone Act of 1972, which addresses surface fault-rupture hazards in active fault zones. An active fault is described by the California Division of Mines and Geology (CDMG) as a fault that has "had surface displacement within Holocene time (about the last 11,000 years)." A potentially active fault is defined as "any fault that showed evidence of surface displacement during Quaternary time (last 1.6 million years)." Numerous active and potentially active faults are present in the vicinity of the project (Figure 3.5-1).

The Seismic Hazards Mapping Act of 1990 and the Seismic Hazards Mapping Regulations. The Seismic Hazards Mapping Act of 1990 (Public Resources Code Section 2690 et seq.) and the Seismic Hazards Mapping Regulations (CCR, Title 14, Division 2, Chapter 8, Article 10) are promulgated for the purpose of protecting public safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failures, or other hazards caused by earthquakes. Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (CDMG 1997), constitutes the guidelines for evaluating seismic hazards other than surface fault-rupture, and for recommending mitigation measures as required by Pub. Res.

Code Section 2695(a). The project is consistent with recommended mitigation measures in Special Publication 117.

California Building Code. The California Building Code is located at CCR, Title 24, Part 2. Title 24 is administered by the California Building Standards Commission which, by law, is responsible for coordinating all building standards. About one-third of the text within the California Building Code has been tailored for California earthquake conditions (International Conference of Building Officials [ICBO] 1994). The proposed seismic retrofitting would be completed in accordance with the California Building Code.

C.6 HAZARDOUS MATERIALS

Classification of Contaminated Media

Soil that is excavated during construction activities and groundwater that is produced in conjunction with dewatering operations may be classified as a hazardous material or a hazardous waste, depending on the types and concentrations of hazardous substances that are present in it. Applicable federal, state, and local laws each contain lists of hazardous materials or hazardous substances that may require special handling. These include "hazardous substances" under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the state Hazardous Substances Account Act (Health and Safety Code Section 25300, et seq.); "hazardous materials" under Health and Safety Code Section 25501, California Labor Code Section 6380 and California Code of Regulations (CCR) Title 8, Section 339; "hazardous substances" under 40 CFR Part 116; and, priority toxic pollutants under CFR Part 122. In addition, "hazardous materials" are frequently defined under local hazardous materials ordinances, such as the Uniform Fire Code.

Generally speaking, "hazardous materials" means any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. Hazardous materials that are commonly found in soil and groundwater include petroleum products, fuel additives, heavy metals, and volatile organic compounds. If concentrations of certain contaminants in the soil or groundwater are high enough to exceed regulatory thresholds or other criteria established under CCR Title 22, Sections 66261.20 to 66261.24, the soil or groundwater would be classified as a "hazardous waste." Soil or groundwater that exhibit these criteria are classified as "characteristic" hazardous wastes. In addition, soil or groundwater that is contaminated with federally "listed hazardous wastes" would be classified as hazardous wastes under California law and would have to be managed accordingly.

Laws Regulating Hazardous Materials and Wastes

Depending on the type and degree of contamination that is present, any of several governmental agencies may have jurisdiction over the project site. Generally, the agency with the most direct statutory authority over the hazardous material will be designated as the lead agency for purposes of overseeing any necessary investigation or remediation. Typically, sites that are nominally contaminated with hazardous materials remain within the jurisdiction of local hazardous materials agencies, such as a local fire department or health care services agency. Sites that have more heavily contaminated soils are more likely to fall under the jurisdiction of the California Department of Toxic Substances Control (DTSC). Typically, the U.S. Environmental Protection Agency would become involved in site investigation or remediation activities only in serious cases (e.g., where a very significant risk to public health exists) or in cases where the construction site happens to fall within the boundaries of an existing "superfund" site. A superfund site is any land that has been contaminated by hazardous waste and identified by the U.S. Environmental Protection Agency as a candidate for cleanup because it poses a risk to human health and/or the environment. DTSC is authorized to administer the federal hazardous waste program under the Resource Conservation and Recovery Act in California, and is also responsible for administering the state superfund program under the Hazardous Substance Account Act.

Sites that have contaminated groundwater fall within the jurisdiction of SFBRWQCB and are subject to the requirements of the Porter-Cologne Water Quality Control Act (see section C.1). Contaminated groundwater that is proposed to be discharged to surface waters or to a publicly owned treatment works would be subject to the applicable provisions of the CWA, including permitting and possibly pretreatment requirements. A NPDES permit is required to discharge pumped groundwater to surface waters, including local storm drains, in accordance with California Water Code Section 13260. Additional restrictions may be imposed upon discharges to water bodies that are listed as "impaired" under Section 303(d) of the CWA, including San Francisco Bay. Where both soils and groundwater are implicated, both DTSC (or a local agency) and the RWQCB may be involved. In addition, excavations in potentially contaminated soil must be completed in accordance with a Soils Management Plan, prepared to minimize exposure to onsite workers and to properly dispose of contaminated soil. This plan would be approved by the RWQCB before construction.

The California Occupational Safety and Health Administration (Cal-OSHA) has primary responsibility for enforcing worker safety regulations, including the federal Hazard Communication Program regulations. Cal-OSHA regulations are found in CCR Title 8. Cal-OSHA regulations are generally more stringent than federal OSHA standards, which address general construction safety but also include specific standards for situations involving potential exposure to hazardous chemicals (e.g., lead).

BART Requirements

In addition to the federal, state, and local regulations that govern pollution control, BART issues standard specifications with respect to pollution abatement as general requirements for all BART contractors. These specifications require minimizing pollution of the environment surrounding the work area by all practicable means. These standards also specify that no waste or eroded materials should be allowed to enter natural or man-made water or sewage removal systems and that all eroded materials from excavations should be contained within the work area. These requirements apply to nonhazardous solid waste as well as to any soil or groundwater that may be contaminated.

Risk-Based Screening Levels

The SFBRWQCB developed Risk-Based Screening Levels (RBSLs) as conservative screening thresholds corresponding to acceptable risk levels for construction workers. The risk levels account for factors such as site use and exposure pathways, direct human exposure, leaching of soil contamination to groundwater, and migration of chemicals of concern from groundwater to surface water. This screening criterion was used during an evaluation of analytical data collected during a Phase II field investigation in association with the proposed project. EPA Region IX has also established Preliminary Remediation Goals (PRGs) for most CERCLA hazardous substances in soils. Different PRGs have been set for industrial and residential land uses. Like the Regional Board's RBSLs, these PRGs are based on highly conservative risk assumptions and generally signify levels of contamination for which "no further action" is needed.

C.7 RISK OF UPSET/SAFETY

Worker Safety Regulations

Construction related to federal projects is regulated by the federal Occupational Safety and Health Administration (OSHA) construction standards. OSHA standards cover general construction but also include specific standards for situations involving potential exposure to hazardous chemicals (e.g., lead) and specific provisions for certain types of construction (welding, work from scaffolds or hoists, excavation, concrete construction, erecting steel structures, work in tunnels, demolition/blasting, and work underwater). OSHA Construction Standards can be found at *29 CFR Part 1926, Safety and Health Standards for Construction*.

The CCR, *Title 8, Chapter 4 – Division of Industrial Safety, Subchapter 4 – Construction Safety Orders,* also governs construction safety. These codes are designed for worker safety, but they also serve to mitigate risk to the general public and, in this case, BART passengers.

Public Safety Regulations

The Caltrans *Manual of Traffic Controls for Construction and Maintenance Work Zones – 1996* (Manual) is also incorporated into California regulations (8 CCR Sections 1597-1599) to cover situations where work site conditions require encroachment into public streets or highways. However, other means of traffic control, such as continuous patrol, detours, barricades, or other techniques for the safety of employees covered in the manual may be employed. The criteria for the positioning, location, and use of traffic control devices as described in the Manual is not mandatory.

C.8 VISUAL RESOURCES

A discussion of local tree ordinances is presented in section C.9, Biological Resources.

Federal Highway Administration Visual Impact Assessment for Highway Projects

The DOT FHWA's guidance document *Visual Impact Assessment for Highway Projects* (FHWA 1988) defines FHWA's methodology for evaluating views of the surrounding landscape *from* the project site or sites (e.g., views available to users of a proposed highway), as well as views *of* a proposed project or project feature from off-site vantage points (e.g., views available to residents living near a proposed highway alignment).

FHWA's framework for evaluating project impacts on the visual environment breaks the analysis down into three parts:

1. Characterization of the visual character and qualities of the project setting (form, line, color, and texture);
2. Determination of project-related impacts on visual resources and the quality of the visual experience; and
3. Identification of the potentially affected viewing audience.

Visual Quality. After the visual character of a landscape has been defined, FHWA methodology requires characterization of the existing level of *visual quality* associated with the project setting in terms of three variables, or evaluative criteria, as follows:

- **Vividness**: Visual power (i.e., memorability) of landscape components. Includes consideration of landforms and landcover (e.g., vegetation, water, and development).
- **Intactness**: Integrity of the natural or built environment and freedom from encroaching elements. Development may enhance or subtract from otherwise intact urban and pristine landscapes.
- **Unity**: Visual coherence or harmony of individual landscape elements; compatibility. Although most landscapes exhibit a greater or lesser degree of unity between natural and built landscape elements, entirely natural landscapes may be visually unified or chaotic, as may predominantly urban landscapes.

When all three of these criteria are rated highly in a project setting, visual quality is accordingly considered to be high. However, a landscape setting determined to possess low visual quality may nonetheless be sensitive to project-related changes and benefit from, or be negatively affected by, project additions to such qualities.

Viewing Audience. FWHA defines the components of visual experience as twofold: (1) the visual resources (discussed above), and (2) the viewer response, or viewing audience. With respect to viewer response, FHWA's Visual Impact Assessment for Highway Projects guidance recommends the identification of major viewer groups, or audiences. Such audiences have defining characteristics that can be identified in the degree of detail appropriate for the project in question.

Viewers are first classified either as users or neighbors of a given transportation route. They are further distinguished by the nature of their exposure to a given visual resource, which is defined by an audience's physical location and proximity, the number of people affected, and (for highway project users in particular) the duration of views.

Where appropriate, as in highly scenic locations, viewer sensitivity may also be classified and is a function of viewer activity (e.g., a distracted motorist in a downtown setting versus a relaxed motorist on a scenic rural route). Other viewer group characteristics include viewer awareness, which is the receptivity of viewers to a visual resource as manipulated by the deliberate creation of a view, a transition between landscape types, or the existing land use context; and local values and goals, which shape view expectations and appreciation.

C.9 BIOLOGICAL RESOURCES

The following statutes govern various project components and are the basis for federal and state permits that would be required prior to construction.

Federal Laws, Policies, and Executive Orders

Endangered Species Act (16 U.S.C. 1531 et seq., as amended). The Endangered Species Act (ESA) protects federally listed and proposed threatened and endangered species, as well as proposed and designated critical habitats. An endangered species is "any species which is in danger of extinction throughout all or a significant portion of its range" (ESA Section 3[6]). A threatened species is "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (ESA Section 3[20]). Consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries is required under Section 7 of this Act for projects that affect listed species or critical habitats. As the project may affect several listed fish species, Section 7 consultation will be required.

Migratory Bird Treaty Act (16 U.S.C. 703 et seq.) and Executive Order 13186. The Migratory Bird Treaty Act (MBTA) governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests. While no specific federal permit for impacts on unlisted migratory birds exists, the USFWS considers impacts on migratory birds for federal projects and may recommend mitigation measures in a Biological Opinion to reduce impacts on migratory birds. Executive Order 13186 describes responsibilities of federal agencies to protect migratory birds, in furtherance of the MBTA, the Bald and Golden Eagle Protection Acts, the Fish and Wildlife Coordination Act, the ESA, and the National Environmental Policy Act (NEPA).

Marine Mammal Protection Act (16 U.S.C. 1361 et seq.). This Act prohibits taking or harassment of any marine mammals except incidental take during commercial fishing, capture under scientific research and public display permits, harvest by native Americans for subsistence purposes, and any other take authorized on a case-by-case basis as set forth in the Act. NOAA Fisheries and USFWS are responsible for implementation of the Marine Mammal Protection Act, depending on the species affected. As the project may result in harassment of marine mammals in the Bay, an Incidental Harassment Authorization (IHA) would be required.

Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et. seq). The 1996 amendments to this Act require a delineation of Essential Fish Habitat (EFH) for all federally managed species. Federal agencies that fund, permit, or carry out activities that may adversely impact EFH are required to consult with NOAA Fisheries regarding potential effects of the action on EFH, and respond in writing to NOAA Fisheries recommendations. As the project would occur within the EFH of several managed species, compliance would be required and would occur concurrently with the Section 7 consultation process for listed fish species.

State Laws and Policies

Porter-Cologne Water Quality Control Act (C.W.C. Section 13000 et seq.; CCR Title 23, Chapter 3, Chapter 15). This Act is described in section C.1, Water Resources.

California Endangered Species Act (Fish and Game Code Section 2050 et seq.). This Act addresses protection of state-listed rare, threatened, and endangered plants and animal species. It requires that state agencies coordinate with the California Department of Fish and Game (CDFG) to ensure that state-authorized or state-funded projects do not jeopardize the existence of a state-listed species; it also prohibits the taking of a listed species without authorization from the CDFG. If the project would result in take of a state-listed species that was not authorized under the federal Biological Opinion from the USFWS or NOAA Fisheries, a Section 2081 permit would be required.

Local Policies

City of Oakland Municipal Code, Title 12, Chapter 12.36 Protected Trees Ordinance. This City of Oakland ordinance protects both indigenous and introduced tree species, growing as single specimens, in clusters, or in woodland situations. The City protects and preserves trees by regulating their removal; prevents unnecessary tree loss and minimizes environmental damage from improper tree removal; encourages appropriate tree replacement plantings; and effectively enforces tree preservation regulations. This ordinance protects coast live oaks 4 inches or larger in diameter, or any other species 9 inches in diameter or larger, except eucalyptus and Monterey pine trees. Monterey pine trees are only protected where more than five trees per acre are proposed for removal.

According to BART's enabling statute, because BART is a special district, BART is not required to comply with certain local ordinances associated with municipal planning and zoning processes, including tree protection ordinances. However, BART seeks to adhere to these policies to the greatest extent feasible. Consequently, the City of Oakland tree protection ordinance is described although these regulations do not define the standards by which impacts of the proposed project are determined.

C.10 AIR QUALITY

The project area is subject to major air quality planning programs required by both the federal Clean Air Act (CAA), which was last amended in 1990, and the California Clean Air Act of 1988 (CCAA). Both the federal and state statutes provide for ambient air quality standards to protect public health, timetables for progressing toward achieving and maintaining ambient standards, and the development of plans to guide the air quality improvement efforts of state and local agencies. National and California ambient air quality standards (NAAQS and CAAQS) have been established for ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and for particulate matter smaller than 10 microns (PM_{10}) or 2.5 microns ($PM_{2.5}$) in diameter.[2] California ambient standards tend to be at least as protective as national ambient standards and are often more stringent. The NAAQS and CAAQS are listed in Table C-2.

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[2] There are also ambient standards for several other pollutants (e.g., lead, sulfates, etc.), but these other pollutants are not discussed in this document because the construction sources associated with this project would emit negligible amounts (or none) of these other pollutants. Emissions of these pollutants from the project would be minimal and would not cause an adverse impact.

Table C-2. California and National Ambient Air Quality Standards and Attainment Status

Pollutant	*Averaging Time*	*California Standards* [a]		*National Standards* [b]	
		CONCENTRATION [c]	STATUS	CONCENTRATION [c]	STATUS
Ozone (O_3)	1-hour	0.09 ppm (180 µg/m^3)	N	0.12 ppm (235 µg/m^3)	N[d]
	8-hour	---	---	0.08 ppm (157 µg/m^3)	U
Carbon monoxide (CO)	8-hour	9.0 ppm (10 mg/m^3)	A	9 ppm (10 mg/m^3)	A[e]
	1-hour	20 ppm (23 mg/m^3)	A	35 ppm (40 mg/m^3)	A
Nitrogen dioxide (NO_2)	Annual	---	---	0.053 ppm (100 µg/m^3)	A
	1-hour	0.25 ppm (470 µg/m^3)	A	---	---
Sulfur dioxide (SO_2)	Annual	---		80 µg/m^3 (0.03 ppm)	---
	24-hour	0.04 ppm (105 µg/m^3)	A	365 µg/m^3 (0.14 ppm)	A
	3-hour	---	---	1,300 µg/m^3 (0.5 ppm)	A
	1-hour	0.25 ppm (655 µg/m^3)	A	---	---
Respirable Particulate Matter (PM_{10})	Annual	20 µg/m^3 [f]	N[g]	50 µg/m^3 [h]	A
	24-hour	50 µg/m^3	N	150 µg/m^3	U
Fine Particulate Matter ($PM_{2.5}$)	Annual	12 µg/m^3 [i]	N[g]	15 µg/m^3 [j]	U
	24-hour	---	---	65 µg/m^3 [k]	U
Lead	30-day	1.5 µg/m^3	A	---	---
	Quarterly	---	---	1.5 µg/m^3	A
Hydrogen sulfide	1-hour	0.03 ppm (42 µg/m^3)	U	---	---
Sulfates	24-hour	25 µg/m^3	A	---	---
Vinyl chloride	24-hour	0.010 ppm (26 µg/m^3)	No information available	---	---
Visibility reducing particles	8-hour (10 AM to 6 PM PST)	(See note l)	U	---	---

A=Attainment N=Nonattainment U=Unclassified ppm=parts per million mg/m3=milligrams per cubic meter µg/m3=micrograms per cubic meter

Notes:

a. California standards for O_3, CO, SO_2 (1 hour), NO_2, PM_{10}, $PM_{2.5}$, and visibility reducing particles, are values that are not to be exceeded. The standards for SO_2 (24-hour), sulfates, lead, hydrogen sulfide, and vinyl chloride standards are not to be equaled or exceeded.

b. National standards, other than O_3 and those based on annual averages, are not to be exceeded more than once a year. The O_3 standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.

Table C-2. California and National Ambient Air Quality Standards and Attainment Status

c. Concentration expressed first in units in which it was promulgated. Equivalent units given in parenthesis are based on a reference temperature of 25 degrees Celsius (°C) and a reference pressure of 760 millimeters (mm) of mercury (1,013.2 millibars). All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of mercury; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

d. In August 1998, the Bay Area was redesignated to nonattainment-unclassified for the national 1-hour ozone standard.

e. In April 1998, the Bay Area was redesignated to attainment for the national 8-hour carbon monoxide standard.

f. Measured as an arithmetic mean. New standard promulgated by the California Air Resources Board (ARB) on June 20, 2002.

g. In June 2002, ARB established new annual standards for PM2.5 and PM10.

h. Measured as an arithmetic mean.

i. New standard promulgated by ARB on June 20, 2002.

j. Three-year average.

k. Three-year average of 95th percentile measurements.

l. In sufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70%. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range when relative humidity is less than 70 percent.

Source: BAAQMD (2003); ARB (2003b)

Federal Requirements

The USEPA oversees state and local implementation of CAA requirements. The USEPA sets national emission standards for mobile sources, which include new on-road motor vehicles, off-road vehicles, and marine engines. USEPA also sets national fuel standards.

State and Local Requirements

Under California law, the responsibility to carry out air pollution control programs is split between the California Air Resources Board (ARB), and Bay Area Air Quality Management District (BAAQMD). The BAAQMD can require stationary sources to obtain permits, as well as impose emission standards and establish operational limits to reduce air emissions.

The ARB shares the regulation of *mobile* sources with the USEPA. The ARB has the authority to set emission standards for on-road motor vehicles and for some classes of off-road mobile sources that are sold in California. The ARB also regulates vehicle fuels to reduce emissions. The ARB sets emission reduction performance requirements for gasoline (California reformulated gasoline) and limits the sulfur and aromatic content of diesel fuel to make it burn cleaner.

C.11 SOCIAL IMPACTS

Community Character and Cohesion

NEPA established that the federal government use all practicable means to ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings (42 U.S.C. 4331[b][2]). FHWA in its implementation of NEPA (23 U.S.C. 109[h]) directs that final decisions regarding projects are to be made in the best overall public interest. This requires taking into account adverse environmental impacts, such as, destruction or disruption of human-made resources, community cohesion, and the availability of public facilities and services.

Environmental Justice Regulations

Executive Order 12898 – Environmental Justice. President Clinton signed Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, on February 11, 1994. The Executive Order directs each federal agency to pursue the achievement of environmental justice as part of their respective missions, by identifying and addressing disproportionately high, adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States.

National Environmental Policy Act. The Presidential Memorandum that accompanies the Executive Order calls for a variety of actions (EPA 1994). Four specific actions are directed at NEPA-related activities, including:

1. Each federal agency must analyze environmental effects, including human health, economic, and social effects, of federal actions, including effects on minority communities and low-income communities, when such analysis is required by NEPA.
2. Mitigation measures outlined or analyzed in EAs, EISs, or Records of Decision (RODs), whenever feasible, should address significant and adverse environmental effects of proposed federal actions on minority communities and low-income communities.
3. Each federal agency must provide opportunities for community input in the NEPA process, including identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of public meetings, official documents, and notices to affected communities.
4. In reviewing other agencies' proposed actions under Section 309 of the CAA, EPA must ensure that the agencies have fully analyzed environmental effects on minority communities and low-income communities, including human health, social, and economic effects.

Federal Highway Administration. The project would be funded, in part with federal funds, by the FHWA through the Caltrans Local Assistance Program. Accordingly, FHWA guidance for evaluating transportation-related Environmental Justice impacts was consulted for this project.

The FHWA has issued Interim Guidance entitled *Addressing Environmental Justice in Environmental Assessments/Environmental Impact Statements*, which implements DOT guidance, and therefore Executive Order 12898 and EPA guidance (FHWA 2001; EPA 1998; DOT 1997). The Interim Guidance specifies that treatment of Environmental Justice in NEPA documents should identify minority populations, identify coordination and access to information and participation, and identify adverse project effects on low-income and minority populations.

California Department of Transportation. All considerations under Title VI of the Civil Rights Act of 1964 and related statutes have also been included in this project. The Department's commitment to upholding the mandates of Title VI is evidenced by its Title VI Policy Statement, signed by the Director, which can be found in Appendix B of this EA.

Appendix D

Section 4(f) Correspondence

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CALIFORNIA DIVISION
650 Capitol Mall, Suite 4-100
Sacramento, CA 95814
October 22, 2004

IN REPLY REFER TO
HDA-CA
File # 04-ALA-0-BRT
Document # P50960

Mr. Bijan Sartipi, Director
Caltrans District 4
P.O. Box 23660
Oakland, CA 94623-0660

Attn: Ms. JoAnn Cullom, Office of Local Assistance

Dear Mr. Sartipi:

Subj: Bay Area Rapid Transit (BART) Seismic Retrofit Project – Section 4(f) Analysis

This is in response to the October 19, 2004, letter from BART regarding the Section 4(f) issue as it pertains to the BART Seismic Retrofit Project. The recreational resources in question are the Hardy Dog Park and the 7th Street Section of the San Francisco Bay Trail. Per 49 USC 303 and 23 CFR 771.135(h), it is the responsibility of the Federal Highway Administration (FHWA) to make a determination regarding the application of Section 4(f). We have reviewed the submittal under BART's October 19, 2004, letter and have determined there is no Section 4(f) use associated with this project.

The Hardy Dog Park was established on state right-of-way and is subject to the terms and conditions of the lease executed on September 11, 1991, between the City of Oakland (lessee) and the California Department of Transportation (Caltrans). The lessee's rights to occupy the property can be revoked at any time "…when any portion… is required for State highway or other public transportation purposes as determined by the …Department of Transportation…". The terms of the lease make it clear that Hardy Dog Park occupies state right-of-way on a temporary basis. Hardy Dog Park is not a publicly owned public park and not a Section 4(f) resource; therefore, no Section 4(f) use can occur.

The scope of the project includes work adjacent to the 7th Street Section of the San Francisco Bay Trail. That portion is within the jurisdiction of the Port of Oakland. It is anticipated the work in this section will take approximately two months and that a detour to the adjacent 7th Street alignment will be in effect for the Bay Trail. Mr. James McGrath's letter dated September 30, 2004, establishes concurrence from the official having jurisdiction that the proposed project will not substantially impair the continuity of the bikeway. Since the other terms of 23 CFR 771.135(p)(7) "Temporary Occupancy" are met, there is no Section 4(f) use. It will be the responsibility of the project sponsor to comply with the measures on Page 1 of Mr. McGrath's letter and consult with the Port as requested.

The information supporting these findings should be included in the "Social Impacts" section of the Draft Environmental Assessment (EA). For reference, see Page 4 of my October 14, 2004, letter with comments on the Draft EA. Also see our Technical Advisory 6640.8A, Page 21, "#4 Social Impacts" (http://www.fhwa.dot.gov/legsregs/directives/techadvs/t664008a.htm).

Please contact Steve Healow, Senior Project Engineer, at (916) 498-5849 if you have any questions on this matter.

Sincerely,

/s/ ***Steve Healow***

For
Gene K. Fong
Division Administrator

cc: w/o Enclosure (by E-mail)
Gary Winters, Caltrans HQ
Terry Abbott, Caltrans HQ
Germaine Belanger, Caltrans HQ
Cindy Adams, Caltrans D-4
Dale Jones, Caltrans D-4
RoeQuel Johnson, Caltrans D-4
Shirley Ng, BART
Jame Layton, BART
Brett Gainer, FHWA
Joan Bollman, FHWA

SMeslow:at

BART

SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT
300 Lakeside Drive, P.O. Box 12688
Oakland, CA 94604-2688
(510) 464-6000

604267

October [illegible], 2004

Mr. Steve Healow
Federal Highway Administration
650 Capitol Mall Room 4-100
Sacramento, CA 95814-2724

Subject: BART Seismic Retrofit Project
Section 4(f) Information

Dear Mr. Healow:

On our meeting on October 8, 2004, additional information was requested related to the Section 4(f) analysis concerning the 7th Street section of the Bay Trail and the Hardy Dog Park. Enclosed is the information clarifying the Hardy Dog Park ownership. The area to be affected by this project is owned by the State of California. A copy of the joint use agreement between BART and Caltrans is attached. The area in question is referenced as parcel J-22 in the agreement. A copy of the lease between the City of Oakland and Caltrans (Marier-Johnson Park Lease) for the use of the area is also enclosed. Per paragraph number 5 of the Marier-Johnson park lease, Caltrans has maintained access to the area for highways purposes and maintenance. A meeting on September 17, 2004 with Caltrans right of way personnel confirmed that BART would need to send a letter to Caltrans a couple of months in advance for approval to close the Hardy Dog Park for retrofit work so that Caltrans in turn could notify the City.

In terms of what would be affected, BART would need to close approximately one-half of the dog park for approximately one month. The area outside the dog park contains two full basketball courts, which would need to be closed for approximately two months due to retrofit and access by the contractor. This information will be clarified and reflected in the revised draft environmental assessment document.

We have also sent letters to the City of Oakland and the Port of Oakland in August 2004 concerning the Seismic Retrofit Project to comply with Section 4(f) requirements. Subsequently, we have received a letter from the Port of Oakland concerning the 7th Street section of the Bay Trail that the BART Seismic Retrofit Project does not constitute a "use" within the meaning of Section 4(f) with two conditions. Please advise us as to how we should incorporate these conditions into the environmental assessment, whether as a mitigation or into the project description. (See enclosures.)

I believe this is the information required for your determination as to whether a Section 4(f) analysis is required. Please inform us of your decision so we can proceed with changes to the draft environmental assessment.

Should you require further information, please contact me at 510-287-4927 or Jamie Layton at 510-874-7423.

Sincerely,

Shirley Ng
Deputy Project Manager
Seismic Retrofit Capital Program
BART-BTOA-04-027

Enc.

CC: w/ encl's.	[illegible] Bellman (FHWA)	[illegible] Hector	J. Layton
	R. Monroe (Caltrans)		[illegible] (Caltrans)
	A. McGan (SAIC)		PDC

August 27, 2004

Jim McGrath
Environmental Manager
Port of Oakland
530 Water Street
Oakland, CA 94607

Subject: BART Seismic Retrofit Project – Section 4(f) [illegible]
[illegible]

Dear Mr. McGrath:

SAIC is pleased to submit this letter and enclosures on behalf of BART. BART is currently preparing jointly with FHWA and Caltrans District 4 an Environmental Assessment (EA) for the proposed BART Seismic Retrofit Project. The EA is expected to be released for public review in early 2005. As part of the EA, a Section 4(f) Resource Analysis was prepared according to Section 4(f) of the Department of Transportation (DOT) Act of 1966 (recodified in 1983 at 49 U.S.C. § 303), which requires disclosure of publicly owned park and recreation areas, wildlife and waterfowl refuges, and historic resources in the project area that would potentially be subject to Section 4(f) use by the project.

This letter is intended to inform you that the proposed project will require construction activities within a segment of the San Francisco Bay Trail under Port jurisdiction. BART has determined that, for the reasons described below, the temporary occupancy of this segment of the Bay Trail by the proposed project does not constitute a "use" within the meaning of Section 4(f) as defined by the Section 4(f) implementing regulations, 23 C.F.R. § 771.135(p)(7): (i) the duration of the occupancy will be temporary and ownership of the land will not change; (ii) the scope of the work is minor; (iii) no permanent adverse physical impacts, or temporary or permanent interference with the activities or purposes of the resource, are anticipated; and (iv) the land will be returned to a condition at least as good as that which existed prior to the project. By this letter, BART respectfully requests the Port's concurrence that the above conditions are met pursuant to 23 C.F.R. § 771.135(p)(7).

The following briefly summarizes the BART Seismic Retrofit Project, identifies the proposed temporary occupancy of the segment of the Bay Trail, describes briefly [illegible] implementation of the project would impact this land, and summarizes the mitigation measures in place to reduce potentially substantial impacts to minimal levels. Copies of the relevant background information from the Draft EA (currently under preparation), including the Project Description and Section 4(f) Resources Analysis are enclosed for your review.

Project Summary

The project consists of the portion of the BART system between the west portal of the Berkeley Hills Tunnel in Oakland, to the Montgomery Street Station in San Francisco. The BART facilities being seismically retrofitted include the Transbay Tube, through which trains run under San Francisco Bay, ventilation structures on either end of the Transbay Tube that allow air circulation within the Tube, aerial guideways (tracks elevated above the ground), and three BART stations (Rockridge, MacArthur, and West Oakland). Detailed descriptions of the seismic retrofit techniques are provided in the EA (under preparation). The seismic retrofit techniques are designed to contain movement of the BART system vertically, laterally, and longitudinally in the event of a strong earthquake. The project is tentatively scheduled to commence construction activities in fall 2005, with project completion anticipated summer 2011.

Project Use of Section 4(f) Resources and Measures to Minimize Harm

San Francisco Bay Trail. The project would require seismic strengthening of the aerial guideway located near the east portal of the Transbay Tube. The columns to be seismically retrofitted are located less than 3 feet from the edge of the San Francisco Bay Trail where it passes by BART's aerial guideway. Excavation for construction of expanded foundations for the columns could abut or extend into (beneath) the trail alignment. In addition, construction-related high noise levels, vibration, localized air quality impacts (i.e., fugitive dust), and potential safety hazards (i.e., from moving equipment, excavation) would preclude use of the trail in the vicinity of the construction work and constitute temporary occupancy. Other project impacts at this location include the reduction of visual quality (i.e., temporary blockage of views, sightlines along the trail, removal of landscaping). Because of the close proximity of the aerial guideway to the trail, construction access and activity would require temporary closure of the adjacent segment of the trail for approximately 2 months.

Occupancy of the trail segment would be temporary, and no portion of the trail would be permanently incorporated into the project. The project would not result in permanent adverse physical changes, nor would it interfere with the purpose or use of the trail by pedestrians, hikers, or bicyclists. Creating a detour around the trail segment that would be impacted by project construction, for the duration of construction in this location, will fully mitigate the temporary occupancy.

Mitigation Measures. Incorporation of these mitigation measures will minimize harm along the San Francisco Bay Trail segment within the project area:

- Provide a temporary detour for the segment of the San Francisco Bay Trail affected by the anticipated 2 months of construction at this location. The recommended detour route is within the adjacent 7th Street right-of-way.
- Repair or replace any portion of the paved trail and associated fencing and landscaping damaged or removed by the project.

The project received an exemption under the California Environmental Quality Act (CEQA) from the California state legislature, which will expire in June 2005. Therefore, to meet the tight project schedule, we ask that you provide the Port's agreement that the conditions for temporary occupancy under 23 C.F.R. § 771.135(p)(7)(iv) and any comments on the project's effects on the affected segment of the San Francisco Bay Trail by September 20, 2004 (an approximately 3-week review period).

Thank you in advance for your comments and adherence to this schedule. If you have any questions, please don't hesitate to contact me at (805) 564-615[illegible] or by email at malkina@saic.com.

Sincerely,
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
WESTERN WATER ENVIRONMENTAL RESOURCES DIVISION

Alison Malkin
Deputy Project Manager

cc: Janie Layton, BART
Tom Horton, BART
Shirley Ng, BART
Norman Carlin, Pillsbury Winthrop
Anne Dedeme, BART

<u>Enclosures</u>

One copy each of Project Description (Chapter 1) and Section 4(f) Resources Study as prepared for Draft EIS under preparation

PORT OF OAKLAND

September 2[illegible], 2004

Ms. Alison Malkin
Deputy Project Manager
SAIC
525 Anacapa Street
Santa Barbara, CA 93101

RE: BART SEISMIC RETROFIT PROJECT EA-SECTION 4(F) RESOURCE ANALYSIS OF THE 7TH STREET BAY TRAIL ALIGNMENT

Dear Ms Malkin:

I am writing you this letter in response to your request that the Port [illegible] the BART Seismic Retrofit Project plans to perform construction in proximity to the 7th Street Bay Trail located within the jurisdiction of the Port of Oakland in Oakland, California. It is my understanding that as part of the Environmental Assessment [illegible] Section 4(f) Resource Analysis was prepared according to Section 4(f) [illegible] Department of transportation (DOT) Act of 1966, which requires disclosure of [illegible] owned recreation areas in the BART Seismic Retrofit project vicinity that would be subject to use by the project.

Based on a review the project description and the recommended impact mitigation measures provided in your letter dated August 27, 2004; the Port is in agreement that the BART Seismic Retrofit Project does not constitute a "use" within the meaning of Section 4(f). This is assuming that the following conditions will be met:

1. The duration of the occupancy of the 7th street Bay Trail will be temporary and the land ownership will not change.
2. The scope of the Retrofit construction work will be minor.
3. No permanent adverse physical impacts or temporary or permanent interference with the activities or purpose of the Bay Trail are anticipated; and
4. The land will be returned to a condition at least as good as that which existed prior to the project.

In order to ensure that these conditions are met, the Port requests that the following measures are implemented to further mitigate any potential impacts.

1. Please submit all construction plans and coordinate the construction schedule with the Port Engineering Design and Construction departments.
2. Please coordinate the alignment of the temporary detour of the trail and the associated directional signage with the Port Environmental Planning department.

Please call Ms. Lauren Eisele at 510-627-1250 if you have any questions.

Sincerely,

James McGrath
Environmental Planning Manager

cc: Lauren Eisele, Port Environmental Planning
Mr. Ron Nelson, Port Engineering Construction
James Csantowski, Port Engineering Design
Janie Layton, BART
Tom Horton, BART
Shirley Ng, BART

August 27, 2[illegible]

Claudia Cappio
Development Director
City of Oakland, Community and Economic Development Agency
250 Frank H. Ogawa Plaza, Suite 3315
Oakland, CA 94612

Re: [illegible] BART Seismic Retrofit Project [illegible] Section 4(f) [illegible]

Dear Ms. Cappio:

SAIC is pleased to submit this letter and enclosures on behalf of BART, which is currently preparing jointly with FHWA and Caltrans District 4 an Environmental Assessment (EA) for the proposed BART Seismic Retrofit Project. The EA is expected to be released for public review in early 2[illegible]. As part of the EA, a section on "Resource Analysis" was prepared according to Section 4(f) of the Department of Transportation (DOT) Act of 1966 (re-codified in 1983 at 49 U.S.C. § 303), which requires disclosure of publicly owned park and recreation areas, wildlife and waterfowl refuges, and historic resources in the project area that would potentially be subject to Section 4(f) use by the project.

This letter is intended to inform you that the proposed project will require construction activities within Hardy Park, located in the Rockridge neighborhood of Oakland under City jurisdiction. BART has determined that, for the reasons described below, the temporary occupancy of Hardy Park by the proposed project does not constitute a "use" within the meaning of Section 4(f), as defined by the Section 4(f) implementing regulations (23 C.F.R. § 771.135(p)(7)): (i) The duration of the occupancy will be temporary and ownership of the land will not change; (ii) the scope of the work is minor; (iii) no permanent adverse physical impacts, or temporary or permanent interference with the activities or purposes of the resource, are anticipated; and (iv) the land will be returned to a condition at least as good as that which existed prior to the project. By this letter, BART respectfully requests the City's agreement that the above conditions are met pursuant to 23 C.F.R. § 771.135(p)(7).

The following briefly summarizes the BART Seismic Retrofit Project, describes the proposed temporary occupancy of Hardy Park, describes briefly how the project will [illegible] [illegible] place to reduce potentially substantial impacts to minimal levels. Copies of the relevant background information from the Draft EA (currently under preparation), including the Project Description and Section 4(f) Resources Analysis are enclosed for your review.

Project Summary

The project consists of the portion of the BART system between the west portal of the Berkeley Hills Tunnel in Oakland, to the Montgomery Street Station in San Francisco. The BART facilities being seismically retrofitted include the Transbay Tube, through which trains run under San Francisco Bay, ventilation structures on either end of the Transbay Tube that allow air circulation within the Tube, aerial guideways (tracks elevated above the ground), and three BART stations (Rockridge, MacArthur, and West Oakland). Detailed descriptions of the seismic retrofit techniques are provided in the EA (under preparation). The seismic retrofit techniques are designed to contain movement of the BART system vertically, laterally, and longitudinally in the event of a strong earthquake. The project is tentatively scheduled to commence construction activities in fall 2005 with project completion anticipated summer 2011.

Section 4(f) Property Status, Effects, and Measures to Minimize Harm

Hardy Park – Project implementation at the Claremont Avenue/Hudson Street BART overpass would require foundation expansions, and new piling and pier cap retrofits of BART piers (columns) located within Hardy Park. The need for construction access to the piers, and the associated construction activity, would require closure of the dog park and basketball facilities for approximately 2 months. Project-related construction would also result in noise, vibration, and localized air quality impacts (i.e., fugitive dust) generated by the operation of construction equipment, which would temporarily affect the park.

Construction occupancy would be temporary, and no portion of the park would be permanently incorporated into the project. The nature and magnitude of changes to the park would be minimal, with no permanent, adverse physical changes or interference with the park's purpose. Clean up, regrading, recompacting, and repavement or re-landscaping of the park to pre-project conditions and replacement of any damaged fencing, will fully mitigate the temporary occupancy.

Seismic strengthening of two additional piers located within the adjacent roadway rights-of-way would occur farther from the park boundaries but would require temporary street closures and elimination of existing on-street parking. While this could inhibit public access to the park, it would not be considered substantial impairment of park utility and would not constitute constructive use or temporary occupancy under Section 4(f).

Claudia Cappio
August 27, 2004

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Mitigation Measures. Incorporation of these mitigation measures will minimize harm at Hardy Park:

- Clean up, regrade or recompact, and repave or re-landscape to pre-project conditions any portion of Hardy Park that is damaged by project construction.

- Replace any fencing removed or altered as a result of the project.

The project received an exemption under the California Environmental Quality Act (CEQA) from the California state legislature, which will expire in June 2005. Therefore, to meet the tight project schedule, we ask that you provide the City's agreement that the conditions for temporary occupancy under 23 C.F.R. § 771.135(p)(7)(v) and any comments on the project's effects on Hardy Park, by September 20, 2004 (an approximately 3-week review period).

Thank you in advance for your comments and adherence to this schedule. If you have any questions, please don't hesitate to contact me at (805) 564-5156, or by email at malkina@saic.com.

Sincerely,
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
WESTERN WATER AND ENVIRONMENTAL RESOURCES DIVISION

Alison Malkin
Deputy Project Manager

cc: Janie Layton, BART
Tom Horton, BART
Shirley Ng, BART
Norman Carlin, Pillsbury Winthrop
Anne Doehne, SAIC

Enclosures

One copy each of Project Description, Chapter 2 and Section 4(f) Resources Analysis prepared for Draft EA (under preparation)