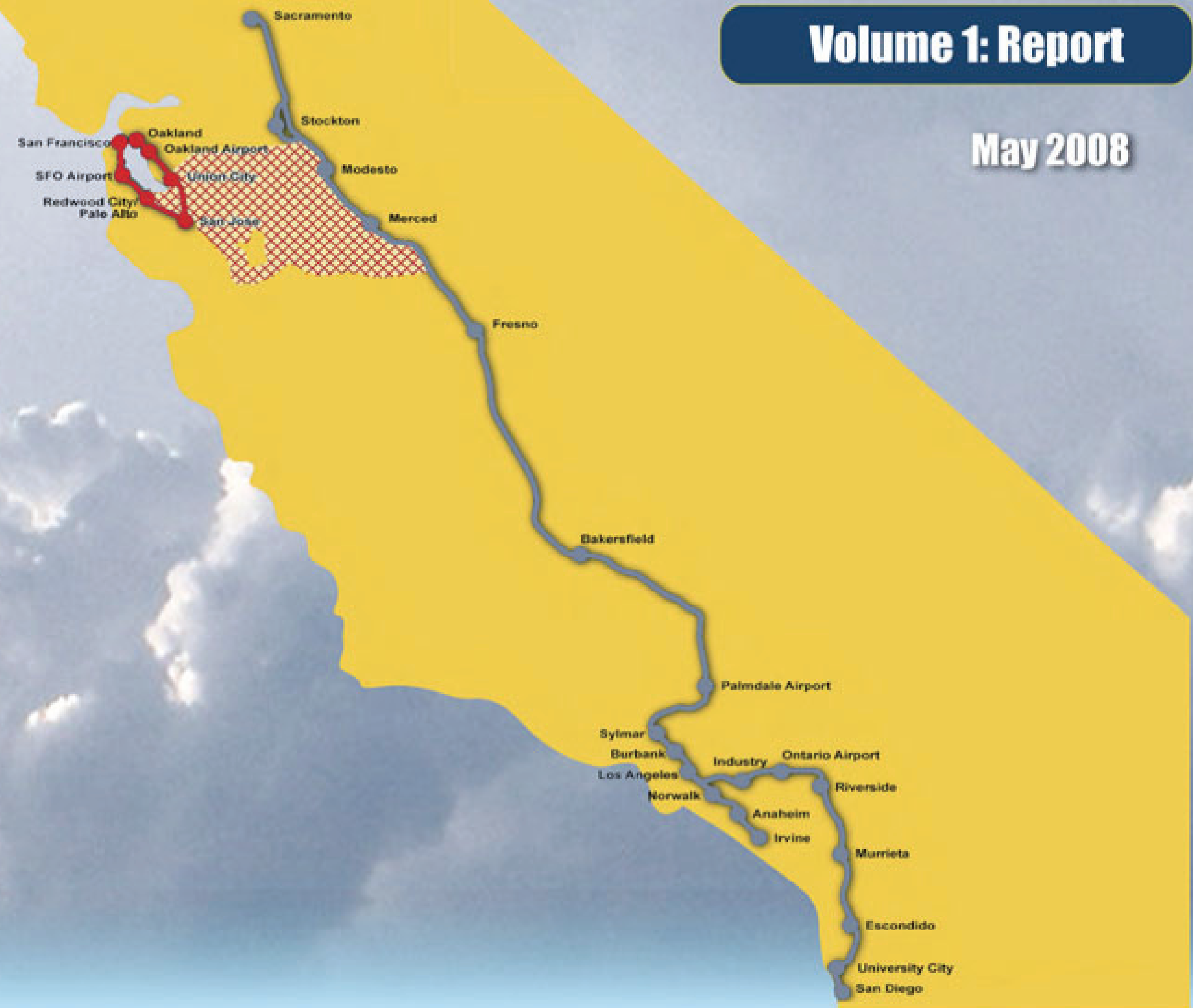
Final
Bay Area to Central Valley High-Speed Train (HST) Program Environmental Impact Report/ Environmental Impact Statement (EIR/EIS)

Volume 1: Report

May 2008



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Final

Bay Area to Central Valley High-Speed Train (HST) Program Environmental Impact Report/ Environmental Impact Statement (EIR/EIS)

Volume 1: Report

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Final
Bay Area to Central Valley High-Speed Train
Program Environmental Impact Report/ Environmental Impact Statement

Pursuant to:
California Environmental Quality Act, P.R.C. 21000 et seq.; State of California CEQA Guidelines, California Administrative Code, 15000 et seq.; and National Environmental Policy Act (42 U.S.C. 4332 [2][c]), 23 C.F.R. part 771 and 64 Fed. Reg. 28545

Prepared by the

California High-Speed Rail Authority

and the

U.S. Department of Transportation
Federal Railroad Administration

with cooperating agencies:

U.S. Environmental Protection Agency
U.S. Army Corps of Engineers

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Abstract: A Statewide Program Environmental Impact Report/ Environmental Impact Statement (EIR/EIS) was certified in November 2005 and was the first phase of a tiered environmental review process for the proposed California HST system in California planned to connect the major metropolitan areas of the state. This document further examines the San Francisco Bay Area to Central Valley region as the next phase of the tiered environmental review process and considers, describes, and summarizes the environmental impacts—at a programmatic level of analysis—of the proposed HST system within the broad corridor between and including the Altamont Pass and Pacheco Pass. Two broad alternatives are considered: 1) No Project Alternative; and 2) High-Speed Train (HST) Alternative (consisting of a range of alignment alternatives and station location options). This Final Program EIR/EIS identifies the Pacheco Pass serving San Francisco and San Jose termini as the preferred HST Network Alternative. The HST system would be capable of speeds in excess of 200 miles per hour (322 kph) on tracks that are mostly dedicated, fully grade-separated, and fenced. Potential environmental impacts include displacement of commercial and residential properties; community and neighborhood disruption; increased noise and vibration; local traffic impacts associated with stations; impacts on historic properties and archaeological sites; impacts on parks and recreation resources; visual impacts in scenic areas of the state; impacts on sensitive biological resources and wetlands; use of energy; and impacts on agricultural lands. Design practices and mitigation strategies are described to avoid or minimize potential impacts; such strategies would be further refined in project-level environmental review.

The Final Bay Area to Central Valley High-Speed Train (HST) Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS) is being made available to the public in accordance with the California Environmental Quality Act and the National Environmental Policy Act.

Visit the California High-Speed Rail Authority Web Site (www.cahighspeedrail.ca.gov), where you can:

- View and download the Final Program EIR/EIS.
- Request a CD-ROM of the Final Program EIR/EIS.
- Locate a library near you to review a hardcopy of the Final Program EIR/EIS.

Printed copies have been placed in the main public libraries in the following cities: Fremont, Gilroy, Livermore, Merced, Modesto, Mountain View, Oakland, Palo Alto, Pleasanton, Sacramento, San Francisco, San Jose, Stockton, and Tracy.

PREFACE

P.1.1 What Is This Document?

A statewide program environmental impact report/environmental impact statement (EIR/EIS) was certified in November 2005 as the first phase of a tiered environmental review process for the proposed California high-speed train (HST) system planned to provide a safe and reliable mode of travel that links the major metropolitan areas of the state. The California High-Speed Rail Authority (Authority), in cooperation with the Federal Railroad Administration (FRA), prepared a Draft Program EIR/EIS for the San Francisco Bay Area to Central Valley region, circulated it for public and agency review in 2007, and then completed this Final Program EIR/EIS that responds to comments received on the Draft Program EIR/EIS. The Program EIR/EIS considers, describes, and summarizes the environmental impacts—at a programmatic level of analysis—of the proposed HST system within the broad corridor between and including the Altamont Pass and Pacheco Pass. In this document, the Authority and the FRA have identified a preferred HST Network Alternative and general alignments, station locations, mitigation strategies, design practices, and further measures to guide the system's development and avoid and minimize potential adverse environmental impacts.

This Final Program EIR/EIS was prepared to comply with two primary environmental laws: the federal National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The purpose of each of these closely related laws is to help decision makers and the public to understand the potential impacts of a proposed action and ways to avoid those impacts. Should the proposed HST system be advanced in the Bay Area to Central Valley region, subsequent project-level environmental review would consider site-specific environmental impacts.

P.1.1 How Do I Use This Document?

The purpose of environmental documents prepared under NEPA and CEQA is to disclose information to decision makers and the public. While the science and analysis that supports this Final Program EIR/EIS is complex, this document is intended for the layperson. Every attempt has been made to limit technical terms and the use of acronyms. Where this cannot be avoided, the terms and acronyms are defined the first time they are used, either in the text or in footnotes. For easy reference, the most frequently used acronyms are provided in a foldout list at the back of this document.

Volume I of this Final Program EIR/EIS is organized into 17 chapters and a Summary. Separate volumes contain appendices (Volume II) and the comments received during the public comment period for the 2007 Draft Program EIR/EIS with responses to these comments (Volume III). For a reader with only a short time to devote to this document, the Summary is the place to start. It provides a summary of all of the substantive chapters in this document and includes a table listing the potential environmental impacts at the program level for each topic. If the reader begins here but wants more information, the Summary directs the reader where to get details elsewhere in the document.

Chapter 1.0, Purpose and Need and Objectives, explains why the project is proposed and provides a history of the planning process for the HST project. Chapter 2.0, Alternatives, describes the proposed HST Network and Alignment Alternatives and station location options and the No Project Alternative, contains illustrations and maps, and also discusses alternatives that were previously analyzed but are no longer being considered. These first two chapters help the reader understand what is being analyzed in the remainder of the document.

Chapter 3.0, Affected Environment, Environmental Consequences, and Mitigation Strategies is where the reader can find information about the existing transportation, environmental, and social conditions in the area of the proposed project. This chapter provides the findings of the analysis of potential environmental impacts, along with broad methods to reduce these impacts (called mitigation strategies).

Chapter 4.0, Costs and Operations, summarizes the estimated capital and operations and maintenance costs for each HST alignment alternative evaluated in the Program EIR/EIS.

Chapter 5.0, Economic Growth and Related Impacts, presents an analysis of the potential growth-inducing effects and related indirect impacts of the alternatives considered in the Program EIR/EIS.

Chapter 6.0, HST Station Area Development, describes the general principles and implementation approaches for HST station area development.

Chapter 7.0, High-Speed Train Network and Alignment Alternatives Comparisons, summarizes and compares the physical and operational characteristics and potential environmental consequences associated with different combinations of alignment alternatives that comprise the HST network alternatives, as well as differences among alignment alternatives and potential station location options.

Chapter 8.0, Preferred HST Alignment Alternatives and Station Location Options, describes the Authority and FRA's preferred HST network and alignment alternatives and station location options. This chapter also describes the evaluation of network alternatives that led to the identification of the preferred alternative.

Chapter 9.0, Unavoidable Adverse Environmental Impacts, describes potentially significant adverse environmental effects, at the program level, that cannot be avoided should the proposed HST network alternative be implemented and any unavoidable adverse impacts of the alternatives. This chapter also describes significant irreversible or irretrievable commitments of resources or foreclosures of future options.

Chapter 10.0, Public and Agency Involvement, contains summaries of coordination and outreach activities, both with agencies and the general public. Chapter 11.0, Organization, Agency, and Business Outreach, identifies entities conferred with during preparation of the Program EIR/EIS.

The remaining six chapters provide reference material. Chapter 12.0, List of Preparers, provides the names and responsibilities of the authors of the Program EIR/EIS. Chapter 13.0, Final Program EIR/EIS Distribution, identifies those informed of the availability of the Final Program EIR/EIS. Chapter 14.0, Sources Used in Document Preparation, cites the references and contacts used in writing this document. Chapter 15.0, Glossary, provides a definition of terms used in the Program EIR/EIS. Chapter 16.0, Index, is a cross-reference of the major topics used in the Program EIR/EIS. Finally, Chapter 17.0, Acronyms, is a foldout list of the most frequently used acronyms.

In Volume III of the Final Program EIR/EIS, there are copies of all written and oral comments received during the public review period for the 2007 Draft Program EIR/EIS (July 16, 2007 to October 26, 2007). Each comment is assigned a unique comment number. Following each piece of correspondence, whether a letter, comment card, e-mail, website, or transcript of an oral comment, responses are provided for each comment, referenced by comment number. Where appropriate, the response indicates where to find more information on the topic in a standard response and/or the Final Program EIR/EIS.

P.1.2 What Has Changed Since the Draft Program EIR/EIS?

The following updates, additions, and revisions have been made since the Draft Program EIR/EIS was circulated in late 2007 and have been included in this Final Program EIR/EIS.

Change	Location
Identifies the Pacheco Pass as the Preferred Alternative.	• Summary • Chapter 2 • Chapter 8
Added the following sections to Summary: S.4 Areas of Controversy S.5 Avoidance and Minimization S.6 HST Station Area Development S.7 Public and Agency Involvement S.8 High-Speed Train Network Alternatives Evaluation S.9 Preferred HST Network Alternative S.10 HST Alignment Alternatives and Station Location Options for the Preferred Pacheco Pass Network Alternative S.11 Least Environmentally Damaging Preferred Alternative (LEDPA) S.12 Next Steps in the Environmental Process S.13 Altamont Pass Project	• Summary
Added or updated information in Table S.8-1, including indirect impacts for floodplains, streams, waterbodies, and wetlands; added fault data; updated airports served and cultural resources and 4(f)/6(f) information.	• Summary
Added information on frequency of trains ("For 139 trains over a 14-hour period… ").	• Summary
Described comments on the alternatives, the evaluation of network alternatives, and the preferred alternative.	• Summary • Chapter 8
Identified and discussed the early compliance with the Clean Water Act related to the LEDPA.	• Summary • Chapter 8
Identified CEQA Environmentally Superior Alternative and NEPA Environmentally Preferable Alternative.	• Summary • Chapter 8
Added updates to Maintenance and Storage Facilities section (including no Los Banos facility).	• Chapter 2 • Chapter 8
Updated information on the Regional Rail Plan for the San Francisco Bay Area.	• Chapter 2 • Section 3.17
Clarified projects included in the No Project Alternative and added an appendix of transit projects.	• Chapter 2 • Appendix 2-C-1
Included more discussion on climate change and greenhouse gases.	• Section 3.3 • Section 3.17
Included a comparison of air quality impacts between Pacheco Pass and Altamont Pass network alternatives.	• Section 3.3 • Appendix 3.3-A
Identified an Authority commitment to acquire easements to protect prime farmland.	• Section 3.8
Updated visual simulation along Henry Miller Road.	• Section 3.9

Updated Calaveras fault information related to the Altamont Pass alternatives and included new figures (Figures 3.13-4b, 3.13-4c, and 3.13-7) showing faults in the East Bay area, Calaveras Fault Area, and the Calaveras Fault location.	• Section 3.13
Identified an Authority commitment to acquire agricultural, conservation, and/or open space easements for potential impacts in and around the Grasslands Ecological Area.	• Section 3.15
Included more information related to parks and recreation and added Figure 3.16-1 showing publicly owned lands.	• Section 3.15 • Section 3.16
Included additional information related to the Grasslands Ecological Area and other conservation areas and added Figure 3.15-5 showing public lands between San Jose and the Central Valley.	• Section 3.15 • Section 3.16
Included a discussion of study areas for each cumulative impact topic and included a list of mitigation strategies for each cumulative impact topic area.	• Section 3.17
Revised text related to coupling and uncoupling (split) of trains.	• Chapter 4
Updated text to reflect that the Authority will undertake a comprehensive economic study for HST stations in the Central Valley to identify businesses/jobs that would benefit from being located near HST station areas, provide priority to stations where there are adopted transit-oriented development plans and general plans, and emphasize planning for bicycles as well as pedestrian traffic at and around stations	• Chapter 6
Identified that the Authority will utilize its resources, both financial and other, to provide incentives for station area planning and amending county general plans.	• Chapter 6
Incorporated information related to public circulation of the Draft Program EIR/EIS.	• Chapter 10
Included the Los Banos Bypass Project (SR-152) in the cumulative impact analysis.	• Appendix 3.17-A
Included the Staff Recommendation presented at the November 14, 2007 Authority Board Meeting and the U.S. EPA concurrence letter on the LEDPA.	• Appendix 8-A • Appendix 8-B
Updated text to reflect change from draft to final.	• Summary • Chapter 1 • Chapter 2 • Chapter 6 • Chapter 8 • Chapter 10 • Chapter 13
Checked use of Transbay Terminal and Transbay Transit Center	• All chapters
Revised text, tables, and figures as appropriate to incorporate comments received on the Draft Program EIR/EIS including federal, state, local, individual, public hearing, and website comments.	• All chapters

P.1.3 What Happens Next?

At the completion of this program environmental review process, the Authority expects to be able to certify the Final Program EIR/EIS and make findings for compliance with CEQA, the FRA expects to be able to issue a Record of Decision for compliance with NEPA, and both agencies expect to be able to make various determinations. Assuming a decision is made to go forward with development of the HST system, the Authority and FRA would focus future project analysis in the study region on alignment and station options selected through this program environmental review process. Site-specific location and design alternatives for the alignment and station options selected at the program-level, including impact avoidance and minimization alternatives and strategies, would be further investigated and considered during Tier 2, project-level environmental review.

Preliminary engineering and project-level environmental review would commence in the study region to the extent needed to assess site-specific issues and potential environmental impacts not already addressed in this Final Program EIR/EIS. Project-level environmental review would focus on a portion or portions of the proposed HST system and would provide further analysis of potential impacts and mitigation at an appropriate site-specific level of detail to obtain needed permits and to implement HST projects. Also, after completing this program environmental process, the Authority would begin working with local governments, transportation agencies, and private parties to identify right-of-way preservation needs and protective advance acquisition opportunities consistent with state and federal authority and requirements.

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SUMMARY

S.1 Introduction and Background

The California High-Speed Rail Authority (Authority) proposes a high-speed train (HST) system for intercity travel in California between the major metropolitan centers of Sacramento and the San Francisco Bay Area in the north, through the Central Valley, to Los Angeles and San Diego in the south. The HST system is projected to carry as many as 117 million passengers annually by the year 2030. The Authority adopted a final business plan (Business Plan) in June 2000, which examined the economic viability of a train system capable of speeds in excess of 200 miles per hour (mph) (322 kilometers per hour [kph]) on a fully grade-separated track, with state-of-the-art safety, signaling, and automated control systems. The Authority and Federal Railroad Administration (FRA) completed a statewide program environmental impact report/environmental impact statement (EIR/EIS) in November 2005 as the first phase of a tiered environmental review process for the proposed HST system. The HST Alternative was selected by the Authority and FRA. As part of this selection, the Authority and FRA defined a broad corridor between the Bay Area and Central Valley for additional review at the program level (Figure S.1-1).

Following the certification of the statewide program EIR/EIS, the Authority initiated this Bay Area to Central Valley environmental review process for compliance with state and federal laws, in particular the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). This Bay Area to Central Valley HST Program EIR/EIS (Program EIR/EIS) further examines this region as the next phase of the tiered environmental review process. The Authority is the project sponsor and the lead agency for purposes of the state CEQA requirements. The FRA is the federal lead agency for compliance under NEPA.

This Bay Area to Central Valley study region is generally bounded by (and includes) the Pacheco Pass (State Route 152 [SR 152]) to the south, the Altamont Pass (Interstate 580 [I-580]) to the north, the BNSF corridor to the east, and the Caltrain corridor to the west[1] (Figure S.1-1). The Authority directed staff to "prepare a separate program-level EIR to identify a preferred alignment within the broad corridor between and including the Altamont Pass and Pacheco Pass for the HST segment connecting the San Francisco Bay Area to the Central Valley." This Program EIR/EIS evaluates the potential impacts of proposed alignment alternatives and station location options in the study region and defines general mitigation strategies to address potentially significant adverse impacts. At the conclusion of this environmental process, the Authority and FRA expect to select a network alternative, the corridor alignment components within it, and the station locations in the study region. Future tiered, site-specific project-level environmental documents will assess the impacts of constructing and implementing individual HST projects (i.e., portions of the HST system).

The Authority envisions seeking possible future federal financial support for the system, which may be provided through the FRA. The FRA and the U.S. Department of Transportation (DOT) have several loan and loan guarantee programs that might be potential sources of future financial assistance. Although no grant or federal bond financing programs currently provide such support, several proposals to create such programs are pending before Congress. In addition to possible funding, a Rule of Particular Applicability is likely to be required from the FRA to establish safety standards for the proposed HST system for operating at speeds over 200 mph (322 kph) and for operations in shared-use rail corridors.

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1 Highway route numbers are provided only as a convenient reference for the reader, not as a limitation on the corridor to be considered.

The Notice of Preparation (NOP) for this Program EIR/EIS was released November 14, 2005. The Notice of Intent (NOI) was published in the Federal Register on November 28, 2005. The scoping process included 12 officially noticed agency and public scoping meetings in late November and early December 2005. Recognizing the important relationship of HST alignments and stations to a regional rail system in the northern California area, the HST scoping meetings were held in conjunction with public meetings on the San Francisco Bay Area Regional Rail Plan initiation meetings. More than 500 people participated in the scoping meetings. During the scoping process, the Authority gathered information from agencies and interested members of the public regarding their questions and concerns related to the scope of this Program EIR/EIS.

Following the issuance of the NOI and NOP and the scoping meetings, the Authority and the FRA formed a working group made up of representatives from 27 federal and state agencies to consult during the environmental review process. The interagency group met during the development of this Draft Program EIS/EIR to discuss major issues from the perspective of these agencies and to provide input to the lead agencies to help focus the analysis and streamline the review process.

The federal and state agency representatives included in this process were asked to provide input for the following specific areas.

- Scope of the Program EIR/EIS.
- Purpose and need statement/program objectives.
- Technical methods of analysis and study area definition.
- Substantive issues of particular concern.
- Sources of information and data relevant to their agencies.
- Impact avoidance, minimization, and mitigation strategies.
- Identification of possible alternatives to be analyzed in the Program EIR/EIS.
- Procedural requirements and permits or approvals necessary for subsequent phases of environmental review.

The Authority also held numerous meetings with and invited input from regional and local agencies in the region potentially affected by the proposed HST system. Meetings of the Authority governing board were also a forum for providing information about the environmental process. These meetings were held in major cities in the project area to provide a convenient opportunity for regional and local participation and input.

Comments received during this scoping process assisted the Authority and FRA in their review and evaluation of possible HST Alignment Alternatives and station location options and identification of those to be carried forward for environmental evaluation in this Program EIR/EIS (described in Section S-3).

S.2 Purpose of and Need for a High-Speed Train System in California

S.2-1 Purpose

This Program EIS/EIR identifies and evaluates HST Alignment Alternatives and station location options within and related to the Bay Area to Central Valley study region as part of a statewide HST system. The purpose of the Bay Area HST is *to provide a reliable high-speed electrified train system that links the major Bay Area cities to the Central Valley, Sacramento, and southern California and that delivers predictable and consistent travel times. Further objectives are to provide interfaces between the HST system and major commercial airports, mass transit, and the highway network and to relieve capacity*

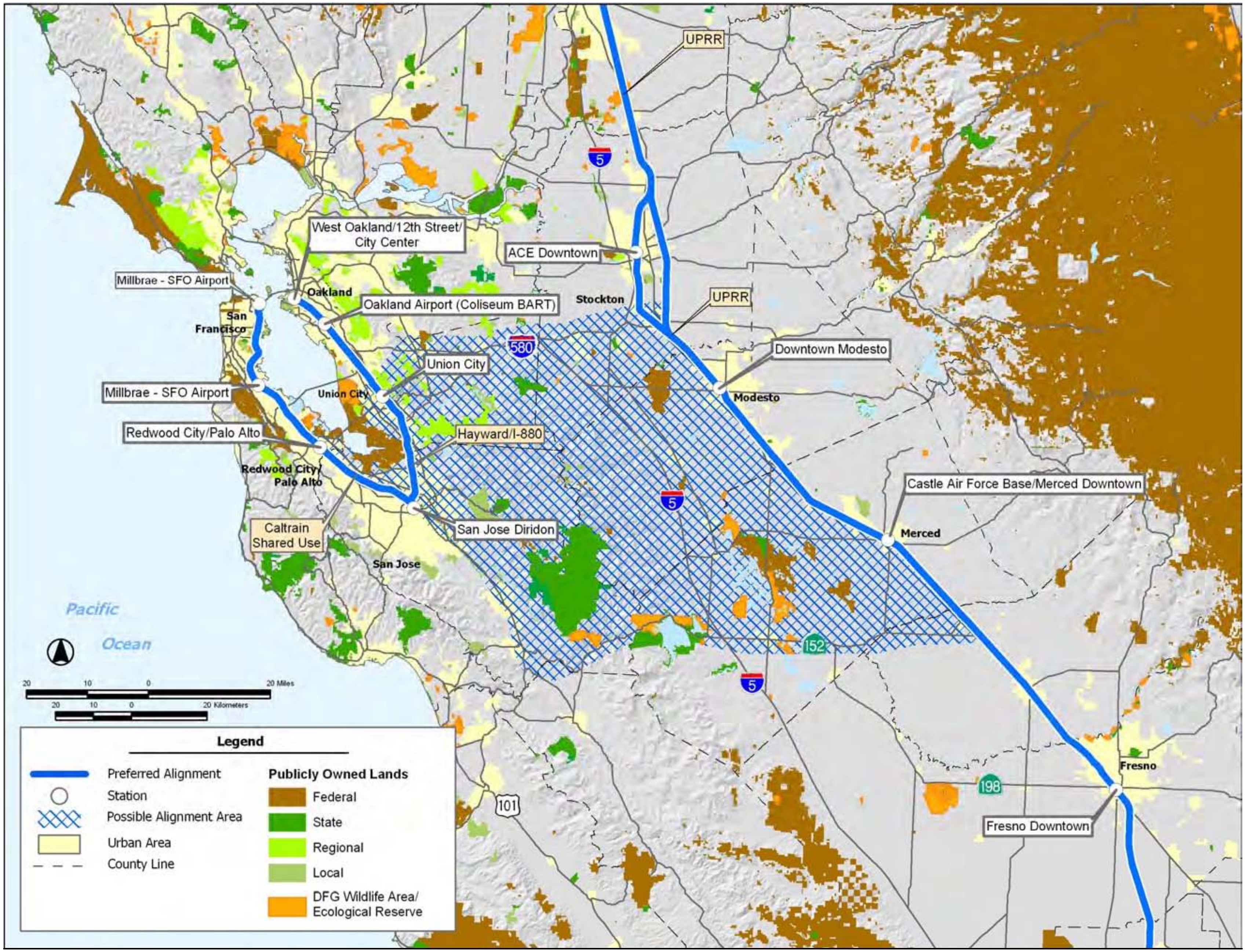

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Figure S.1-1
Bay Area to Central Valley Corridor

constraints of the existing transportation system in a manner sensitive to and protective of the Bay Area's and California's unique natural resources.

S.2-2 Statewide Need[2]

The capacity of California's intercity transportation system is insufficient to meet existing and future demand, and the current and projected future congestion of the system will continue to result in deteriorating air quality, reduced reliability, and increased travel times. The system has not kept pace with the tremendous increase in population, economic activity, and tourism in the state. The interstate highway system, commercial airports, and conventional passenger rail system serving the intercity travel market are operating at or near capacity and will require large public investments for maintenance and expansion to meet existing demand and future growth over the next 20 years and beyond. Moreover, the ability to expand many major highways and key airports is uncertain; some needed expansions may be impractical or may be constrained by physical, political, or other factors. Simply stated, the need for improvements serving intercity travel in California relates to the following issues.

- Future growth in demand for intercity travel.
- Capacity constraints that will result in increasing congestion and travel delays.
- Unreliability of travel stemming from congestion and delays, weather conditions, accidents, and other factors that affect the quality of life and economic well-being of residents, businesses, and tourism in California.
- Reduced mobility as a result of increasing demand on limited modal connections between major airports, transit systems, and passenger rail in the state.
- Poor and deteriorating air quality and pressure on natural resources as a result of expanded highways and airports.

S.2-3 Regional Need

The needs of the Bay Area to Central Valley region are similar to those identified for the statewide HST system.

A. REGIONAL GROWTH

Today, the nine-county Bay Area is home to nearly 7 million people and more than 3 million jobs. By 2050, the region's population is anticipated to grow by more than 40%, for a total of 10 million people. This population growth will put tremendous pressure on the existing transportation network, and the peak travel periods are expected to encompass many more hours of the day. For example, MTC's 2000 San Francisco Bay Crossing Study projected the Bay Bridge peak period to more than double from 1.5 hours in 2000 to 3.5 hours by 2020.

Additionally, growth in the region is taking place in the form of dispersed land uses that rely on individual vehicles for most trips. Without improved and more extensive transit systems leading to the main Central Valley cities and connecting them to each other, there will be little chance for these cities to move toward compact transit-oriented development.

B. REGIONAL CONGESTION

The Bay Area already experiences the second-worst traffic congestion in the country, after Los Angeles. Congestion is expected to worsen over the next 25 years, especially in existing hotspots. The combination of significant population growth, dispersed development patterns

[2] Also presented in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005).

(requiring a car for most trips), highway facilities that cannot keep pace with traffic demands, and large increases in interregional commuting, has worsened and will continue to worsen congestion levels and the associated environmental and economic impacts.

C. ECONOMIC IMPLICATIONS

The adverse economic impacts of congestion and inadequate transportation/transit access are already apparent. The 150,000 daily hours of Bay Area commute congestion had an estimated cost of $2.6 billion in 2003 alone. When transportation access to urban and suburban centers becomes too difficult, employers are likely to move jobs to areas where land prices are lower and workers' commutes might be shorter. Without better passenger rail access, major job growth will continue to decentralize and move to places like the Central Valley.

D. ENVIRONMENTAL IMPLICATIONS

Without an expanded rail and transit network and more compact development, there may be greater adverse effects on the natural environment. More than 400,000 acres (ac) (161,874 hectares [ha]) of land in the Bay Area are at risk from development. Promoting development in walkable communities near HST, intermodal, and other transit stations offers the best opportunity for taking development pressure off open space and farms. Demand for an additional 550,000 homes near transit in the Bay Area by 2030 is anticipated, but transit-oriented development functions well only when transit service is sufficiently frequent and reliable that residents can reduce the length and the number of car trips they take.

An additional growing environmental concern is global climate change, and the transportation sector is responsible for about 40% of greenhouse gas emissions in California, and up to 50% in the Bay Area. Because these emissions are directly proportional to the amount of fuel burned, offering effective and efficient transportation choices can result in reduced driving and reduced emissions.

S.3 Alternatives

The Program EIR/EIS evaluates the No Project, and HST Alternative Alignments and station locations options, and representative HST Network Alternatives within the Bay Area to Central Valley region.

S.3-1 No Project Alternative

This Program EIR/EIS compares the No Project and HST Alternative Alignments (Figure S.3-1). For the No Project Alternative, both existing and future conditions (2030) are considered. The No Project Alternative represents the region's transportation system (highway, air, and conventional rail) as it existed in 1999–2000 and as it would be in 2030 with the addition of transportation projects currently programmed for implementation (already in funded programs/financially constrained plans) according to the State Transportation Improvement Program (STIP), regional transportation plans (RTPs) for all modes of travel, airport improvement plans, and intercity passenger rail plans.

The No Project Alternative addresses the geographic area serving the same intercity travel market as the proposed HST Alignment Alternatives in the region, as described below. The No Project Alternative is assessed for how it would satisfy the purpose and need and program objectives for the HST system regarding congestion, safety, reliability, and travel times.

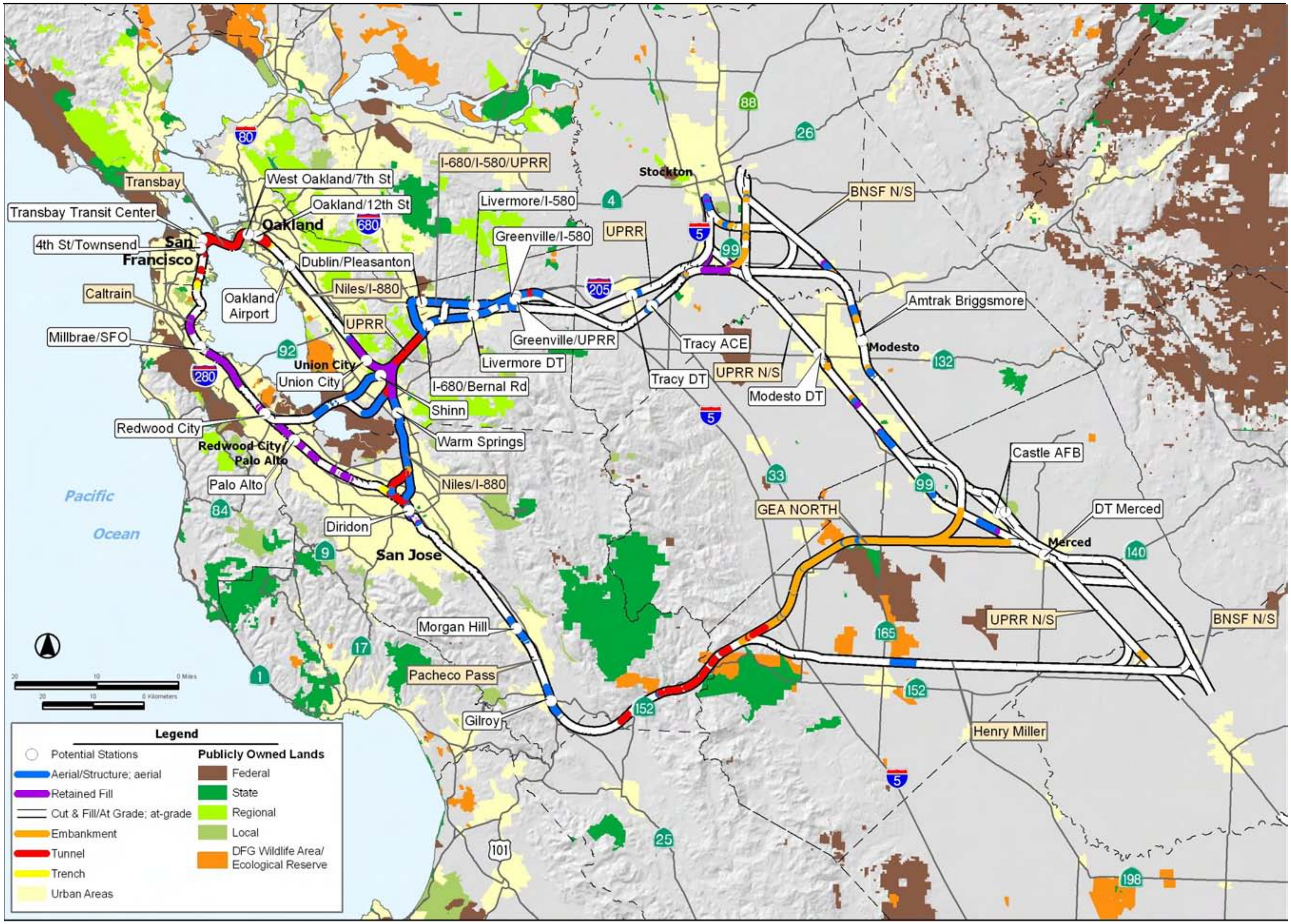

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Figure S.3-1
Bay Area to Central Valley High Speed Train Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

S.3-2 High-Speed Train Alignment Alternatives and Station Location Options

The HST Alignment Alternatives and station location options in the region represent the proposed action. A statewide HST system was selected by the Authority and FRA as the preferred system alternative in the statewide Program Final EIR/EIS. It has been identified on a statewide basis as the environmentally preferred alternative under NEPA, as well as the environmentally superior alternative under CEQA.

The HST system would consist of steel train tracks on a trackbed placed at grade level, on an aerial structure, in a tunnel, or in a trench. Trainsets would travel on the trackbed between stations and would be powered by electrical power supplied to the train from an overhead catenary system that would receive its power from the power distribution system. Train maintenance and layover facilities would be located at select locations along the HST line. This Program EIR/EIS analyzes the impacts from portions of the system that would be located within the broadly defined Bay Area to Central Valley region—referred to as the *study region* in this Program EIR/EIS.

Technology

Informed by previous studies and the statewide program EIR/EIS, the Authority and FRA selected state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology for the proposed statewide system, which would serve the major metropolitan centers in California, including the study region.

State-of-the-art safety, signaling, and automated train-control systems would be used. The steel-wheel-on-steel-rail electrified train is proposed to be primarily on exclusive track, with small portions of the route on shared track with other passenger rail operations. The train track would be at grade, in an open trench or tunnel, or on an elevated guideway, depending on terrain and physical constraints. To reduce potential environmental impacts, extensive portions of many of the alignment alternatives are within or adjacent to existing rail or highway right-of-way, rather than on new alignment. Tunnel segments of the alignment are proposed through the mountain passes (e.g., Diablo Range/Pacheco Pass between south San Jose and the Merced).

Service Levels

Most passenger service is assumed to run between 6:00 a.m. and 8:00 p.m. By 2030, the proposed service would include approximately 124–139 weekday trains in each direction to serve the study region and the statewide intercity travel market, with 91–96 of the trains running between northern and southern California and the remaining 33–43 trains serving shorter distance markets. The proposed system would be capable of speeds in excess of 200 mph (322 kph), and the projected travel times would be designed to compete with air and auto travel. For example, the projected travel time by HST between San Francisco in the Bay Area and Los Angeles would be just over 2 and a half hours. For 139 trains over a 14-hour period, the overall average train frequency on a given alignment segment would be approximately 10 trains per hour per direction. The frequency of these trains would vary over the period of the day, with more frequent long-distance trains departing in the peak hours from the major urban origins.

A representative statewide system evaluated in this Program EIR/EIS was forecast to carry between 88 and 117 million passengers in 2030, with the potential to accommodate higher ridership by adding trains. For a conservative assessment of potential environmental impacts, the higher ridership forecast has been used in describing the proposed HST system and its impacts, and is referred to as *representative demand* ridership. However, for resource topics where the high-end ridership forecasts would result in potential benefits (e.g., energy, air quality, and travel conditions), the low-end ridership forecasts were used the analysis.

Determination of Range of Alternative Alignments and Station Location Options

The Authority and the FRA started developing the HST Alignment Alternatives by seeking to identify the most reasonable and practicable HST corridors, alignments, and station location options for analysis in this Program EIR/EIS. As part of this process, HST technologies and corridors previously considered were reevaluated, and a screening of potential alignment alternatives and station location options was conducted. This screening analyzed all reasonable and practical alignment alternatives and station location options within the selected HST corridors in the study region.

The evaluation of potential HST corridors, alignment alternatives, and station location options used the following factors: extent of construction difficulty, environmental impacts, land use compatibility, right-of-way needs, potential connectivity/accessibility to other transportation facilities and services, and ridership/revenue generation potential. The screening of alignment alternatives and station location options comprised the following key activities.

- Review of past alignment alternatives and station location options identified within selected corridors defined in previous studies.
- Identification through the environmental scoping process of alignment alternatives and station location options not previously evaluated.
- Evaluation of alignment alternatives and station location options using standardized engineering, environmental, and financial criteria (described above) and evaluation methodologies at a consistent level of analysis.
- Identification of the ability of alignment alternatives and station location options to meet defined objectives.

The results of this analysis are documented in the *Draft Alignment Alternatives and Potential Station Locations Options Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006), presented at the Authority's March 22, 2006, board meeting and in the *Additional Potential HST Alignment and Stations Considered but Rejected Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006) presented at the Authority's August 9, 2006, *Board Meeting*. Technical data, combined with public and agency input, provided the Authority and the FRA with the necessary information to focus further studies for the Program EIR/EIS on those alignment alternatives, station location options, and HST systems that represent a reasonable range of practicable alternatives to meet the project purpose and attain several objectives established by the Authority. Those objectives include:

- Maximize ridership and revenue potential.
- Maximize connectivity and accessibility.
- Maximize compatibility with existing and planned development.
- Maximize avoidance of areas with geologic and soils constraints.
- Maximize avoidance of areas with potential hazardous materials.
- Minimize operating and capital costs.
- Minimize impacts on natural resources.
- Minimize impacts on social and economic resources.
- Minimize impacts on cultural resources.

Complex issues associated with the tunneling were addressed as part of the statewide program EIR/EIS process. This work focused on the feasibility, construction methods, and cost assumptions associated with proposed tunneling for the HST system and resulted in the Authority's objective of minimizing the amount of tunneling required, particularly the use of long tunnels (more than 6 mi [10 km] long), due to cost, time of construction, and potential for delay. Tunnels more than 12 mi (19 km) long are generally considered infeasible for this project, and it is the Authority's objective to cross major fault zones at grade. The technical information produced as part of the statewide program EIR/EIS is documented in the *Tunneling Issues Report* (California High-Speed Rail Authority January 2004).

Alternative Alignments and Station Location Options

To facilitate analysis and presentation of the HST Alignment Alternatives in this Program EIR/EIS, the study region was divided into six corridors: (1) San Francisco to San Jose, (2) Oakland to San Jose, (3) San Jose to Central Valley, (4) East Bay to Central Valley, (5) San Francisco Bay Crossings, and (6) Central Valley. These corridors encompass considerable variations in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections). The alignment alternatives and station location options considered in each corridor are defined in Table S.3-1.

Table S.3-1

Alignment Alternatives and Potential Station Location Options

Corridor	Possible Alignments	Alignment Alternative	Alignment Alternative Description
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	From San Francisco, this alignment alternative would follow south the Caltrain rail alignment and assumes that the HST system would share tracks with Caltrain commuter trains. The entire alignment would be grade separated.
	1 of 1	Dumbarton to San Jose	
Station Location Options One of two: Transbay Transit Center or 4th and King Millbrae/SFO One of two: Redwood City or Palo Alto			
Oakland to San Jose: Niles/ I-880	1 of 2	West Oakland to Niles Junction	From Oakland, this alignment alternative would travel south following the Union Pacific Railroad's (UPRR's) Niles Subdivision Line (i.e., Hayward Line) and then transition to I-880. The alignment would be at-grade along the Niles Subdivision Line.
		12th Street/City Center to Niles Junction	
	1 of 2	Niles Junction to San Jose via Trimble	The alignment alternative would be at-grade along the Niles Subdivision Line and on an aerial structure in the median of I-880. The I-880 HST portion would mostly be on an aerial configuration from San Jose to Fremont. The Trimble Road segment would be on an aerial structure and in a tunnel (where adjacent to San Jose International Airport).
		Niles Junction to San Jose via I-880	This alignment alternative would travel south following the UPRR's Niles Subdivision Line (i.e., Hayward Line), then transition to I-880. The alignment would be at-grade along the Niles Subdivision Line and on an aerial structure in the median of I-880. The I-880 HST portion would mostly be on an aerial configuration from San Jose to Fremont.

Corridor	Possible Alignments	Alignment Alternative	Alignment Alternative Description
Station Location Options One of two: West Oakland/7th Street or 12th Street/City Center Coliseum/Airport One of two: Union City (BART) or Fremont (Warm Springs)			
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	This alignment alternative would extend south along the Caltrain/UPRR rail corridor through the Pacheco Pass and then the San Joaquin Valley along either Henry Miller Road (connecting to either the UPRR or BNSF) or north of the Grassland Ecological Area (GEA) connection to the BNSF.
	1 of 3	Henry Miller (UPRR Connection)	
		Henry Miller (BNSF Connection)	
		GEA North	
Station Location Options o San Jose (Diridon) o One of two stations: Morgan Hill (Caltrain) or Gilroy (Caltrain)			
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680, then use the I-680 alignment before transitioning to the I-580 corridor (at the I-580/I-680 junction).
		I-580/ UPRR	This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680, then use the UPRR alignment through Pleasanton before transitioning to the I-580 corridor through Livermore and the Altamont Pass to Tracy.
		Patterson Pass/UPRR	This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680 then use the UPRR alignment through Pleasanton and Livermore before transitioning to the I-580 corridor through the Patterson Pass between Livermore and Tracy.
		UPRR	This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680, then use the UPRR alignment through Pleasanton and Livermore before transitioning to the I-580 corridor through the Altamont Pass to Tracy.
	1 of 4	Tracy Downtown (BNSF Connection)	From Livermore, these alignments would pass through either downtown Tracy or to the current Tracy ACE station connection with either the BNSF or UPRR.
		Tracy ACE Station (BNSF Connection)	
		Tracy ACE Station (UPRR Connection)	
		Tracy Downtown (UPRR Connection)	
Station Location Options One of six stations, depending on the alignment alternative: Pleasanton (I-680/Bernal Rd), Pleasanton (BART), Livermore (Downtown) , Livermore (I-580), Livermore (Greenville Road/UPRR), Livermore (Greenville Road/I-580) One of two stations, depending on the alignment alternative: Tracy (Downtown) or Tracy (ACE)			

Corridor	Possible Alignments	Alignment Alternative	Alignment Alternative Description
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	This alignment alternative would connect the Oakland (West Oakland or 12th Street City Center) and San Francisco (Transbay Transit Center or 4th and King) HST stations via a new transbay tube. This alignment could serve either Altamont Pass or Pacheco Pass alignment alternatives.
		Trans Bay Crossing – 4th & King	
	1 of 6	Dumbarton (High Bridge)	This alignment alternative would serve the Altamont Pass alignment alternatives and link the East Bay to the San Francisco Peninsula in the vicinity of the existing Dumbarton Rail Bridge. Between Niles Junction and the Dumbarton Bridge, this option would use the Centerville rail alignment. Design options for this alignment include use of an improved Dumbarton Rail Bridge (low level), a new high-level bridge, and a new transbay tube.
		Dumbarton (Low Bridge)	
		Dumbarton (Tube)	
		Fremont Central Park (High Bridge)	This alignment alternative would serve the Altamont Pass alignment alternatives and link the East Bay to the San Francisco Peninsula in the vicinity of the existing Dumbarton Rail Bridge. Between Niles Junction and the Dumbarton Bridge, this alignment alternative would use an existing utility alignment and a new alignment through the Don Edwards Natural Wildlife Refuge. Design options for this alignment include use of an improved Dumbarton Rail Bridge (low level), a new high-level bridge, and a new transbay tube.
		Fremont Central Park (Low Bridge)	
		Fremont Central Park (Tube)	
Station Location Options Union City (Shinn)			
Central Valley	1 of 6	BNSF – UPRR	This alignment alternative would use various connectors between the BNSF and UPRR alignments.
		BNSF	This alignment alternative would connect with either the Altamont or Pacheco Pass alignment alternatives, using principally the BNSF rail line in the Central Valley.
		UPRR N/S	This alignment alternative would connect with either the Altamont or Pacheco Pass alignment alternatives, using principally the UPRR rail line in the Central Valley.
		BNSF Castle	This alignment alternative would diverge from the BNSF alignment to serve the Castle Air Force Base (AFB).
		UPRR – BNSF Castle	This alignment alternative would diverge from the UPRR - BNSF alignment to serve the Castle AFB.
		UPRR – BNSF	This alignment alternative would use various connectors between the UPRR and BNSF alignments.
Station Location Options One of two stations for Modesto, depending on the alignment alternative: Downtown Modesto or Briggsmore (Amtrak). One of two stations for Merced, depending on the alignment alternative: Downtown Merced or Castle AFB.			

The alignment alternatives and stations location options analyzed in this Program EIR/EIS are shown in Figure S.3-1. For purposes of this analysis, conceptual designs were developed for all of the alignment alternatives and station location options carried forward that include plan and profile sheets, cross sections, and station descriptions (Appendices 2-D through 2-F). Conceptual designs are based on *Engineering Criteria* (California High-Speed Rail Authority and Federal Railroad Administration 2004).

As part of the development of the *Bay Area Regional Rail Plan*, some HST Alignment Alternatives were considered for regional rail "overlay" services that would be implemented by other transportation agencies in cooperation with the Authority. Overlay services would involve operating regional commuter trains on the HST infrastructure and serving additional non-HST regional rail stations. Regional rail overlay services are not integral to the HST system and are not considered alternatives in this Program EIR/EIS; however, the development of the regional rail plan is considered in the cumulative analysis of HST Alignment Alternatives as a related but separate potential project.

Network Alternatives

Information for a range of HST Network Alternatives is also reported to better understand the implications of selection of certain alignment alternatives and station location options. A network alternative consists of a combination of alignment alternatives and station location options (i.e., combining the corridors described on page S-6 and listed in Table S.3-1, to provide an HST network in the study region as part of a statewide HST system). To provide a broad range of information about network alternatives, several operating scenarios for combinations of terminus stations were investigated, with one exception (a network alternative that terminates in Union City), the network alternatives range from one to three of the major city centers in the Bay Area (San Francisco, Oakland, and San Jose) having direct HST service. Representative network alternatives are defined in Chapter 2, described in Chapter 7, and evaluated in Chapter 8. The Preferred Network Alternative is described in Section S.9 and Chapter 8.

S.4 Areas of Controversy

In considering a choice of alignment alternatives and station location options to form an HST network in the study region, the Authority has taken into account potential impacts on natural resources, cost, travel conditions, effects on travel time and ridership, and public and agency input. Other considerations include possible modifications to alignment alternatives by using more costly designs and construction techniques (e.g., tunnels and elevated guideways), or moving the location of alignments for functional or cost reasons or to avoid or minimize impacts on sensitive resources. The following are the known principal areas of controversy:

- Selection of an HST network with appropriate service to the Bay Area, including choice of mountain crossing, choice of alignments, location of stations, and number of stations directly served (Chapters 2, 7, and 8).
- Impacts to biological resources and wildlife areas, particularly related to the San Francisco Bay Crossings and the Grasslands Ecological Area (GEA) (Section 3.15 and Chapter 8).
- Impacts to urban areas, mostly from noise and visual effects, community effects, and property impacts related to right-of-way acquisition (Sections 3.4, 3.7, and 3.9).

S.5 Avoidance and Minimization

As currently planned, the HST system would avoid and minimize many potential negative environmental consequences. Conceptual designs for the HST Alignment Alternatives meet the project objectives and design criteria, which set specific goals to avoid and minimize negative environmental consequences.

Chapter 3 includes in each topic area a discussion of mitigation strategies. In addition, design and construction practices have been identified that would be employed as the HST system is developed further in the project-level environmental review, final design, and construction stages. Key aspects of the design practices include (i.e., are not limited to) the following.

- Minimize impact footprint and associated direct impacts to farmlands, parklands, biological, and water resources through maximum use of existing transportation corridors.
- Minimize impact associated with growth effects through the selection of multi-modal transportation hubs for potential HST station locations that would maximize access and connectivity as well as provide efficient (transit oriented) growth centered on these station locations.
- Minimize impact to farmlands and associated growth through the selection of multimodal transportation hubs for potential HST station locations that would maximize access and connectivity as well as provide for efficient (transit-oriented) growth centered on these station locations.
- Increase safety and circulation and potentially reduce air pollution and noise impacts, through use of grade separation at road crossings, of considerable portions of adjacent existing services with construction of the planned HST system.
- Pursue agreements with owners/rail operators to place the HST alignment within existing rail rights-of-way, to reduce the need for additional right-of-way and minimize potential impacts to agricultural resources and other natural resources.
- Cooperate with regulatory agencies to develop acceptable specific design and construction standards for stream crossings, including (i.e., not limited to) maintaining open surface (bridged versus closed culvert) crossings, infrastructure setbacks, erosion control measures, sediment-controlling excavation/fill practices, and other best management practices.
- Fully line tunnels with impermeable material to prevent infiltration of groundwater or surface waters to the extent possible based on available geologic information and previous tunneling projects in proximity to proposed tunnels.
- Where there is potential for significant barrier effects that could divide wildlife populations or habitat areas or impede wildlife migration corridors, underpasses or overpasses or appropriate passageways will be designed during project-level environmental review for implementation at reasonable intervals during construction to avoid, minimize, or mitigate potential impacts to wildlife movement.
- The potential impacts associated with construction access roads would be greatly limited, and avoided altogether through sensitive areas (as defined at the project level), by using in-line construction (i.e., by using the new rail infrastructure as it is built to transport equipment to and from the construction site and transporting excavated materials away from the construction area to appropriate reuse [e.g., as fill material, aggregate for new concrete] or disposal sites). To avoid creating access roads in sensitive areas (as defined at the project level), necessary geologic exploration would be conducted using helicopter transport for drilling equipment to minimize surface disruption, followed by site restoration on the completion of work.

In addition, the network alternatives have the potential to reduce overall air pollution, total energy consumption, and traffic congestion as compared to the No Project Alternative. Comparing the energy required by each mode to carry a passenger 1 mile (1.6 km), an HST needs only about one-third that required by an airplane and one-fifth that required by a commuter automobile trip. Comparing the pollutant burden generated by each mode to carry a passenger 1 mile (1.6 km), an HST generates approximately less than one-tenth of the pollutants (excluding CO_2) that would be generated by an airplane or by a commuter automobile trip. The representative base HST forecast would result in a reduction of 22 million barrels of oil and 17.6 billion pounds of CO_2 emissions annually by 2030, as compared to the No Project Alternative. Diversions from the automobile to HST could lead to a projected

5% statewide reduction in vehicle miles traveled (VMT) on the highway system, with VMT reductions of between 7% and 12% in Bay Area and Central Valley counties.

S.6 HST Station Area Development

There would be great benefits from enhancing development patterns and increasing development densities near proposed HST stations. To further this objective the Authority has outlined the station area development objectives described in Chapter 6. These include:

- The preferred HST station locations would be multi-modal transportation hubs and would typically be in traditional city centers to provide maximum opportunity for station area development in accordance with the purpose, need, and objectives for the HST system.
- To be considered for a station, the proposed site must have the potential to promote higher density, mixed-use, pedestrian-oriented development around the station.
- As the HST project proceeds to more detailed study, and before a final station location decision is made, the responsible local governments(s) are expected to provide (through planning and zoning) for transit oriented development around HST stations.
- As the project proceeds to more detailed study, local governments are expected to finance (e.g., through value-capture or other financing techniques) the public spaces needed to support the pedestrian traffic generated by hub stations, as well as identifying long-term maintenance of the spaces.
- Parking for the HST services at HST stations would be provided at market rates, with a strong preference that parking be placed in structures.
- Provide incentives for local governments in which potential HST stations would be located to prepare and adopt station area plans, amend city and county general plans, and encourage transit oriented development in the vicinity of HST stations.

S.7 Public and Agency Involvement

Public and agency involvement was conducted as part of this program environmental process. Involvement was accomplished through a variety of means, including the scoping process, which included a series of public and agency scoping meetings, consultation meetings with federal and state resource agency staff representatives throughout the environmental process, informational meetings with interested groups and agencies, presentations and briefings to a broad spectrum of interest groups, information materials (such as a series of fact sheets), the Authority's Web site presenting information about the proposed project and study evaluations, noticed public meetings of the Authority's governing board at which key policy issues and decisions were raised and discussed and opportunities for public comment were provided, public circulation and posting of the Draft Program EIR/EIS on the Authority's website, and 8 public hearings on the Draft Program EIR/EIS.

S.7-1 Summary of Comments on the Identification of the Preferred Alternative

The identification of a preferred HST alignment between the Bay Area and Central Valley is controversial, and this program EIR/EIS process has received a considerable amount of comment from agencies (federal, state, regional, and local), organizations, and the general public. There is a wide divergence of opinion with many favoring the Pacheco Pass, many favoring the Altamont Pass, and many favoring a combination of both passes (with the Pacheco serving as the north/south HST connection and Altamont primarily serving interregional commuter service between Sacramento/Northern San Joaquin Valley and the Bay Area).

A. PACHECO

The Pacheco Pass supporters include the Metropolitan Transportation Commission (MTC), the cities of San Francisco, San Jose, Redwood City, Fremont, Morgan Hill, Cupertino, Sunnyvale, Gilroy, and Salinas; the counties of San Francisco, Santa Clara, San Mateo, and Monterey; Congress members Lofgren, Honda, Eshoo, and Lantos; Assembly member Beale; State Senators Alquist and Maldanado; the San Francisco County Transportation Agency; the Santa Clara Valley Transportation Authority (VTA); Peninsula Corridor (Caltrain) Joint Powers Board (JPB); San Mateo County Transit District (SamTrans); San Mateo County Transportation Authority (TA); Monterey County Transportation Agency; Alameda County Congestion Management Agency; Alameda County Supervisor Scott Haggerty; the San Jose, the Redwood City, and the San Mateo County Chamber of Commerce; the Silicon Valley Leadership Group; and a number of members of the public representing themselves.

There are a number of reasons supporters give for preferring the Pacheco Pass, including: 1) quicker travel times between San Jose/Silicon Valley and Southern California; 2) more frequent/better service between Bay Area and southern California; 3) higher ridership potential; 4) less potential environmental impacts; 5) avoiding impacts on wildlife and sensitive habitat through Don Edwards San Francisco Bay National Wildlife Refuge; 6) best serves the Caltrain Corridor (San Francisco to Gilroy); 7) provides good HST access for the three county Monterey Bay area with a south Santa Clara HST station; 8) can serve San Francisco, Oakland, and San Jose without a new crossing of the Bay; 9) all service through San Jose/best serves south Bay; and 10) less cost for first phase of system between the Bay Area and Anaheim.

There are a considerable number of organizations, agencies, and individuals who have expressed concern regarding potential impacts on the GEA and/or the uninhabited portions of the Pacheco Pass by HST alternatives via the Pacheco Pass. These include the USFWS, CDFG, California Department of Parks and Recreation, Grassland Water District, Grassland Resources Conservation District, Grassland Conservation, Education & Legal Defense Fund, Ducks Unlimited, California Outdoor Heritage Alliance, California Waterfowl Association, Sacramento Area Council of Governments, Citizens' Committee to Complete the Refuge, Bay Rail Alliance, California Rail Foundation (CRF), California State Parks Foundation (CSPF), Defenders of Wildlife, Planning and Conservation League (PCL), Regional Alliance for Transit (RAFT), Sierra Club, Train Riders Association of California (TRAC), and Transportation Solutions Defense and Education Fund (TRANSDEF). California Department of Parks and Recreation raised concerns regarding potential impacts on State Parks and reserve resources through the Pacheco Pass. In addition, the town of Atherton opposes use of the Caltrain Corridor between San Jose and San Francisco and the City of Millbrae has raised concerns regarding potential impacts through the City of Millbrae.

B. ALTAMONT

The Altamont Pass supporters include the cities of Oakland, Union City, and Atwater; the town of Atherton; the counties of San Joaquin, Stanislaus, Mariposa, and Kern; the California Partnership for the San Joaquin Valley; the San Joaquin Regional Policy Council; Sacramento Area Council of Governments; San Joaquin County Council of Governments; Tulare County Association of Governments; Altamont Commuter Express (ACE); California Department of Parks and Recreation; California Environmental Coalition; California State Parks Foundation (CSPF); Planning and Conservation League (PCL); Sierra Club; Grassland Water District; Grassland Resources Conservation District; Grassland Conservation, Education & Legal Defense Fund; California Outdoor Heritage Alliance; Bay Rail Alliance; Transportation Involves Everyone (TIE); San Joaquin COG Citizens Advisory Committee; Tracy Region Alliance for a Quality Community; Ducks Unlimited; Transportation Solutions Defense and Education Fund (TRANSDEF); California Rail Foundation (CRF); Defenders of Wildlife; Regional Alliance for Transit (RAFT); Citizens' Committee to Complete the Refuge; Train Riders Association of California (TRAC); and a number of members of the public representing themselves.

There are a number of reasons supporters give for preferring the Altamont Pass including: 1) quicker travel times between Sacramento/Northern San Joaquin Valley and the Bay Area; 2) best serves the Central Valley; 3) more Northern San Joaquin markets served on the Authority's adopted first phase of construction between the Bay Area and Anaheim; 4) higher ridership potential; 5) less potential for environmental impacts; 6) avoids impacts on wildlife and sensitive habitat through Pacheco Pass and the GEA; 7) serves a greater population/more population along the alignment; 8) best serves ACE corridor and reduces traffic along I-580; 9) better service between Bay Area and Southern California (either reduced frequency is needed on shared Caltrain alignment or HST trains can be split); 10) best serves San Jose since it would be a terminus station and with much faster travel times to commuter markets in the Northern San Joaquin Valley; and 11) is less sprawl inducing.

There are a considerable number of organizations, agencies, and individuals who have expressed concern regarding potential impacts on the San Francisco Bay and Don Edwards San Francisco Bay National Wildlife Refuge by HST alternatives via the Altamont Pass using a Dumbarton Crossing. These include the MTC; BCDC; USEPA; USFWS; Don Edwards San Francisco Bay National Wildlife Refuge; Congress members Zoe Lofgren, Michael Honda, Anna Eshoo, and Tom Lantos; State Senators Elaine Alquist and Abel Maldanado; Assembly member Jim Beale; Santa Clara County; San Mateo County Transit District (SamTrans); San Mateo County Transportation Authority (TA); Peninsula Corridor (Caltrain) Joint Powers Board (JPB); San Francisco Bay Trail Project; San Jose Chamber of Commerce; San Francisco Bay Trail Project; the City of San Jose; the City of Oakland; and Don Edwards (Member of Congress, 1963-1995). The East Bay Regional Park District has raised concerns in regards to potential impacts on nine regional parks, in particular the Pleasanton Ridge and Vargas Plateau regional parks, and the Alameda Creek Regional Train between Pleasanton and Niles Junction for Altamont Pass alternatives. In addition, the City of Fremont opposes the Altamont Pass, and the City of Pleasanton does not support the Altamont Pass but remains "open" to terminating Altamont alternatives in Livermore. The MTC and Alameda County Supervisor Scott Haggerty also support the investigation of Altamont Pass alternatives terminating in Livermore.

C. COMBINED PACHECO AND ALTAMONT

After completing a two-year "Regional Rail" planning process, the MTC has re-confirmed support for the Pacheco alignment via the San Francisco Peninsula as the main HSR express line between Northern and Southern California, however, MTC's resolution also endorses the Altamont route as better suited to serve interregional and local travel between the Bay Area and the Northern San Joaquin Valley and requests that CHSRA consider seeking additional HSR bond funds dedicated to upgrading the Altamont corridor for regional service. The Tri-Valley Policy Working Group and Technical Advisory Committee (Tri-Valley PAC) took a similar position:

> The Draft Bay Area EIR/EIS includes a Bay Area HSR alignment that would include High Speed Train service through the Pacheco Pass and regional overlay service provided through the Altamont pass. The Policy Advisory Committee believes that this option may present the best way of addressing our concerns and delivering optimal HST service to the region as a whole.

The Capitol Corridor JPB supports "in principle the concept of the two high-speed alignments into and out of the Bay Area. Each alignment would provide a means to meet the high-speed travel markets for (1) long distance travelers from Los Angeles/Southern California using the Pacheco Pass route and (2) the interregional travelers from the Central Valley using the Altamont Pass route." The MTC recommendations are also supported by the Alameda County Congestion Management Agency and Alameda County Supervisor Scott Haggerty.

The USEPA recommended "eliminating from further consideration a high speed rail alternative connecting Bay Area to Central Valley that includes both an Altamont and a Pacheco Pass alignment, termed, "*Pacheco Pass with Local Service*" in the Draft PEIS. This scenario would effectively result in twice the habitat fragmentation, noise, and indirect impacts to aquatic resources. This alternative would likely result in CWA Section 404 permitting challenges because it is difficult to demonstrate that mountain crossings at both Pacheco and Altamont Passes represent the LEDPA given the increased indirect impacts to aquatic resources and habitat fragmentation associated with this alternative."

S.8 High-Speed Train Network Alternatives Evaluation

HST Network Alternatives represent different ways to combine HST Alignment Alternatives and station location options to implement the HST system in the study region. The Draft Program EIR/EIS focused on analysis of HST Alignment Alternatives. Because there are many possible combinations of alignments and stations, 21 representative HST network alternatives were considered and described to better understand the implications of selection of certain alignment alternatives and station location options. The evaluation of Network Alternatives presented in Chapter 8 in this Final Program EIR/EIS has been informed by agency and public review and comment on the Draft Program EIR/EIS.

A summary evaluation considering important differences among network alternatives is described below. Table S.8-1 presents the characteristics and potential impacts for the 21 representative network alternatives. These representative network alternatives are grouped into three basic approaches for linking the Bay Area and Central Valley: Altamont Pass (11 network alternatives); Pacheco Pass (6 network alternatives); and Pacheco Pass with Altamont Pass (local service) (4 network alternatives). The impact quantities provided are prior to any mitigation. A more extensive presentation of characteristics and potential impacts is provided in Chapter 7.

The network alternatives were developed to enable an evaluation and comparison of how various combinations of alignment alternatives would meet the project's purpose and need and how each would perform as a HST network (e.g., travel times between various station locations, anticipated ridership, operating and maintenance costs, energy consumption, and auto trip diversions). The different system characteristics, as well as environmental factors of the network alternatives, present complex choices that are now better supported and informed in this Final EIR/EIS, following agency and public review and comment on the Draft Program EIR/EIS.

The network alternatives vary in the degree they serve urban areas/centers and international airports. All but one would provide direct HST services to (i.e., include a HST station within) one and up to three of the major urban centers in the Bay Area—San Francisco, San Jose, and Oakland. Some of the network alternatives would provide service to one or more of the three Bay Area international airports at San Francisco, Oakland, and San Jose. Connectivity and enhancement of other transit systems (e.g. ACE, Caltrain, Capitol Corridor, BART, and Valley Transportation Authority) also varies greatly among the network alternatives.

Overall, implementing the HST system would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic in specific travel corridors. Full grade-separation along Bay Area rail corridors used by the HST would improve local traffic flow and reduce air pollution at existing rail crossings. The more extensive the HST system implemented in the Bay Area, the greater the travel condition benefits, including increased connectivity to other transit systems, increased convenience, increased reliability, and improved travel times. In particular, more direct connections to the region's airports provide increased connectivity for air transportation system riders.

Recognizing the benefits described above, as well as other attributes, the cities of San Francisco, Oakland, and San Jose all strongly support direct HST service to their respective downtowns. This support was expressed as comments on the Draft Program EIR/EIS, and is consistent with comments/input provided by these cities over the ten years since the Authority was created. MTC, the regional government for the Bay Area, supports direct HST service to the downtowns of each of these three major Bay Area urban centers.

A number of Network Alternatives clearly do not meet the purpose and need for the HST system. The Altamont Pass network alternative that terminates in Union City fails since it does not provide direct HST service to San Francisco, Oakland, or San Jose (the major Bay Area cities) nor does it provide interface with the major commercial airports. Also failing are a Pacheco Pass network alternative that terminates in San Jose and three Altamont Pass network alternatives that only serve one of the three major urban areas/centers. These four alternatives directly provide HST service to at most only one major Bay Area city and one of the region's major commercial airports.

The Pacheco Pass with Altamont Pass (local service) network alternatives do not compare well against either the Pacheco Pass or Altamont Pass network alternatives in the Draft Program EIR/EIS for HST service to be provided by the Authority. These network alternatives resulted in similar ridership and revenue forecasts (with less revenue than comparable Pacheco Pass network alternatives) while having considerably higher capital costs ($4.4–6.0 billion more for comparable terminus station locations). Although the Pacheco Pass with Altamont Pass (local service) alternatives would increase connectivity and accessibility by potentially providing direct HST service to additional markets, these alternatives would have considerably higher environmental impacts, construction issues and logistical constraints than Altamont or Pacheco Pass alternatives. The USEPA concluded that the Pacheco Pass with Altamont Pass (local service) network alternatives are not likely to contain the Least Environmentally Damaging Alternative (LEDPA), which is a clean water requirement.

S.8-1 Comparison of Pacheco Pass and Altamont Pass Alternatives

Public Input: There is a wide divergence of opinion for the selection of the alignment between the Bay Area and Central Valley with many favoring the Pacheco Pass, many favoring the Altamont Pass, and many favoring doing both passes (with the Pacheco serving as the north/south HST connection and Altamont primarily serving interregional commuter service between Sacramento/Northern San Joaquin Valley and the Bay Area). San Francisco, Oakland, and San Jose, the three major urban centers of the Bay Area, all want direct HST service. The Central Valley (including Sacramento) and many transportation and environmental organizations strongly prefer the Altamont Pass, whereas much of the Bay Area (MTC, San Francisco, San Jose, San Francisco Peninsula, and Monterey Bay Area) agencies strongly support the Pacheco Pass. Opposition has been raised to potential impacts for both the Pacheco Pass (impacts on the GEA, Pacheco Pass, the Town of Atherton, and Millbrae), and the Altamont Pass (impacts on the San Francisco Bay, Don Edwards San Francisco Bay National Wildlife Refuge, East Bay regional parks, the City of Fremont, City of Livermore, and the City of Pleasanton).

Ridership and Revenue: The HST ridership and revenue forecasts done by MTC in partnership with Authority concluded that both the Pacheco Pass and Altamont Pass network alternatives have high ridership and revenue potential. Distinct differences were found between the Pacheco Pass and Altamont Pass for certain markets, and the sensitivity tests help in the selection of alignments alternatives and station options within the corridors studied. Nonetheless, while additional forecasts with different assumptions may result in somewhat different results, the bottom-line conclusion is expected to remain the same: both the Pacheco Pass and Altamont Pass have high ridership potential. This overall conclusion is consistent with the previous ridership analysis done for the Authority's Business Plan (June 2000). It is the conclusion of this analysis that both the Pacheco Pass and Altamont Pass alternatives have high ridership potential and that ridership and revenue do not differentiate between these alternatives.

Capital and Operating Costs: Capital and operating costs are not substantially different between the Pacheco Pass and Altamont Pass alternatives that meet the purpose and need of the proposed HST system and serve similar termini stations. It is therefore the conclusion of this analysis that capital and operating costs do not differentiate between the Pacheco Pass and Altamont Pass alternatives.

Table S.8-1. Summary of Characteristics and Impacts for the Network Alternatives

	Altamont Pass											Pacheco Pass						Pacheco Pass with Altamont Pass (local service)			
Characteristic/Impacts	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland & San Jose Termini	San Jose Terminus	San Francisco Terminus	Oakland Terminus	Union City Terminus	San Francisco & San Jose — via SF Peninsula	San Francisco, San Jose, Oakland – no Bay Crossing	Oakland & San Francisco – via Transbay Tube	San Jose, Oakland, & San Francisco via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland, & San Jose Termini	San Jose Terminus	San Jose, San Francisco & Oakland-via Transbay Tube	San Jose, Oakland & San Francisco-via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	SF, Oak, & SJ Termini (without Dumbarton Bridge)	San Jose Terminus
Figure # (see Chapter 7 of the Program EIR/EIS)	*7.2-1*	*7.2-2*	*7.2-3*	*7.2-4*	*7.2-5*	*7.2-6*	*7.2-7*	*7.2-8*	*7.2-9*	*7.2-10*	*7.2-11*	*7.2-12*	*7.2-13*	*7.2-14*	*7.2-15*	*7.2-16*	*7.2-17*	*7.2-18*	*7.2-19*	*7.2-20*	*7.2-21*
Length (miles)	203.34	182.16	241.16	160.18	191.56	170.86	157.93	213.30	244.70	179.64	199.11	267.53	256.87	309.60	213.15	276.31	265.66	339.16	318.45	360.90	286.04
Number of stations	9	8	11	6	8	7	5	9	11	8	9	7	7	10	4	8	8	10	9	12	7
Capital costs (billions $)	$12.7	$10.0	$15.1	$7.7	$11.0	$8.2	$6.0	$12.6	$14.5	$12.9	$14.8	$12.4	$11.6	$16.0	$8.0	$17.0	$16.3	$18.3	$16.0	$20.4	$13.5
Capital costs/mile of alignment (millions)	$62.5	$54.9	$62.6	$48.1	$57.4	$48.0	$38.0	$59.1	$59.3	$71.8	$74.3	$46.3	$45.2	$51.7	$37.5	$61.5	$61.4	$54.0	$50.2	$56.5	$47.2
Ridership (millions annual)	87.91	88.01	81.13	94.65	93.88	94.39	83.49	90.75	85.22	95.94	89.62	93.33	91.37	85.52	79.69	95.2	92.07	96.15	92.88	87.81	89.79
Revenue (millions annual)	$2,844	$2,881	$2,625	$3,176	$3,127	$3,153	$2,701	$2,743	$2,733	$3,164	$2,884	$3,090	$3,071	$2,782	$2,666	$3,152	$3,038	$2,992	$3,065	$2,897	$2,963
Annual operating costs (millions)	$1,099	$1,085	$1,098	$1,076	$1,124	$1,093	$1,073	$1,115	$1,123	$1,106	$1,093	$1,182	$1,166	$1,174	$1,099	$1,196	$1,179	$1,171	$1,140	$1,179	$1,130
Bridge over bay=B Transbay tube=T	B	—	B	—	B	—	—	B	—	T	T	—	—	—	—	T	T	B	—	—	—
SF, Oakland, San Jose - # served	2	2	3	1	1	1	0	2	3	1	3	2	2	3	1	3	3	2	2	3	1
International airports	SFO/SJC	OAK/SJC	SFO/OAK/SJC	SJC	SFO	OAK	—	SFO/SJC	SFO/OAK/SJC	OAK	SFO/OAK/SJC	SFO/SJC	OAK/SJC	SFO/OAK/SJC	SJC	SFO/OAK/SJC	SFO/OAK/SJC	SFO/SJC	OAK/SJC	SFO/OAK/SJC	SJC
Express Train Travel Times (Hours:Min)																					
San Francisco - Los Angeles	2:36	—	2:36	—	2:36	—	—	2:36	3:17	2:31	2:31	2:38	—	2:38	—	2:38	2:38	2:38	—	2:38	—
Oakland - Los Angeles	—	2:23	2:23	—	—	2:23	—	—	2:23	2:23	2:23	—	2:30	2:30	—	2:46	2:30	—	2:30	2:30	—
San Jose - Los Angeles	2:19	2:19	2:19	2:19	—	—	—	2:37	2:19	—	2:19	2:09	2:09	2:09	2:09	2:09	2:09	2:09	2:09	2:09	2:09
San Francisco - Sacramento	1:06	—	1:06	—	1:06	—	—	1:06	1:39	0:57	0:57	1:47	—	1:47	—	1:47	1:44	1:15	—	1:48	—
Oakland - Sacramento	—	0:53	0:53	—	—	0:53	—	—	0:53	0:53	0:53	—	1:38	1:38	—	1:54	1:38	—	1:00	1:00	—
San Jose - Sacramento	0:49	0:49	0:49	0:49	—	—	—	1:03	0:49	—	0:49	1:18	1:18	1:18	1:18	1:18	1:18	0:56	0:56	0:56	0:56
Union City - Los Angeles	—	—	—	—	—	—	2:13	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Characteristic/Impacts	Altamont Pass											Pacheco Pass						Pacheco Pass with Altamont Pass (local service)			
	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland & San Jose Termini	San Jose Terminus	San Francisco Terminus	Oakland Terminus	Union City Terminus	San Francisco & San Jose — via SF Peninsula	San Francisco, San Jose, Oakland – no Bay Crossing	Oakland & San Francisco – via Transbay Tube	San Jose, Oakland, & San Francisco via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland, & San Jose Termini	San Jose Terminus	San Jose, San Francisco & Oakland- via Transbay Tube	San Jose, Oakland & San Francisco- via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	SF, Oak, & SJ Termini (without Dumbarton Bridge)	San Jose Terminus
Union City - Sacramento	—	—	—	—	—	—	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Farmland (acres)	764.2	761.9	764.2	761.9	757.8	755.5	755.5	757.8	761.9	755.5	761.9	1,372.3	1,378.7	1,378.7	1,372.3	1,372.3	1,378.7	1,380.0	1,384.1	1,384.1	1,384.1
Prime farmland (acres)	429.1	426.8	429.1	426.8	422.7	420.3	420.3	422.7	426.8	420.3	426.8	663.3	669.7	669.7	663.3	663.3	669.7	760.4	764.5	764.5	764.5
Floodplains (acres) direct impacts (direct/indirect)	308.3/ 969	218.6/ 720	315.3/ 984	211.6/ 706	270.7/ 817	181.1/ 568	177.6/ 561	317.7/ 891	314.5/ 896	181.1/ 568	218.6/ 720	520.8/ 1,633	477.5/ 1,639	573.4/ 1,814	424.9/ 1,458	520.8/ 1,633	477.5/ 1,685	547.1/ 3,411	456.4/ 1,633	552.2/ 1,685	432.2/ 1,479
Floodplains/linear mile of alignment	1.52	1.20	1.31	1.32	1.41	1.06	1.12	1.49	1.29	1.01	1.10	1.95	1.86	1.85	1.99	1.88	1.80	1.61	1.43	1.53	1.51
Streams (linear feet) (direct/indirect)	16,824/ 71,320	17,660/ 76,905	19,814/ 82,951	14,670/ 65,274	15,995/ 67,867	16,831/ 72,451	14,432/ 65,198	17,481/ 70,714	20,273/ 82,171	16,831/ 73,451	17,660/ 76,905	20,276/ 90,572	21,788/ 99,406	24,401/ 104,672	17,663/ 85,306	20,276/ 90,572	30,278/ 137,768	27,130/ 125,490	27,666/ 132,501	30,278/ 137,768	24,197/ 120,049
Waterbodies (lakes + SF bay) (acres) (direct/indirect)	39.6/ 154.9	2.3/ 7.6	39.6/ 154.9	2.3/ 7.6	39.6/ 154.9	2.3/ 7.6	2.3/ 7.6	39.6/ 154.9	2.3/ 11	38.8/ 243.1	38.8/ 243.1	3.8/ 19.7	4.5/ 17.6	4.5/ 21	3.8/ 16.3	40.3/ 255.2	41/ 253.1	41.9/ 164.9	5.3/ 18.92	5.3/ 22.3	4.6/ 17.6
Wetlands (acres) (direct/indirect)	45.9/ 2,526	12.3/ 805	46.3/ 2,594	12.0/ 737	44.4/ 2,259	10.8/ 539	10.7/ 499	44.4/ 2,264	12.4/ 957	33.6/ 1,892	35.1/ 2,158	15.6/ 1,601	17.4/ 1,825	17.5/ 1,977	15.5/ 1,449	38.4/ 2,955	40.2/ 3,179	56.1/ 3,499	25.3/ 2,180	25.4/ 2,332	23.7/ 1,972
Nonwetland waters (linear feet)	16,773	14,032	16,932	13,577	15,947	13,502	13,113	15,947	14,662	13,502	14,032	14,395	14,533	15,123	14,395	14,395	14,553	19,891	17,977	18,556	17,521
Species (special status plants)	56	40	57	39	56	39	38	56	56	40	42	58	49	63	46	59	50	70	67	71	54
Species (special status wildlife)	50	44	50	43	49	44	36	49	50	43	43	53	49	53	38	53	49	57	51	58	50
Cultural resources (number)	151	128	175	93	146	112	88	182	205	114	119	167	106	195	78	108	111	198	133	222	109
Fault Crossings (Active & Potentially Active)	11	7	13	6	9	5	4	10	9	5	7	5	6	8	3	5	6	13	10	12	9
Crosses Active Fault in Tunnel (Calaveras)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Immediately Adjacent & Parallel to Active Fault (Hayward)	No	Yes	Yes	No	No	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	Yes	Yes	No
4(f)/6(f) Resources (0-150 feet)	32	29	39	22	24	21	18	30	39	22	30	18	21	31	8	19	22	35	36	46	27

Characteristic/Impacts	Altamont Pass											Pacheco Pass						Pacheco Pass with Altamont Pass (local service)			
	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland & San Jose Termini	San Jose Terminus	San Francisco Terminus	Oakland Terminus	Union City Terminus	San Francisco & San Jose — via SF Peninsula	San Francisco, San Jose, Oakland – no Bay Crossing	Oakland & San Francisco – via Transbay Tube	San Jose, Oakland, & San Francisco via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland, & San Jose Termini	San Jose Terminus	San Jose, San Francisco & Oakland-via Transbay Tube	San Jose, Oakland & San Francisco-via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	SF, Oak, & SJ Termini (without Dumbarton Bridge)	San Jose Terminus
Station Location Options																					
Transbay Transit Center	■		■		■			■	■	■	■	■		■		■	■	■		■	
Millbrae/SFO	■		■		■			■	■			■		■		■		■		■	
Redwood City (Caltrain)	■		■		■				■							■					
Palo Alto (Caltrain)								■				■		■				■		■	
West Oakland/7th Street		■	■			■			■	■	■		■	■		■	■		■	■	
Coliseum/Airport		■	■			■			■	■	■		■	■			■		■	■	
Union City (BART)		■	■			■	■		■	■	■		■	■			■		■	■	
Union City (Shinn)					■			■													
Fremont (Warm Springs)	■			■														■			■
San Jose (Diridon)	■	■	■	■				■	■		■	■	■	■	■	■	■	■	■	■	■
Gilroy (Caltrain)												■	■	■	■	■	■	■	■	■	■
Pleasanton (I-680/Bernal Rd)	■	■	■	■	■	■	■	■	■	■	■							■	■	■	■
Tracy (Downtown)	■	■	■	■	■	■	■	■	■	■	■							■	■	■	■
Modesto (Downtown)	■	■	■	■	■	■	■	■	■	■	■							■	■	■	■
Briggsmore (Amtrak)												■	■	■	■	■	■				
Merced (Downtown)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Notes

■ indicates stations served

Travel Times/Travel Conditions: Either the Pacheco Pass or Altamont Pass would provide quick, competitive travel times between northern and southern California. The Pacheco Pass would provide the quickest travel times between the south Bay and southern California (10 minutes less than the Altamont alternatives serving San Jose via the East Bay [I-880], and 28 minutes less than the Altamont San Francisco and San Jose—via San Francisco Peninsula alternative for express service). The Pacheco Pass enables a potential station in southern Santa Clara County (at Gilroy or Morgan Hill), which provides superior connectivity and accessibility to south Santa Clara County and the three Monterey Bay counties and utilizes the entire Caltrain corridor between San Francisco and Gilroy. San Francisco and San Jose would be served with one HST alignment along the Caltrain corridor providing the most frequent service to these destinations, whereas the most promising Altamont Pass alternatives would require splitting HST services (express, suburban express, skip-stop, local, regional) between two branch lines to serve San Jose and either San Francisco or Oakland. The Altamont Pass would provide considerably quicker travel times between Sacramento/Northern San Joaquin Valley and San Francisco or Oakland than the Pacheco Pass (41 minutes less between San Francisco and Sacramento for express service). The Altamont alternatives using the East Bay to San Jose would have express travel times about 29 minutes less than the Pacheco pass between Sacramento and San Jose, while the Altamont San Francisco and San Jose—via the San Francisco Peninsula alternative would take 15 minutes less than the Pacheco Pass for this market. The Altamont Pass would enable a potential Tri-Valley HST station and a potential Tracy HST station, which provide superior connectivity to the Tri-Valley/Eastern Alameda County, Contra Costa County, and the Tracy area and provide for the opportunity for shared infrastructure with an improved ACE commuter service, although additional infrastructure would be necessary for commuter overlay service with associated impacts. The Altamont Pass would have more potential Central Valley stations served on the Authority's adopted first phase for construction between the Bay Area and Anaheim (Tracy and Modesto). The travel time for direct service and travel conditions would be significantly different between the Altamont Pass alternative to Oakland and San Jose in comparison to the other two promising Altamont alternatives and the preferred Pacheco Pass alternatives (which directly serve San Francisco and San Jose). The Oakland and San Jose alternative would provide superior travel times, connectivity and accessibility to Oakland, Oakland International Airport, and the East Bay, but would not directly serve downtown San Francisco, SFO, or the San Francisco Peninsula/Caltrain Corridor.

Constructability Issues and Logistical Constraints: There are constructability issues and logistical constraints with both the Pacheco and Altamont pass alternatives. However, the construction related issues and logistical constraints associated with the Altamont Pass alternatives are greater than those for the Pacheco Pass. All Altamont Pass alternatives have considerable constructability issues through the right-of-way constrained Tri-Valley area (Livermore and Pleasanton) and tunneling/seismic issues in the Pleasanton Ridge/Niles Canyon area. All Altamont Pass alternatives have tunneling/seismic issues (Calaveras Fault) in the Pleasanton Ridge as well as seismic issues in the East Bay (Hayward Fault). For direct service to San Francisco, the most promising Altamont Pass alternatives require a new Bay Crossing at Dumbarton, which must also go through the Don Edwards San Francisco Bay National Wildlife Refuge and the City of Fremont (which opposes construction of the east-west link through Fremont). For the Altamont Pass alternative serving Oakland, the MTC concluded that "development of an East Bay option with direct service to San Jose and Oakland would include significant right-of-way risk gaining an agreement from UPRR to provide access to Oakland." For the Altamont Pass east bay link to San Jose, Caltrans District 4 has commented that use of the I-880 median would result in significant construction stage impacts between Fremont and San Jose. The Pacheco Pass requires coordination and shared-use on the Caltrain corridor and would have tunneling and environmental issues through the Pacheco Pass, as well as aerial structures and other design refinements and mitigation measures to minimize or avoid potential impacts on the GEA.

Environmental Impacts: The preferred Pacheco Pass alternative would have greater potential impacts on acres of farmlands than the most promising Altamont Pass alternatives (1,372 ac vs. 758 – 764 ac) and potentially impact more acres of floodplains (521 ac vs. 219-318ac) and more linear feet of streams (20,276 linear ft vs. 16,824–17,660 linear ft). This alternative would also potentially result in impacts on resources within the generally designated GEA and would have the potential to impact wildlife movement. The preferred Pacheco Pass alternative would have somewhat less potential impacts for noise and vibration and would affect a fewer number of 4(f) and 6(f) resources (14 vs. 34-36) than the most promising Altamont Pass alternatives. The differences in the impacts on waterbodies, wetlands, nonwetland waters, species, and cultural resources would vary considerably depending upon the Altamont Pass alternative. The two Altamont Pass alternatives providing direct service to San Francisco would include a new Bay crossing at Dumbarton and would cross areas within the Don Edwards San Francisco Bay National Wildlife Refuge (wetlands and sensitive habitat) and therefore would have considerably higher impacts on waters, wetlands, and 4(f) resources than the Pacheco Pass alternative. In comparison to these Altamont Pass alternatives, the Pacheco Pass alternative would have considerably less potential impacts on waterbodies (3.8 ac vs. 39.6 ac), considerably less potential impacts on wetlands (15.6 ac vs. 44.4–45.9 ac), and fewer potential impacts on nonwetland waters (14,395 linear ft. vs. 15,947–16,773 linear ft), while having relatively similar potential impacts on the number of special status plant species (58 vs. 56), special status wildlife species (53 vs. 49-50), and cultural resources (167 vs. 151-182). In comparing the Altamont Pass alternative to Oakland and San Jose along the east bay, the Pacheco Pass alternative to San Francisco and San Jose would have slightly more potential impacts on waterbodies (3.8 ac vs. 2.3 ac), wetlands (15.6 ac vs. 12.3 ac), and nonwetland waters (14,395 linear ft vs. 14,032 linear ft), special-status plant species (58 vs. 40), special-status wildlife species (53 vs. 44), and cultural resources (167 vs. 128). The Pacheco Pass Alternative would avoid impacts on the Don Edwards San Francisco Bay National Wildlife Refuge, and mitigation measures would reduce or avoid potential impacts on resources within the GEA and in particular along existing Henry Miller Road.

S.9 Preferred HST Network Alternative

The Authority and FRA identify as the preferred alternative:

- Pacheco Pass to San Francisco (via San Jose) for the proposed HST system (see Figure S.9-1)

The Pacheco Pass alternative serving San Francisco and San Jose termini best meets the purpose and need for the proposed HST system. Key reasons include:

1) The Pacheco Pass minimizes impacts on wetlands, waterbodies, and the environment.

The statewide HST system should provide direct service to Northern California's major hub airport at SFO and major transit, business, and tourism center at downtown San Francisco. The Pacheco Pass alternative serving San Francisco and San Jose termini has the <u>least</u> potential environmental impacts overall while providing direct HST service to downtown San Francisco, SFO, and the San Francisco Peninsula (Caltrain Corridor) and minimizes construction and logistical issues which can lead to delay and cost escalation.

The Pacheco Pass alternatives enable San Francisco, SFO, and the San Francisco Peninsula to be directly served without a crossing of the San Francisco Bay. Altamont Pass alternatives requiring a San Francisco Bay crossing would have the greatest potential impacts on the San Francisco Bay and have high capital costs and constructability issues. The Dumbarton Crossing would also have the greatest potential impacts on wetlands and the Don Edwards San Francisco Bay National Wildlife Refuge. To implement these alternatives, extensive coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission and the Bay crossing would be subject to the USACE, CDFG, and BCDC permit process. A number of agencies, organizations, and individuals have raised concerns regarding to the construction of a HST crossing of the San Francisco Bay (see Section S.7.1).

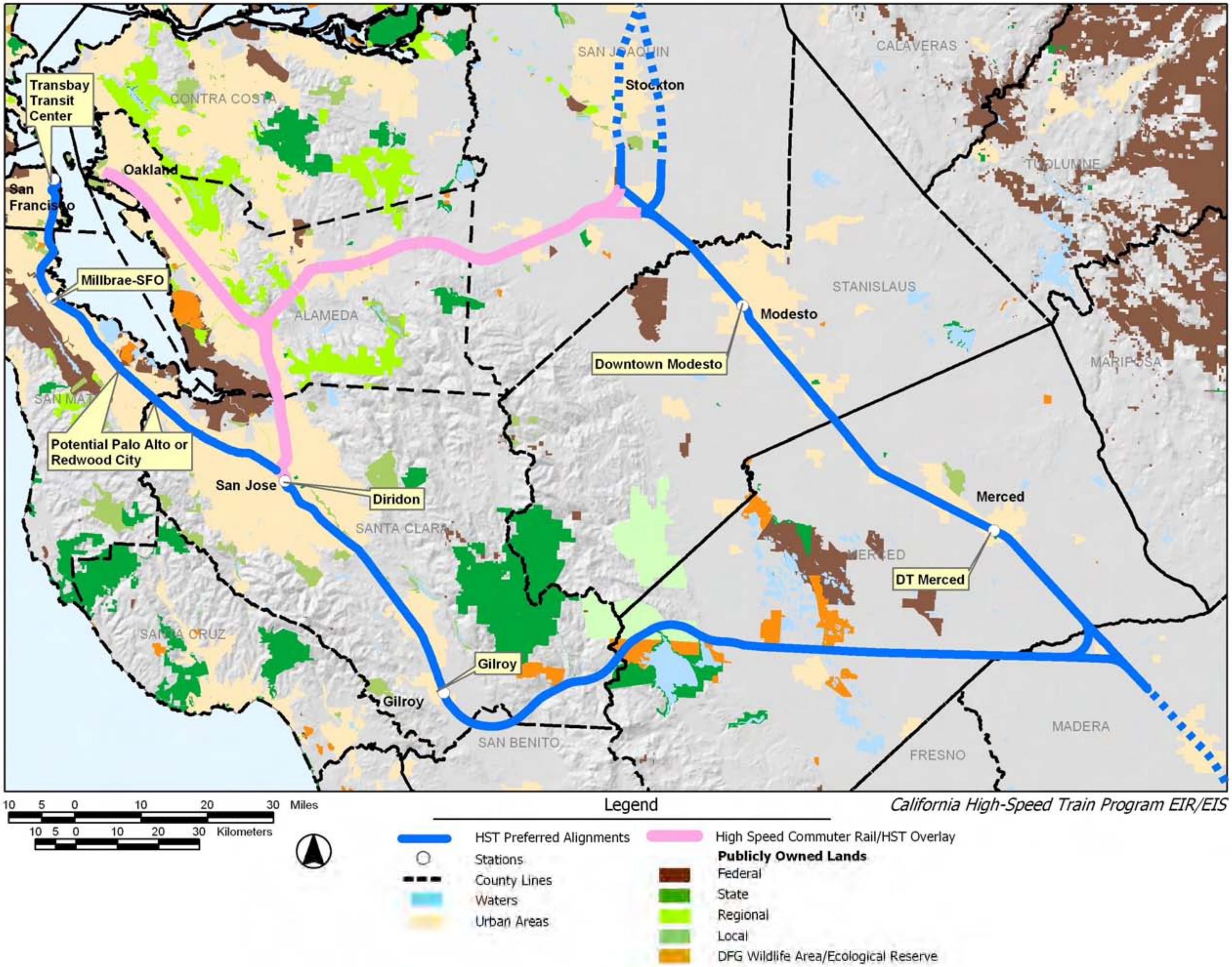

Figure S.9-1
Bay Area to Central Valley HST Preferred Alternative

While a considerable number of comments have raised concerns about potential environmental impacts for Pacheco Pass alternatives (in particular relating to potential impacts on the GEA), HST via the Pacheco Pass is feasible and preferred because it would result overall in fewer impacts when compared to the Altamont Pass alternatives with a Bay crossing. Additionally, the Pacheco Pass alternative would include various measures to avoid, minimize, and/or mitigate those environmental impacts to the extent feasible and would offer opportunities for environmental improvements along the HST right of way that could be accomplished during project design, construction, and operation, including through the use of tunnels and aerial structures where appropriate. This contrasts with the more uncertain regulatory approvals that would be needed for crossings of San Francisco Bay and the Don Edwards San Francisco Bay National Wildlife Refuge. Identification of a preferred alternative in the Final Program EIR/EIS is required for NEPA compliance. Since the identified preferred alternative would have the least overall environmental impacts, it is also identified as the environmentally superior alternative for CEQA compliance and the environmentally preferable alternative under NEPA.

2) The Pacheco Pass best serves the connection between the Northern and Southern California.

Operational benefits result in greater frequency and capacity:

San Francisco and San Jose would be served with one HST alignment along the Caltrain corridor providing the most frequent service to these destinations, whereas the most promising Altamont Pass alternatives would split HST services (express, suburban express, skip-stop, local, regional) between two branch lines to serve San Jose and either San Francisco or Oakland—reducing the total capacity of the system to these markets. The proposed HST system already has two locations where there are branch splits (north of Fresno—to Sacramento and the Bay Area, and south of Los Angeles Union Station—to Orange County and the Inland Empire). Avoiding additional branch splits in the HST alignment would benefit train operations and service.

Provides a superior connection between the South Bay and Southern California:

The Pacheco Pass enables the shortest connection to be constructed between the South Bay and Southern California with the quickest travel times between these markets. A southern Santa Clara County HST station increases connectivity and accessibility for the South Bay and the three county Monterey Bay area.

Fewer stations between the Major Metropolitan Areas:

The core purpose of the HST system is to serve passenger trips between the major metropolitan areas of California. There is a critical tradeoff between the accessibility of the system to potential passengers that is provided by multiple stations and stops, and the resulting HST travel times. Additional or more closely spaced stations (even with limited service) would lengthen travel times, reduce frequency of service, and the ability to operate both express and local services. The Pacheco Pass has the advantage of fewer stops through the high-speed trunk of the system between San Francisco or San Jose and Southern California, the most populated regions of the state.

Between Merced and Gilroy, the HSTs will be maintaining speeds well over 200 mph. The fact that there is no population concentrations between Merced and Gilroy along the Pacheco Pass is a positive attribute since there are fewer communities and hence fewer community impacts. Additionally, there will be no HST station between Gilroy and Merced. As a result, the Pacheco Pass minimizes the potential for sprawl inducement as compared with the Altamont Pass.

Minimizes Logistical Constraints:

The Pacheco Pass avoids construction issues and logistical constraints through the Tri-Valley and Alameda County. The Tri-Valley PAC has raised serious concerns with all the Altamont Pass alternatives regarding land use compatibility and right-of-way constraints and the need for aerial structures through the Tri-Valley. All Altamont Pass alternatives have tunneling/seismic issues (Calaveras Fault) in the Pleasanton Ridge/Niles Canyon area as well as seismic issues in the East Bay (Hayward Fault). Both the City of Fremont and the City of Pleasanton are opposed to HST alternatives through these cities because of potential environmental issues, right-of-way constraints, and other logistical issues.

3) The Pacheco Pass best utilizes the Caltrain corridor.

The Pacheco Pass alternative would enable the early, incremental implementation of the entire Caltrain Corridor section between San Francisco, San Jose, and Gilroy. The HST system is complementary to Caltrain and would utilize the Caltrain right-of-way and share tracks with express Caltrain commuter rail services. Caltrain intends to use lightweight, electrified trains that would be compatible with HST equipment. Because it utilizes the Caltrain corridor, environmental impacts would be minimized. Utilizing the Caltrain Corridor (between San Francisco and San Jose) allows the Authority to maximize the use of local and regional funds dedicated to train service improvements, and thereby helping to reduce the need for state funds.

4) The Pacheco Pass is strongly supported by the Bay Area region, cities, agencies, and organizations.

Much of the Bay Area local and regional governments, transportation agencies, and business organizations strongly support the Pacheco Pass alternative to San Francisco via San Jose and the Caltrain Corridor. As described in Section S.7.1, there is strong local and regional government support along the Pacheco Pass alignment throughout the Bay Area. This support is critical towards implementing this major infrastructure project through the heavily urbanized Bay Area linking San Francisco, San Jose and Gilroy.

The Central Valley (including Sacramento) and many transportation and environmental organizations are united in strongly preferring the Altamont Pass. However, to reach the major markets in the Bay Area, the Altamont Pass alternatives must go through Alameda County, including Livermore and Pleasanton in the Tri-Valley and Fremont. The Tri-Valley PAC (a partnership that includes the cities of Dublin, Livermore, Pleasanton, Danville, San Ramon, and Tracy along with transportation providers LAVTA, ACE, and BART) has raised serious concerns regarding right-of-way constraints and the need for aerial structures through the Tri-Valley. The Tri-Valley PAC supports HST service through the Pacheco Pass and "regional overlay service provided through the Altamont pass." They believe that this option may present the best way of addressing their concerns and delivering optimal HST service to the region as a whole. The Alameda County Congestion Management Agency and Alameda County Supervisor Scott Haggerty both support the MTC recommendation for the Pacheco alignment via the San Francisco Peninsula as the main HST express line between Northern and Southern California while also supporting upgraded interregional services between the Bay Area—Sacramento and the San Joaquin Valley via the Altamont Pass. The City of Fremont opposes the Altamont Pass alternative as does the City of Pleasanton although Pleasanton remains "open" to terminating Altamont alternatives in Livermore. The concerns through Alameda County are significant enough that the MTC, Alameda County Congestion Management Agency, and Alameda County Supervisor Scott Haggerty have requested that "the CHSRA also evaluate an alternative in the Altamont Corridor that terminates HSR at a proposed BART Livermore station"—even with the main HST express line using the Pacheco Pass.

S.10 HST Alignment Alternatives and Station Location Options for the Preferred Pacheco Pass Network Alternative

S.10-1 San Francisco to San Jose: *Caltrain Corridor (Shared Use)*

The Program EIR/EIS analyzes one alignment option between San Francisco and San Jose along the San Francisco Peninsula that would utilize the Caltrain rail right-of-way and share tracks with express Caltrain commuter rail services.

A. PREFERRED STATION LOCATIONS:

- *Downtown San Francisco Terminus: Transbay Transit Center*
  The Transbay Transit Center would offer the greatest connectivity and accessibility to San Francisco and the Bay Area, best serve as a regional transit hub, and have the highest ridership potential. It also has considerable agency and public support.

- *San Francisco Airport Connector Station: Millbrae (SFO)*
  The Millbrae (SFO) HST station supports the objectives of the HST project by providing an interface with the northern California hub airport for national and international flights.

- *Mid-Peninsula Station: Continue to investigate both potential sites and work with local agencies and the Caltrain JPB to determine whether a mid-peninsula station site should be developed.*
  The Palo Alto and Redwood City station options would both be multi-modal stations, with similar costs, construction issues, right-of-way issues, and potential environmental impacts. The Palo Alto station option would have somewhat better connectivity and higher ridership, while the Redwood City site is supported by the City of Redwood City.

<u>San Jose to Central Valley</u>

Pacheco Pass via Henry Miller Road (UPRR Connection) is the preferred alternative. At the project-level, however, the Authority and the FRA will continue to seek and evaluate alignment alternatives utilizing the Pacheco Pass that would minimize or avoid impacts to resources in the Grassland Ecological Area (GEA). The Authority has committed to acquire agricultural, conservation, and/or open space easements for potential impacts in and around the GEA (see Section 3.15). In addition, the Authority has committed to acquire easement to protect prime farmland (see Section 3.8). The Authority and FRA re-affirm their Statewide Program EIR/EIS decision that there will be no HST stations between Gilroy and Merced.

The Pacheco Pass via Henry Miller Road alternative would provide slightly higher ridership potential, provide the fastest travel times and the most direct link between the Bay Area and Southern California, and would generally parallel an existing roadway corridor through the environmentally sensitive areas that cross from the Bay Area to the Central Valley minimizing potential severance and other environmental impacts as compared to the Pacheco via GEA North alternative.

Preferred Station Locations:

- *Downtown San Jose Terminus: Diridon Station*
  Diridon Station is a multi-modal hub that maximizes connectivity to downtown San Jose, San Jose International Airport, and the southern Bay Area; would have high ridership potential; and is favored by the City of San Jose and the Valley Transportation Authority (VTA).

- *Southern Santa Clara County: Gilroy Station (Caltrain)*
  Gilroy (Caltrain) Station is the preferred HST station to serve Southern Santa Clara County and the Monterey Bay Area. This station would provide the highest accessibility and connectivity for these regions and would have the highest ridership potential.

Central Valley Alignment:
UPRR N/S Alternative is the preferred alternative. However, at the project-level, the Authority would continue to evaluate the BNSF Alternative because of the uncertainty of negotiating with the UPRR for use of some of their right-of-way and would continue investigation of alignments/linkages to a potential maintenance facility at Castle AFB.

The UPRR alternative would have high potential ridership, would serve potential downtown station sites at Modesto and Merced providing the highest connectivity and accessibility for this part of the Central Valley, and would best meet the Authority's adopted transit-oriented development criteria for station locations.

Preferred Station Locations:

- *Modesto: Downtown Modesto*
  The Downtown Modesto Station is the preferred HST station for Modesto because it maximizes connectivity and accessibility to downtown Modesto and would best meet the Authority's adopted transit-oriented development criteria for station locations by serving the downtown of this Central Valley city.

- *Merced: Downtown Merced*
  The Downtown Merced Station is the preferred HST station for the Merced area because it maximizes connectivity and accessibility to downtown Merced and would best meet the Authority's adopted transit-oriented development criteria for station locations by serving the downtown of this Central Valley city.

Maintenance Facilities: *Castle AFB*
There is strong agency and public support in the Merced region for a maintenance facility at Castle AFB, the preferred location, whereas the West Oakland site would not serve the preferred Pacheco Pass alternative. The determination of the number of maintenance facilities needed for the statewide system and their locations will be further defined at the project-level.

San Francisco Bay Crossings:
No Bay crossing for the proposed HST system.

The preferred alternative has no San Francisco Bay crossing. Alternatives with a bay crossing would have the greatest potential impacts on the San Francisco Bay and have high capital costs and constructability issues. The Dumbarton Crossing would also have the greatest potential impacts on wetlands and the Don Edwards San Francisco Bay National Wildlife Refuge. To implement these alternatives, extensive coordination would be required with the U.S. Army Corps of Engineers (USACE) under Section 10 of the Rivers and Harbors Act, U.S. Fish and Wildlife Service (USFWS), and the California Coastal Commission. Crossing the Bay would be subject to the USACE, California Department of Fish and Game (CDFG), and San Francisco Bay Conservation and Development Commission (BCDC) permit process. A number of agencies and organizations are opposed to the construction of new HST crossings of the San Francisco Bay.

S.11 Least Environmentally Damaging Preferred Alternative (LEDPA)

The EPA and USACE have participated in the development of both the Draft and Final Program EIR/EIS and, in accordance with the June 12, 2006 Interagency Memorandum of Understanding among federal agencies and the Authority for this tier 1, or programmatic, environmental review, were consulted concerning the selection of the corridor and alignments most likely to yield the least environmentally damaging practicable alternative (LEDPA). The EPA and USACE have concurred that the preferred Pacheco Pass Network Alternative serving San Francisco and San Jose Termini discussed above is most likely to yield the LEDPA. In addition, the HST Alternative represents the proposed action and the

Authority and FRA have identified the preferred HST Alternative as environmentally preferable under NEPA and environmentally superior under CEQA.

S.12 Next Steps in the Environmental Process

At the completion of this program environmental process, the Authority expects to be able to certify the Program EIR/EIS and make findings for compliance with CEQA, the FRA expects to be able to issue a Record of Decision for compliance with NEPA, and both agencies expect to be able to make various determinations. Assuming a decision is made to go forward with development of HST, the Authority and FRA would focus future project analysis in the study region on alignment and station options selected through this program environmental process. Site-specific location and design alternatives for the preferred alignment and station options, including avoidance and minimization alternatives, would be fully investigated and considered during tier-2, project-level environmental review.

Preliminary engineering and project-level environmental review would commence in the study region to the extent needed to assess site-specific issues and potential environmental impacts not already addressed in this Program EIR/EIS. Project-level environmental review would focus on a portion or portions of the proposed HST system and would provide further analysis of potential impacts and mitigation at an appropriate site-specific level of detail to obtain needed permits and to implement HST projects. Also, after completing this program environmental process, the Authority would begin working with local governments, transportation agencies, and private parties to identify right-of-way preservation needs and protective advance acquisition opportunities consistent with state and federal authority requirements.

S.13 Altamont Pass Project

The Altamont Pass provides superior travel times between Sacramento/Northern San Joaquin Valley and the Bay Area and is strongly supported by the Central Valley. Many of the comments received in support of the Altamont Pass are related to its great potential for serving long-distance commuters between the Central Valley and the Bay Area. As indicated by the comments received by the Tri-Valley PAC, many of the negative impacts associated with construction of HST through the Tri-Valley might be considerably reduced by the elimination of the additional tracks needed for HST express services.

The Authority is pursuing a partnership with “local and regional agencies and transit providers” to propose and develop a joint-use (“Regional Rail” and HST) infrastructure project in the Altamont Pass corridor—as advocated in MTC’s recently approved “Regional Rail Plan for the San Francisco Bay Area”. Regionally provided commuter overlay services would require regional investment for additional infrastructure needs and potentially need operational subsidies. The Authority cannot unilaterally plan for regionally operated commuter services.

“Regional Rail” in the Altamont Pass corridor will be pursued as an independent project to satisfy a different *purpose and need* [3] from the proposed HST system, but that would also accommodate HST service. The Authority’s pursuit of improved regional rail service in the Altamont Pass corridor is dependent upon forming a partnership with the region for the joint-use infrastructure. After a partnership is established, the Authority will spearhead (or some combination of lead, collaborate and coordinate) future environmental studies and work in partnership with other agencies to secure local, state, federal, and private funding to develop a joint-use infrastructure project in the Altamont corridor, including recommending that this corridor be added as part of the HST funding package.

[3] As defined in CEQA and NEPA implementing regulations, procedures, and guidelines.

The Authority's analysis suggests that Altamont HST overlay service might terminate in Oakland and/or San Jose via the East Bay (see Figure S.9-1), whereas the Regional Rail Plan recommends it cross the Bay at Dumbarton. MTC also recommends future study of terminating this service in Livermore. As a part of future studies, the Authority will need to work with MTC and other agencies to define the appropriate alternatives to be investigated for "Regional Rail"/HST in the Altamont Pass to serve long-distance inter-regional commuters. The Authority is pursuing potential joint-use Altamont Corridor "Regional Rail"/HST services and identifying alternatives for further evaluation including: direct service to Oakland and/or San Jose or potentially terminating HST service at Livermore (connecting to an extended and enhanced BART system). The Authority's objective is that the infrastructure would be electrified, fully grade-separated, and compatible with and shared by HST services. Providing connectivity and accessibility to Oakland and Oakland International Airport would be a crucial objective for this project.

To lay the groundwork for a future "Regional Rail"/HST Altamont Pass project, the Authority will work with ACE, SJRRC, San Joaquin County Council of Governments, the Tri-Valley Pac, Alameda County, Santa Clara County and others to get the Altamont "Regional Rail"/HST project identified in the update to the 2035 Regional Transportation Plan (RTP) and funds programmed in the 2035 RTP and RTIP. Once the Bay Area to Central Valley HST Program EIR/EIS is certified, the Authority will lead a Altamont "Regional Rail"/HST Steering Committee that will include MTC, and agencies and transit providers along the Altamont corridor project study that will address the Altamont Pass, the East Bay connections and stations in partnership, and provide the information necessary for the Authority to undertake an environmental study for this project.

1 PURPOSE AND NEED AND OBJECTIVES

The California High-Speed Rail Authority (Authority) and the Federal Railroad Administration (FRA) of the U.S. Department of Transportation (DOT) completed a statewide program environmental impact report/ environmental impact statement (EIR/EIS) as the first phase of a tiered environmental review process for the proposed California High-Speed Train (HST) system (California High-Speed Rail Authority and Federal Railroad Administration 2005). As part of the selected HST Alternative, the Authority and FRA defined a broad corridor between the Bay Area and Central Valley for additional review at the program level. This Bay Area to Central Valley HST Program EIR/EIS (Program EIR/EIS) further examines this broad corridor as the next phase of the tiered environmental review process.

Additionally, future tiered site-specific project environmental documents will assess the impacts of constructing and implementing individual HST projects (i.e., portions of the HST system).

This chapter provides brief background information about the Authority's choice to proceed with a statewide HST system and its decision to undertake additional programmatic environmental review for the Bay Area to Central Valley corridor (Section 1.1), the purpose of the HST system for the Bay Area to Central Valley corridor (Section 1.2.1), and the statewide and regional need for the HST system to relieve the growing capacity and congestion constraints on intercity travel using existing highway, airport, bus, and conventional passenger rail infrastructure (Section 1.2.2). This chapter also describes how the proposed HST system would deliver predictable, consistent, and shorter travel times; augment the existing transportation infrastructure; and help relieve congestion and capacity constraints with a reliable, safe, low-emission, time-efficient travel alternative.

1.1 Introduction

The Authority was created pursuant to state legislation in 1996 to develop a plan for the construction, operation, and financing of a statewide, intercity high-speed passenger train system offering intercity service (California Public Utilities Code § 185000 *et seq.*). The Authority completed several initial studies to assess the feasibility of an HST system in California and to evaluate the potential ridership for a variety of alternative corridors and station areas. Based on the results of these studies, the Authority recommended evaluation of a proposed HST system as the logical next step in the development of California's transportation infrastructure. The Authority does not have responsibility for transit systems or other intercity transportation systems and facilities, such as highways, airports, or conventional passenger rail.

In June 2000, the Authority adopted the final *High-Speed Train System Business Plan* (Business Plan) (California High Speed Rail Authority 2000) for an economically viable 700-mile-long (1,127-kilometer [km]-long) HST system. This system would be capable of speeds in excess of 200 miles per hour (mph) (322 km per hour [kph]) and would travel on a mostly dedicated system with fully grade-separated tracks and with state-of-the-art safety, signaling, and automated train control systems. It would connect and serve the major metropolitan areas of California, extending from Sacramento and the San Francisco Bay Area through the Central Valley to Los Angeles and San Diego. Such a system would be expected to carry a minimum of 88 million passengers annually, representing 66 million intercity trips and 22 million intra-regional trips, by the year 2030, and would have revenues in excess of operations and maintenance costs. Of this projected HST ridership, 37% of the intercity trips (24.4 million) and 21% of the intra-regional trips (4.6 million) are expected to begin or end in the Bay Area to Central Valley study region.

The Authority envisions seeking possible future federal financial support for the statewide system that might be provided through the FRA. The FRA and the DOT have several loan and grant programs that might be potential sources of future financial assistance. Several proposals for intercity rail programs have been introduced in the 109th and previous congressional sessions. In addition to possible funding, a Rule of Particular Applicability may be required from the FRA to establish safety standards for the proposed HST system for operating speeds over 200 mph (322 kph) and for operations in shared-use rail corridors.

Following adoption of the Business Plan, the Authority commenced an environmental review process to comply with federal and state laws, in particular the National Environmental Policy Act of 1969 (NEPA) (42 USC § 4321 *et seq.*) and the California Environmental Quality Act (CEQA) (Cal. PRC § 21000 *et seq.*). The completed statewide program EIR/EIS, as the first-phase of a tiered environmental review process for the proposed HST system, evaluated three alternatives: (1) No-Project, (2) Modal (highway and airport expansion), and (3) HST. The HST alternative was selected when the program EIR was certified by the Authority via Resolution No. 05-01, signed November 2, 2005, and when FRA issued a Record of Decision on November 28, 2005.

The Authority resolution (No. 05-01) approved the HST system as the program alternative. The HST system would use electrically propelled steel-wheel-on-steel-rail trains capable of maximum operating speeds of 220 mph (322 kph) on dedicated, fully grade-separated lines. In addition, the HST system would use design practices to avoid, minimize, and mitigate potential impacts.

The resolution also authorized Authority staff to "prepare a separate program-level EIR to identify a preferred alignment within the broad corridor between and including the Altamont Pass and Pacheco Pass for the HST segment connecting the San Francisco Bay Area to the Central Valley." This Bay Area to Central Valley corridor is generally bounded by (and includes) the Pacheco Pass (State Route 152 [SR-152]) to the south, the Altamont Pass (Interstate 580 [I-580]) to the north, the BNSF Corridor to the east, and the Caltrain Corridor to the west[1] (Figure 1.1-1).

The Program EIR/EIS enables the Authority and FRA to evaluate the potential impacts of proposed HST system alignment and station locations in the Bay Area to Central Valley corridor, select preferred alignments and station locations, and define general mitigation strategies to address any potentially significant adverse impacts.

NEPA requires federal agencies to prepare an EIS for proposed actions that have the potential to cause significant environmental impacts. Because of possible funding and regulatory action, the FRA is the lead federal agency, working with the Authority as the lead state agency, for the environmental review required by NEPA and related statutes. The FRA has further determined that the preparation of a tier 1, program-level EIS for the proposed HST system in the Bay Area to Central Valley corridor is the appropriate NEPA document because of the conceptual stage of planning and decision-making. Decisions related to advancing and ultimately constructing the proposed HST system could constitute major federal actions requiring environmental review under NEPA for several federal agencies in addition to the FRA, including the Federal Highway Administration (FHWA), U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (USACE), Federal Aviation Administration (FAA), U.S. Fish and Wildlife Service (USFWS), and Federal Transit Administration (FTA). The EPA and USACE are cooperating agencies for this Program EIR/EIS.

The proposed HST system in the Bay Area to Central Valley corridor is subject to environmental review under CEQA, and the Authority is both the project sponsor and the lead agency for CEQA compliance. The Authority has determined that an EIR is the appropriate CEQA document for the project at this conceptual stage of planning and decision-making, which includes selecting a preferred alignment and station locations.

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1 Highway route numbers are provided only as a convenient reference for the reader, not as a limitation on the corridor to be considered.

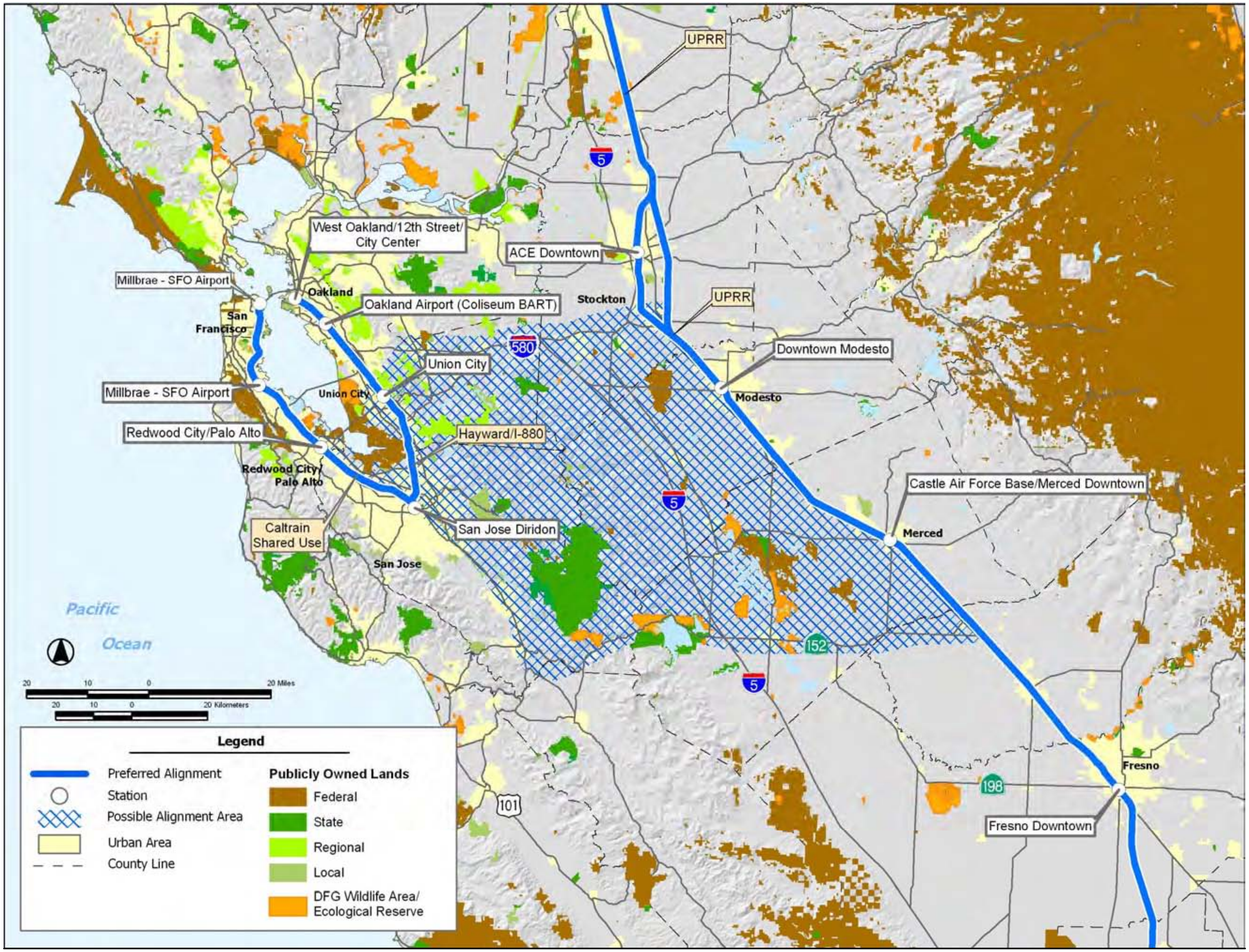


Figure 1.1-1
Bay Area to Central Valley Corridor

No permits were sought in this phase of environmental review. After the selection of preferred alignments and station locations in the Bay Area to Central Valley corridor and completion of this Program EIR/EIS, project-specific environmental documentation will be prepared to assess in more detail the impacts of reasonable and feasible alignment and station options in this segment of the system.

Preparation of a program-level document followed by more detailed project-specific documents that *tier*[2] off the program document offers a number of advantages. As described in Council on Environmental Quality (CEQ) regulations (40 CFR § 1508.28), FHWA Guidelines (23 CFR Part 771; 52 FR § 32646 [August 1987]), and the State CEQA Guidelines (14 CCR § 15168[b]), this approach offers the following advantages:

- More exhaustive consideration of impacts and alternatives than would be practical in an individual or project-specific EIR/EIS.
- Consideration of cumulative impacts that might be slighted in a case-by-case analysis.
- An opportunity for decision-makers to consider broad policy alternatives and program-level mitigation strategies at an early stage, when the flexibility to incorporate them is greater.
- Ability to avoid reconsideration of policy issues in subsequent documents.
- Early coordination with USACE and EPA to identify avoidance and minimization opportunities that are likely to yield or will lead to the selection of a least environmentally damaging practicable alternative (LEDPA) under Section 404 of the Clean Water Act (CWA).
- Less paperwork by encouraging the reuse of data through incorporation by reference in subsequent tiered documents.

The required contents of a program EIR/EIS are the same as those of a project-level document. However, the level of detail provided in the two types of documents differs substantially because a program-level document analyzes a general conceptual design of the proposed program and alternatives rather than providing detailed analysis of a specific project proposal.

A program EIR/EIS is an informational document intended to analyze and to disclose to the public and to public decision-makers the environmental effects and benefits of a proposed program and its alternatives. The preparation, circulation, and review of a draft program EIR/EIS provides for the evaluation of alternatives, including a no-project/no-action alternative; the assessment of all significant environmental impacts; and the opportunity for public input and comments to help inform the decision-making process. Evaluating alternatives as required by the FRA 's Procedures for Considering Environmental Impacts (64 FR § 28545 [May 26, 1999]) and other federal agency NEPA regulations and State CEQA Guidelines helps ensure that avoidance and minimization of potential environmental impacts are addressed, and potential benefits, costs, and trade-offs of the alternatives are considered.

This Program EIR/EIS was prepared under the supervision and direction of the FRA and the Authority in conjunction with other federal agencies and with input from state and local agencies. It is intended that other federal, state, regional, and local agencies use this Program EIR/EIS to review the proposed program and develop expectations for the project-level (tier 2) environmental reviews that would follow selection of preferred HST alignments and station locations in the Bay Area to Central Valley corridor.

The preparation of this Program EIR/EIS was coordinated with the concurrent preparation of a Bay Area Regional Rail Plan by a coalition of the San Francisco Bay Area Rapid Transit District (BART), the Metropolitan Transportation Commission (MTC), the Peninsula Corridor Joint Powers Board (Caltrain), and

[2] *Tiering* refers to a multilevel approach where a first tier environmental document analyzes general matters and subsequent tiers analyze narrower projects/actions, referencing the more general document.

the Authority. Bay Area voters in 2004 passed Regional Measure 2, which required MTC to adopt a Regional Rail Plan. As stipulated in the Streets and Highways Code Section 30914.5 (f), the Regional Rail Plan defined the future passenger rail transportation network for the nine-county San Francisco Bay Area, including an evaluation of the HST options. Information on the Regional Rail Plan is available at www.bayarearailplan.info.

1.2 Purpose of and Need for High-Speed Train System

Purpose and need are closely linked but subtly different. *Need* may be thought of as the problem and *purpose* as an intention to address the problem. *Purpose* describes why the sponsoring agency is proposing an action that may have environmental impacts and provides the basis for selecting reasonable and practicable alternatives for consideration, comparing the alternatives, and selecting the preferred alternative (40 CFR § 1502.13 ["The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action"]; see also NEPA § 102.). CEQA requires that an EIR identify the project sponsor's objectives, which are similar to the purpose required by NEPA (CEQA Guidelines, CCR, Title 14, § 15124 [b]). The *objectives* provide benchmarks for selecting a reasonable range of alternatives for analysis, as required by CEQA. The Authority has responded to this mandate by adopting the objectives and policies described in Section 1.2.1 below for the proposed HST system to guide compliance with CEQA and NEPA.

1.2.1 Purpose of High-Speed Train System

This Program EIS/EIR identifies and fully evaluates alternative HST alignments and stations within and related to the Bay Area to Central Valley corridor as part of a statewide HST system. The purpose of the Bay Area HST is to provide a reliable high-speed electrified train system that links the major Bay Area cities to the Central Valley, Sacramento, and Southern California, and that delivers predictable and consistent travel times. Further objectives are to provide interfaces between the HST system and major commercial airports, mass transit, and the highway network and to relieve capacity constraints of the existing transportation system in a manner sensitive to and protective of the Bay Area to Central Valley region's and California's unique natural resources.

This purpose is consistent with recent expressions of federal transportation policy, most notably the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) (Public L. 109-59; 119 Stat. 1144 [2005]), Transportation Equity Act for the 21st Century (TEA-21) (Pub. L. 105-178; 112 Stat. 107 [1998]), and its predecessor the Intermodal Surface Transportation Efficiency Act (ISTEA) (Pub. L. 102-240; 105 Stat. 1914 [1991]), which encourage public transportation investment that increases national productivity and domestic and international competition while improving safety and social and environmental conditions. Specifically, these policies encourage investments that offer benefits such as those listed below.

- Link all major forms of transportation.
- Improve public transportation systems and services.
- Provide better access to seaports and airports.
- Enhance efficient operation of transportation facilities and service.

The Authority's statutory mandate is to plan, build, and operate a HST system that is coordinated with the state's existing transportation network, particularly intercity rail and bus lines, commuter rail lines, urban rail transit lines, highways, and airports. The Authority has responded to this mandate by adopting the following objectives and policies for the proposed HST system.

- Provide intercity travel capacity to supplement critically over-used interstate highways and commercial airports.
- Meet future intercity travel demand that will be unmet by present transportation systems and increase capacity for intercity mobility.
- Maximize intermodal transportation opportunities by locating stations to connect with local transit, airports, and highways.
- Improve the intercity travel experience for Californians by providing comfortable, safe, frequent, and reliable high-speed travel.
- Provide a sustainable reduction in travel time between major urban centers.
- Increase the efficiency of the intercity transportation system.
- Preserve environmental quality and protect California's sensitive environmental resources by reducing emissions and vehicle kilometers/vehicle miles traveled for intercity trips.
- Consult with resource and regulatory agencies during the tier 1 environmental review and use all available information for identifying the alternative that is most likely to yield the least damaging practicable alternative by avoiding sensitive natural resources (e.g., wetlands, habitat areas, conservation areas) where feasible.
- Maximize the use of existing transportation corridors and rights-of-way, to the extent feasible.
- Develop a practical and economically viable transportation system that can be implemented in phases by 2020 and generate revenues in excess of operations and maintenance costs.

1.2.2 Statewide and Regional Need for High-Speed Train System

The need for an HST system exists at both the statewide and regional levels.

A. STATEWIDE NEED[3]

The capacity of California's intercity transportation system is insufficient to meet existing and future demand, and the current and projected future congestion of the system will continue to result in deteriorating air quality, reduced reliability, and increased travel times. The system has not kept pace with the tremendous increase in population, economic activity and tourism in the state. The interstate highway system, commercial airports, and conventional passenger rail system serving the intercity travel market are operating at or near capacity and will require large public investments for maintenance and expansion to meet existing demand and future growth over the next 20 years and beyond. Moreover, the ability to expand many major highways and key airports is uncertain; some needed expansions may be impractical or may be constrained by physical, political, and other factors. Simply stated, the *need* for improvements serving intercity travel in California relates to the following issues.

- Future growth in demand for intercity travel.
- Capacity constraints that will result in increasing congestion and travel delays.
- Unreliability of travel stemming from congestion and delays, weather conditions, accidents, and other factors that affect the quality of life and economic well-being of residents, businesses, and tourism in California.
- Reduced mobility as a result of increasing demand on limited modal connections between major airports, transit systems, and passenger rail in the state.

[3] Also presented in statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005).

- Poor and deteriorating air quality and pressure on natural resources as a result of expanded highways and airports.

The following sections provide additional information on these factors, emphasizing the transportation constraints and capacity limitations relevant to intercity travel in California.

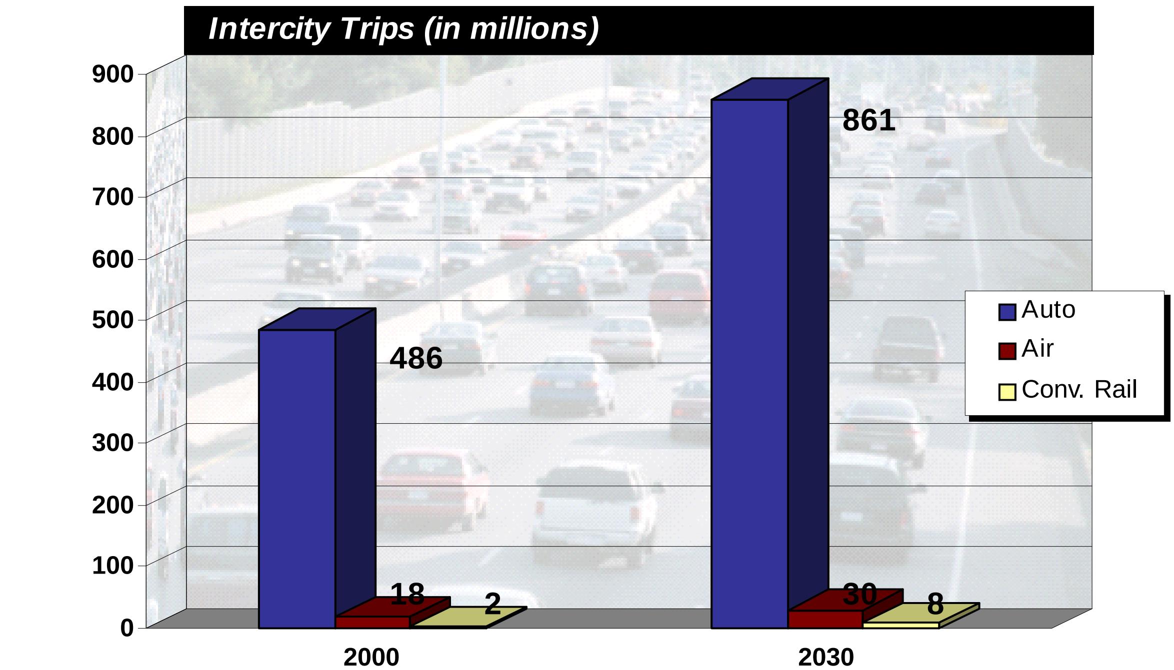
Travel Demand and Capacity of California's Intercity Transportation System

Intercity travel in California is forecasted to increase up to 63% between 2000 and 2030, from 550 million trips to more than 896 million trips (Figure 1.2-1). According to the Department of Finance, the state population is projected to increase by more than 13 million people in the same time period, from about 34 million to over 48 million people statewide (more than 40% growth). The population growth is shown by region in Figure 1.2-2. The highest regional growth rate is projected for the Central Valley (79% between 2000 and 2030). However the Inland Empire (Riverside and San Bernardino Counties) area of the Los Angeles region is forecast to grow by more than 82% over the same period.

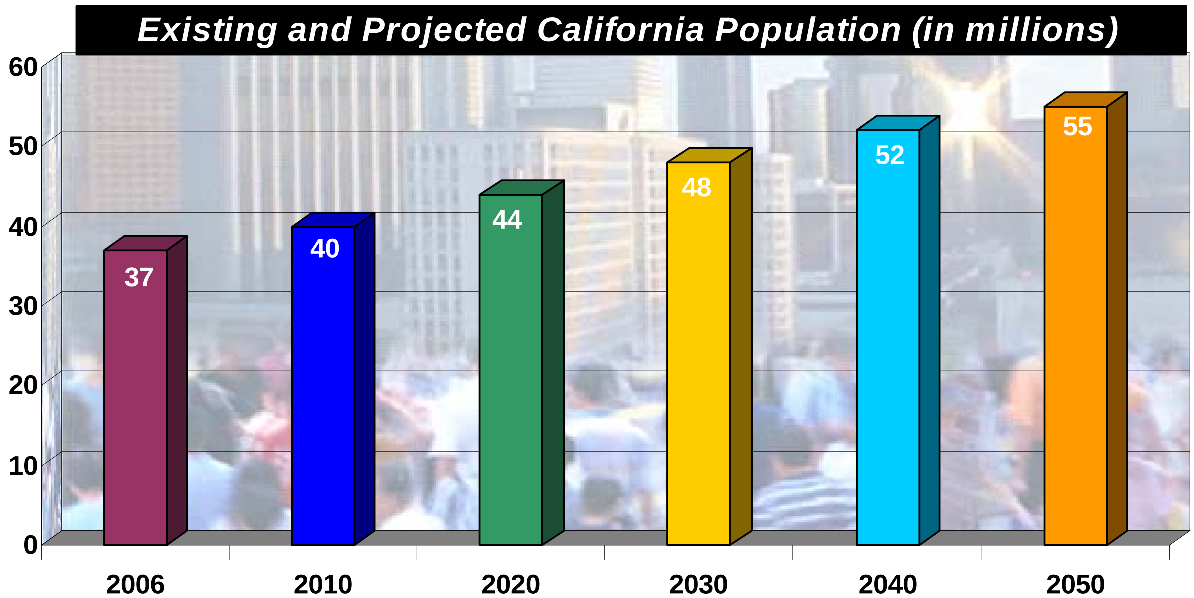
The greatest increase in population is projected to occur in the Southern California region (including Los Angeles) (5.6 million between 2000 and 2030). In 2000, Californians made more than 550 million trips per year between the state's metropolitan regions, including those in northern and southern California and in between. Approximately 188 million of these trips were journeys of at least 100 miles (161 km); by 2030, this number is expected to increase to 271 million trips per year. Without high-speed trains, more than 3% of all intercity travel and 11% of longer intercity trips (those in excess of 100 miles [161 km]) are forecasted to be air travel. At present, the automobile dominates intercity travel. Auto trips are expected to account for more than 95% of all intercity travel and close to 86% of longer intercity trips in 2030. Also by 2030, almost 50% of the intercity travel market between the state's major metropolitan regions is expected to have a destination within the Bay Area to Central Valley study region.

Much of the intercity travel in California consists of trips of intermediate distance. A statewide forecasting model was developed in 2006 (Cambridge Systematics), and Table 1.2-1 shows the model results for expected growth in traffic volumes on major highways from 2000 to 2030. These trips include more than 339 million annual intercity trips between the Central Valley and other metropolitan areas, or 38% of all intercity travel. Travel between the Los Angeles and San Diego regions is the second-largest geographic market, with more than 134 million trips per year in 2030. Travel between Sacramento and San Francisco represents the third-largest intercity travel market in the state, at over 67 million trips per year. In addition, Los Angeles to San Francisco is the busiest air travel route in the United States, with 8.6 million in-state air trips and 19 million total air trips in 2005. The in-state air trips between these two cities represented about 43% of the intercity trips in this market via all modes of transportation.

The demand for air travel has grown dramatically in California and nationwide with a period of suppressed demand from the effects of the World Trade Center terrorist attack on September 11, 2001. Federal, state, and regional transportation plans forecast recovery from this reduction and continued growth in air travel over the next 15 years. Table 1.2-2 shows air travel growth between the San Francisco Bay Area and southern California from 1992 to 2005, with projections to 2020. Overall, annual passenger demand at San Francisco International Airport (SFO) has increased from 31 million passengers in 1990 to 41 million in 2000; during the same period, the demand at Los Angeles International Airport (LAX) increased from 45.8 million to 67 million.



Source: Cambridge Systematics, 2007



Source: State of California, Department of Finance, *Population Projections by Race/Ethnicity for California and its Counties 2002-2050* , Sacramento, California, May 2004

Table 1.2-1
Travel Growth in 20 Years for Intercity Highways

Major Highways	Average Daily Volume 2000	Average Daily Volume 2030	Percent Change 2000–2030
I-5 between San Diego and Los Angeles (Orange County-LA County line)	150,000	306,000	103
I-5 between Los Angeles and Bakersfield (at Santa Clarita)	192,000	308,000	60
SR-99 in Central Valley (north of Bakersfield)	49,000	77,000	56
US 101 just south of San Jose	137,000	234,000	71
I-580 between Bay Area and Stockton (at Livermore)	138,000	181,000	31
Source: Cambridge Systematics 2007.			

Table 1.2-2
Intercity Air Travel between Southern California and San Francisco Bay Area (Annual Enplanements)

Airport	Historical		Projected Continued Trend		Percent Change
	1992	2000	2005	2020	2005–2020
Bay Area to Southern California Airports					
San Francisco	1,667,290	1,531,306	2,949,590	5,563,183	89
Oakland	1,317,960	2,072,328	2,664,380	4,474,188	68
San Jose	687,680	2,127,815	3,927,300	6,897,516	76
Bay Area	3,674,922	5,733,449	9,541,270	16,934,887	77
Southern California To Bay Area Airports					
Los Angeles	1,688,870	2,286,330	4,212,440	6,819,689	62
John Wayne	588,670	1,766,314	2,281,030	3,422,818	50
Ontario	559,980	607,930	1,213,240	1,881,429	55
Burbank	705,110	1,066,844	1,834,560	2,582,595	41
Long Beach	130,300	0	-		
So. California	3,672,930	5,727,418	9,541,270	14,706,531	54
All Travel	7,345,860	10,856,550	19,082,540	31,641,418	62

Source: FAA Terminal Area Forecasts and U.S. Department of Transportation O&D Market Database.
Note: These data represent all air trips, including both in-state and out-of-state (i.e., connecting) travelers and differ from the HST ridership forecasting model, which includes only in-state travelers.

The MTC projects that air travel at SFO will increase to 61 million passengers in 2030—an increase of 65% over 30 years, with an associated increase in airport congestion.[4] Estimates for LAX indicate that regional demand for flights will increase by about 54% between 1996 and 2015 (LAX Master Plan Supplement to the Draft EIS/EIR 2003). The Southern California Association of Governments (SCAG) regional transportation plan indicates that the practical physical capacity of LAX with its existing configuration is 78 million annual passengers (Southern California Association of Governments 2001).

[4] Regional Airport Plan, MTC, 2000

Population growth and increasing tourism in California place severe demands on the already congested transportation system serving the state's major metropolitan areas. As described in the regional transportation plans for areas that would be served by the proposed HST system, the highways and airports serving key cities are operating at capacity, and plans for expansion will not keep pace with projected growth over the next 20–40 years. The volume of traffic on major highways and the number of enplanements at key airports are presented in Tables 1.2-1 and 1.2-2. Figure 1.2-3 illustrates the major routes and airports used for intercity travel between the markets potentially served by the HST system.

According to the FAA,

> Delays at San Francisco International and other major airports are expected to worsen within the next decade unless capacity is increased by building new runways or with other improvements, according to a landmark federal study released yesterday. For the first time, the Federal Aviation Administration tallied the number of flights that 31 major U.S. airports can accommodate in good and bad weather, when air-traffic controllers must use radar to ensure that planes are properly separated. The FAA found that seven major airports, including San Francisco International, will experience "significant delays" within the next 10 years as air travel surges to 1 billion passengers annually. (San Francisco Chronicle, April 26, 2001).

Airports at or nearing capacity, like SFO, will likely be forced to reduce air service on intercity travel markets with high levels of service (such as between LAX and SFO). As stated by John L. Martin, director of San Francisco International Airport:

> The airport is now focused on increasing long-haul and international service, because this type of service translates to larger aircraft with more passengers per plane, but fewer flights. That, along with the implementation of a new radar landing procedure, allows SFO to make more efficient use of its limited runway capacity. The 'smart growth' program at SFO has resulted in a 12% growth in passenger traffic in the first 11 months of 2004, while the number of flight operations has grown by only 5.1%. Larger planes with higher passenger loads. (*San Francisco Chronicle*, February 8, 2005).

Travel Time

Travel time is the time spent in a highway vehicle, in an aircraft, or on a train for a specific point-to-point trip. *Total travel time* includes the time spent getting to a station or an airport, waiting for the next scheduled train or flight, getting to the boarding area, checking and retrieving luggage, getting a rental car or taxi, and getting to the final destination. Total travel time is an important economic factor for business travel because it is a business cost that affects worker productivity and scheduling of business activities. Table 1.2-3 shows the approximate total travel time in 2000 and the projected total travel time in 2030 for auto, air, and rail between various city pairs, based on the ridership analysis completed for the HST forecasting model (Cambridge Systematics 2007), including information collected from regional transportation planning agencies, Caltrans, and current air and conventional rail schedules.

Projected increases in automobile travel time are largely caused by increased travel demand and resulting congestion on highways used for intercity travel, and programmed and funded improvements would not measurably change future conditions. Although Amtrak has proposed improvements that could reduce conventional rail travel time over the next 20 years, they are not programmed or funded. There are some capacity improvements funded for the Central Valley and southern California, but these are only basic enhancements that will do more to improve reliability than travel time. The 20-year 10-billion-dollar Amtrak plan includes adding 21 intercity roundtrips,

Figure 1.2-3
Major Intercity Travel Routes and Airports

adding capacity, increasing speeds, and enhancing grade crossing safety. These improvements will benefit all rail users, including both freight and commuter traffic.

Table 1.2-3
Estimated Total Travel Times (Door to Door) between City Pairs by Auto, Air, and Rail Peak Conditions

City Pair	Auto 2000	Auto 2030	Air 2000	Air 2030[a]	Conventional Rail 2000[b]
Los Angeles downtown to San Francisco downtown	6:28	6:50	3:30	3:38	10:05[c]
Fresno downtown to Los Angeles downtown	3:32	3:41	3:17	3:24	5:46[d]
Los Angeles downtown to San Diego downtown	2:37	2:41	2:51	3:01	3:26
Burbank (Airport) to San Jose downtown	5:31	5:54	2:46	2:43	9:46[e]
Sacramento downtown to San Jose downtown	2:29	2:32	3:33	3:33	4:06

[a] Represents the same level of service observed in 2005, compiled from the Federal Aviation Administration data from the 10 percent ticket sample combined with wait, terminal, access and egress times developed from the California High-Speed Rail ridership forecasting model (Cambridge Systematics 2007).

[b] Conventional rail assumptions for travel times and wait and terminal times are the same for 2000 and 2030. Access and egress times may vary but in practice do not vary significantly between 2000 and 2030.

[c] Based on October 27, 2003, San Joaquin schedule, which would require bus connections from Los Angeles to Bakersfield and from Emeryville to San Francisco. The travel time with the Coast Starlight from Los Angeles to San Francisco would be 13:05.

[d] Based on October 27, 2003, San Joaquin schedule, which would require bus connections from Los Angeles to Bakersfield.

[e] Based on October 27, 2003, San Joaquin schedule, which would require bus connections from Burbank to Bakersfield and from Stockton to San Jose.

Source: Parsons Brinckerhoff 2003 and Cambridge Systematics 2007.

Reliability

Reliability is the delivery of predictable, consistent, travel times that remain the same over a period of years. As discussed above, roadway congestion, limited airport capacity, track conflicts between passenger rail and freight rail, and a growing intercity travel market are adversely affecting the travel time reliability of air, conventional passenger rail, and automobile travel. Weather-related events are an additional source of disruption and delay that affect transportation reliability. Based on current performance and projected congestion levels, the reliability of highway and air travel will continue to worsen in future years.

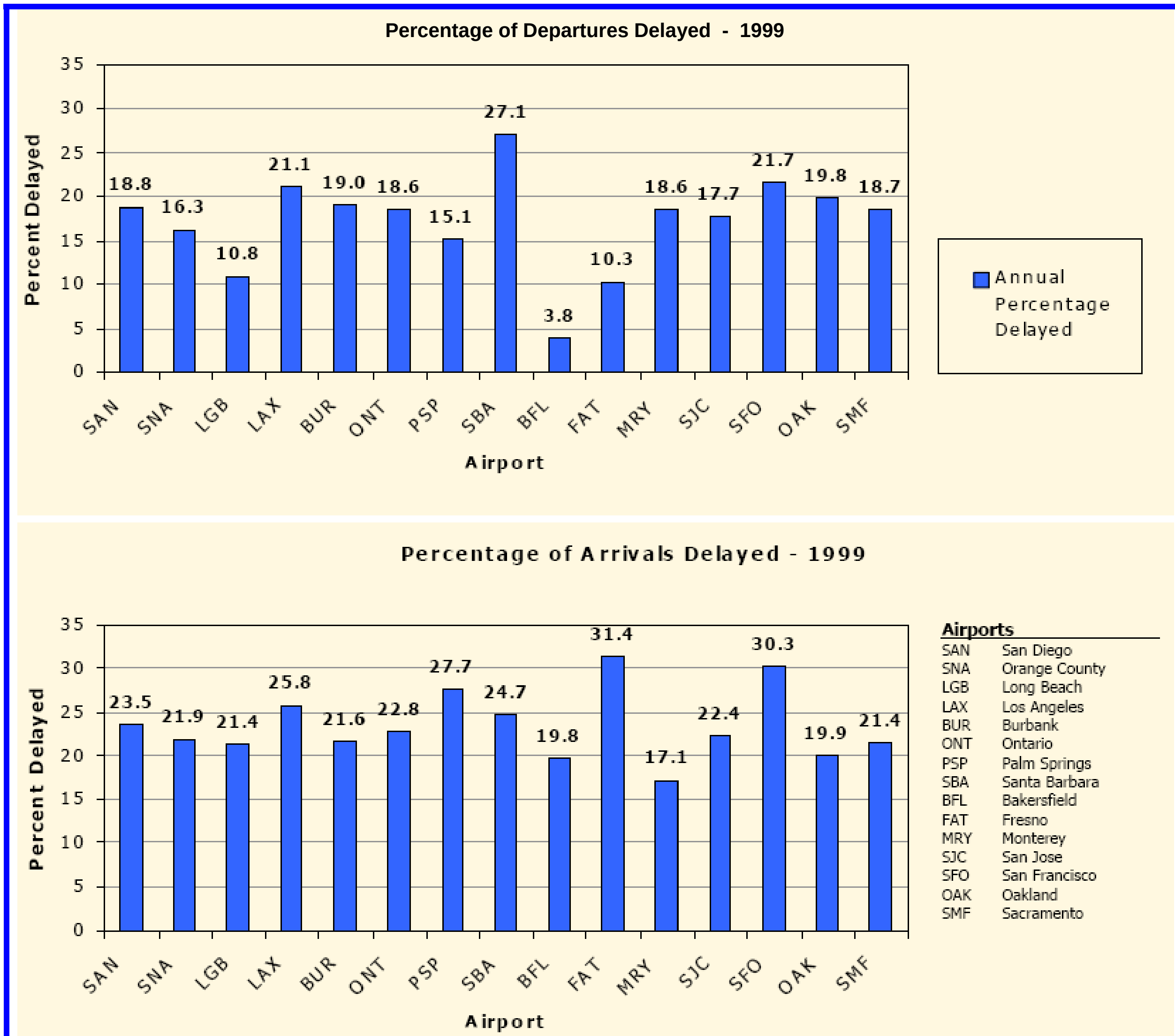
From 1990 to 2020, the Bay Area regional transportation plan (RTP) forecasts a 249% increase in average daily vehicle hours of delay. The Bay Area may be an extreme case, but there are many causes of increased highway congestion rates all over California. For example, accidents, road work, cars stranded along the roadside, or a routine traffic violation stop can create a bottleneck effect, potentially delaying commuters for miles. Poor weather conditions (rain, wind, and dense Central Valley fog) also have a negative effect on the reliability of highway travel times. Rain and wind can make the roads dangerously slick, increasing accident rates. Snow and icy weather make roads conditions even worse, especially in heavily traveled areas. Fog, haze, and glare at times can distract drivers or cause them to slow down.

Weather conditions are also a key factor in flight delay. For instance, during poor weather conditions at SFO as of 1999, more than 25% of flight departures were delayed by more than 1 hour and 10% were delayed by more than 2 hours. By contrast, when weather conditions were good, 83% of flights arrived on time. The percentages of delayed arrivals and departures are illustrated in Figure 1.2-4 for each of the major California airports serving the intercity travel market. Some airlines adjust their schedules to achieve on-time arrivals even if departures are delayed; some airlines have increased their scheduled flight times between high-demand city pairs such as LAX and SFO to maintain their on-time arrival statistics in the face of potentially increasing delays (Office of Inspector General 2000). Weather also results in flight cancellations. As noted by the *San Francisco Business Times*, "During good weather, SFO can accept between 60 and 65 aircraft per hour. But fog or rain causes delays at SFO on average every third day, reducing the number of landings to about 30 per hour." (*San Francisco Business Times*, December 12, 2003, Eric Young).

Aircraft delays cost both the airlines and the traveling public time and money, and the FAA has identified the reduction of airport delay nationwide as one of its highest priorities. Data from the DOT's *Air Travel Consumer Report* show SFO and LAX ranking among the worst of major airports in the country in terms of delay (U.S. Department of Transportation 2003). Airport delays are a function of capacity, weather conditions, and safety conditions. When demand at an airport exceeds the capacity on the airfield at that time, flights are delayed until they can be safely accommodated. Delayed flights sometimes compound problems for other flights and can result in cancelled flights. Because the FAA Ground Delay Program holds flights at their point of departure until the destination airport can accept the demand, and because short flights (e.g., SFO to LAX) are more easily adjusted than longer flights (e.g., East Coast or Midwest to West Coast), short flights are more likely to experience delays or capacity reductions. Consequently, intercity air travel within California can be hard hit by delays related to total airport demand.

Safety

Projected growth in the movement of people and goods in California by auto, air, and rail over the next two decades underscores the need for improved travel safety. With more and more vehicles on the intercity highways, the potential for accidents increases. The California Department of Highway Safety and Motor Vehicles publishes an annual summary of accident data for state highways. As shown in Table 1.2-4, there were a total of 4,094 fatalities and 203,386 nonfatal injuries on California highways in 2004, which corresponds to a fatality rate of 1.25 per 100 million vehicle miles of travel (VMT).



[a] Threshold of delay greater than 9 minutes.

Source: Air Travel Consumer Report 2004

Figure 1.2-4
Airport Delay—1999*

Table 1.2-4
State of California Vehicular Accident Statistics

California Statistics	1995	2000	2004
Fatal Collisions	3,636	3,331	3,701
Persons Killed in Collisions	4,165	3,730	4,094
Injury Collisions	196,569	198,348	203,386
Persons Injured in Collisions	304,941	303,023	302,357
Population (millions)	32.063	34.480	36.591
Motor Vehicle Miles of Travel (millions)	274,840	306,371	328,255
Mileage Death Rate *	1.52	1.22	1.25
* Number of persons killed per 100 million miles of travel.			
Source: *2004 Annual Report of Fatal and Injury Motor Vehicle Traffic Collisions,* Statewide Integrated Traffic Records System (SWITRS), California Highway Patrol, 2004.			

Correspondingly, while the national vehicular fatal crash rates per vehicle mile and per total population improved between 1995 and 2005, the number of national vehicular fatalities increased over the same time period from 37,241 to 39,189, as shown on Table 1.2-5.

Commercial airline travel accident/injury rates nationally have remained fairly constant over the last 10 years. In 1999, the number of accidents for commercial airlines was 0.0077 per one million miles (1.6 million km) flown; this represents 0.0003 fatalities per 1 million miles flown (National Transportation Safety Board 2000).

Table 1.2-5
National Vehicular Crash Statistics

National Statistics	2005	2000	1995
Motor Vehicle Fatal Crashes	39,189	37,526	37,241
Traffic Crash Fatalities vehicle occupants and motorcycle riders	37,594	36,348	35,291
Vehicle Miles Traveled (Billions)	2,965	2,747	2,423
Resident Population (Thousands)	296,410	282,193	262,803
Rates: Fatalities			
Fatalities per 100 Million Vehicle Miles Traveled	1.47	1.53	1.73
Fatalities per 100,000 Population	14.66	14.86	15.91
Source: Fatality Analysis Reporting System (FARS), National Center for Statistics and Analysis, 2006.			

Table 1.2-6 shows a comparison of the number of fatal accidents by mode for the United States. HSTs in Europe and Japan have not reported any fatalities at high speeds and are not shown in the table. As shown in the table, there were 12 fatalities (railroad employee and passenger fatalities only) associated with passenger railroad operations (intercity and commuter railroad services) across the

United States in 2005. For the years 2000–2005, rail passenger fatalities ranged from 0 to 12. The corresponding fatality rate per 100 million miles ranged from 0.00 to 0.08. (Federal Railroad Administration 2007.)

As shown in Table 1.2-6, the average passenger fatality rates from 2000 to 2005 for U.S. air carrier, highway, and railroad were 0.02, 0.55, and 0.02 passenger fatalities per 100 million passenger miles, respectively. It should be noted that the U.S. railroad fatalities occurred on a system that is not fully grade-separated, but the zero fatalities on the European and Japanese rail systems are on fully grade-separated systems.

Table 1.2-6
National Transportation Fatalities by Mode

	2000	2001	2002	2003	2004	2005	Average
U.S. Air Carrier[a]							
Passenger Fatalities	92	531	0	22	14	22	114
Passenger Miles (100 Millions)	7,008	6,585	6,505	6,742	7,523	7,951	7,052
Passenger Fatalities/100 Million Passenger Miles	0.01	0.08	0.00	0.00	0.00	0.00	0.02
Highway (total)							
Passenger Fatalities	36,348	36,440	37,375	37,341	37,304	37,594	37,067
Passenger Miles (100 Millions)	64,555	65,730	67,116	67,915	69,631	69,678	67,437
Passenger Fatalities/100 Million Passenger Miles	0.56	0.55	0.56	0.55	0.54	0.54	0.55
Railroad (total[b])							
Passenger Fatalities	0	1	7	1	1	12	4
Passenger Miles (100 Millions)	141.8	152.9	148.9	153.8	152.3	155.7	151
Passenger Fatalities/100 Million Passenger Miles	0.00	0.01	0.05	0.01	0.01	0.08	0.02

Notes

[a] Carriers operating under 14 CFR 121, all scheduled and nonscheduled service. Since Mar. 20, 1997, 14 CFR 121 include aircraft with 10 or more seats that formerly operated under 14 CFR 135.

[b] Passenger fatalities caused by collisions and other train accidents.

Sources

Air:

Internet site www.ntsb.gov/aviation (April 2007).

Bureau of Transportation Statistics, Internet site http://www.bts.gov/xml/air_traffic/src/datadisp.xml (April 2007).

Highway:

Fatality Analysis Reporting System (FARS), National Center for Statistics Analysis (April 2007).

1975-2004: Ibid., *Traffic Safety Facts 2004*, DOT HS 809 775 (Washington, DC: 2005), table 4, Internet site http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2003F.pdf (February 16, 2006).

Railroad:

Federal Railroad Administration, Office of Safety Analysis, Internet site http://safetydata.fra.dot.gov (March 2007).

Modal Connections

Limited connections exist between intercity travel facilities (primarily airports) and the extensive regional urban and commuter transit systems in the state. While some major connections with existing rail have been completed, such as the extension of the BART system to SFO, other airports remain entirely unconnected to the local and regional transit systems. Where connections exist (except for BART), the connections are cumbersome, often involving multiple transfers and long waits.

Air Quality and Protection of Natural Resources

The Clean Air Act (CAA) makes transportation conformity the affirmative responsibility of the DOT and the Metropolitan Planning Organizations (MPOs). *Transportation conformity* addresses strategies for the attainment and maintenance of air quality standards contained in the California State Implementation Plan (SIP) used to evaluate transportation alternatives, including the no-project/no-action alternative. Figure 1.2-5 shows the counties in California designated as nonattainment areas.

Maintaining air quality is one goal of the State Transportation Improvement Program (STIP) and the various RTPs. Metropolitan areas will continue to be challenged to reduce emissions to acceptable levels from a growing number of vehicles and to maintain air quality standards by encouraging more efficient use of land resources, improving mobility, and providing alternative transportation facilities and services. Policies aimed at reducing the demand for trips in single-occupant vehicles are integral to all transportation plans and programs to help areas presently in nonattainment conform to federal air quality standards.

One statewide strategy adopted in the SIP is development of multiuse corridors with designated lanes for high-occupancy vehicles (HOVs), transit, and rail alternatives. Meeting federal and state air quality standards over the next 20–40 years will also require reductions in the total distance traveled by vehicles, integration of land use and transportation planning and development, development of transportation demand strategies, implementation of operational improvements, and use of new technologies that improve transportation efficiencies and provide a transportation alternative to the single-occupant automobile. For example, in 2000, 89% of intercity trips in California of a distance of at least 100 miles (161 km) were made by automobile.

In addition to improving and maintaining the state's air quality, another critical need is to protect and preserve natural resources by limiting potential impacts related to expanding transportation systems. Key resources include wetlands and waterways, habitat areas for sensitive species of plants and animals, wildlife migration corridors, and agricultural lands. These natural resources have been subject to both direct and indirect impacts as the population has increased and growth has occurred in the less developed areas of the state. Avoidance of sensitive natural resources is a guiding criterion in the environmental review process. Various agencies, including USACE, USFWS, and the California Department of Fish and Game (CDFG) may have jurisdiction to impose specific restrictions on the use of wetlands and encroachment into wildlife habitat areas, wildlife migration corridors, and conservation areas important to the protection of threatened or endangered species. The environmental analysis process includes consideration of alternatives that offer opportunities to protect and enhance sensitive natural resources and improve existing conditions.

Another priority is the conservation of energy, and particularly the reduction in demand for petroleum. The need to reduce per-passenger energy consumption is important now and is becoming ever more important as energy use depletes reserves, drives up the cost of fuels or energy, and affects air quality.

B. REGIONAL NEED

The Bay Area to Central Valley link is an essential component of the proposed statewide HST system. More than 42% of the intercity travel market forecast for 2030 between the state's major metropolitan areas and more than 62% of the projected intercity ridership of the proposed statewide HST system would have a trip-end (either origin or destination) in the Bay Area to Central Valley study region. In addition to the needs of this region as part of a statewide system (as described earlier) there are similar needs within the Bay Area to Central Valley that are described below.

Regional Growth

Today, the nine-county Bay Area is home to nearly 7 million people and supplies more than 3 million jobs. By 2050, the region's population is anticipated to grow by more than 40% for a total of 10 million people. Recent projections for how the region will grow, adopted by the Association of Bay Area Governments, presume a shift to more compact growth patterns, with about 60% of the population growth taking place in the major cities and the inner suburbs that ring the Bay. This shift still leaves 40% of the growth to continue to occur in the Bay Area's outer ring of more distant suburbs and agricultural lands.

This population growth will put tremendous pressure on the existing transportation network, as can be seen by the substantial growth that is projected in specific Bay Area transportation corridors (Figure 1.2-6). The peak travel periods are expected to encompass many more hours of the day. For example, MTC's 2000 San Francisco Bay Crossing Study projected the Bay Bridge peak period to more than double from 1.5 hours in 2000 to 3.5 hours by 2020. A growing number of trips made throughout the day for shopping, education, recreation, and other activities are also anticipated.

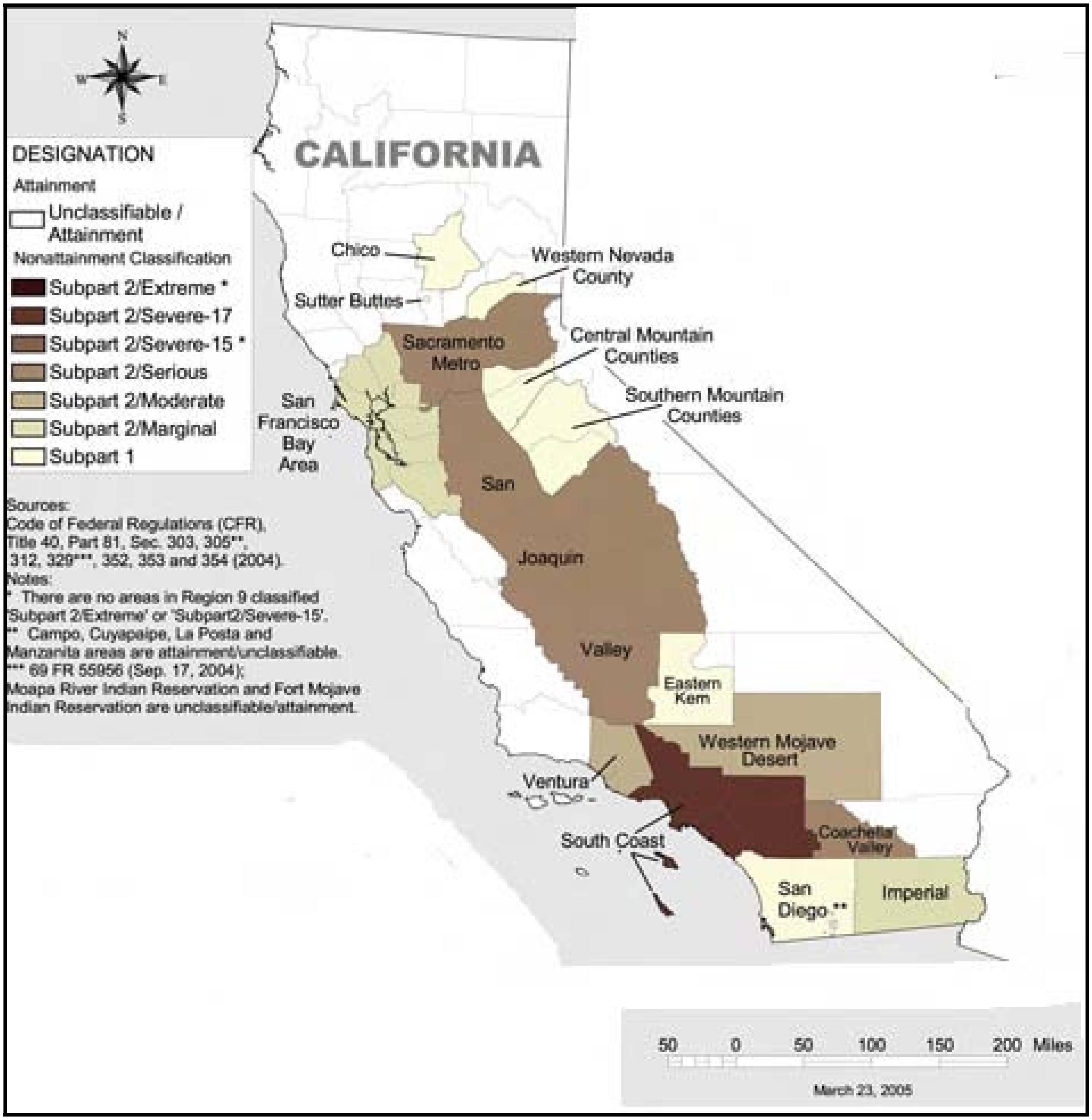
While the Bay Area continues to grow at a steady rate, the Sacramento and Central Valley areas are experiencing a true population boom. San Joaquin County, just east of the Altamont Pass, will lead the way with a more than 200% increase in population by 2050 (Figure 1.2-7). This population growth and the growing interconnectedness of the region's economies are creating a surge in travel through the "gateways" that connect the Bay Area with the rest of northern California.

As shown in Figure 1.2-8, the greatest increase in travel growth into the Bay Area over the next 25 years is anticipated to come from areas to the east. By 2030, commutes from Sacramento Valley will grow by more than 200% and from the San Joaquin Valley by 112%.

Not only is the population increasing rapidly in these regions, but the growth is taking place in the form of segregated and dispersed land uses, which rely on individual vehicles for most trips. Without stronger transit systems leading to the main Central Valley cities and connecting them to each other, there will be little chance for the cities to move toward compact transit-oriented development or to satisfy the Bay Area planning framework.

Regional Congestion

The Bay Area already experiences the second-worst traffic congestion in the country, after Los Angeles. Congestion is expected to worsen over the next 25 years, especially in existing hotspots (Figure 1.2-9). Congestion often seems to come "out of nowhere" but there is actually a clear cause—as the volume of traffic exceeds a road's capacity, the speed of traffic decreases exponentially rather than gradually. As Figure 1.2-10 illustrates, once the traffic slows to 5 or 10 mph, the number of cars a road can accommodate in an hour (its "vehicle throughput") also decreases. With more people trying to get through a road that now carries fewer cars, the traffic delays increase exponentially. Speeds degrade to stop-and-go conditions, pollution emissions worsen, and vehicles become less fuel efficient, making the environmental impacts of traffic more severe.



U.S. Department of Transportation
Federal Railroad Administration

Figure 1.2-5
2006 Area Designations for National Ambient Air Quality Standards—Ozone

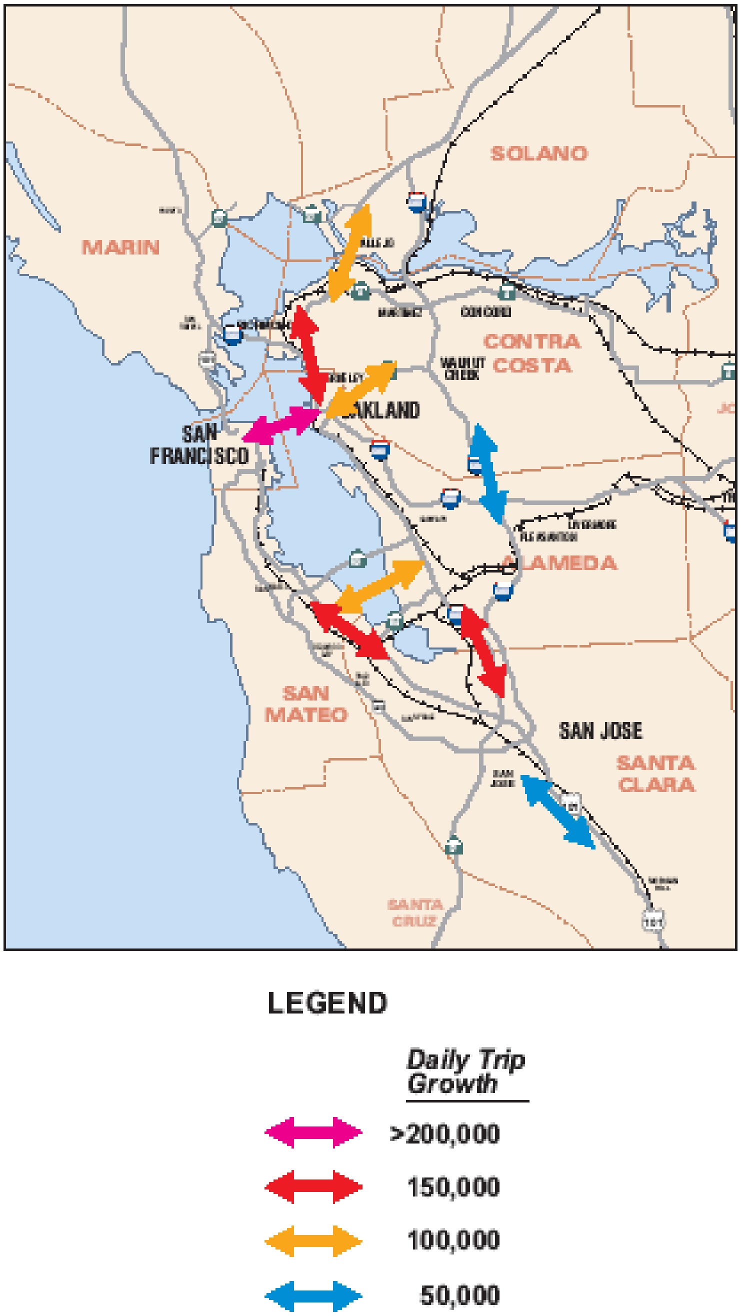
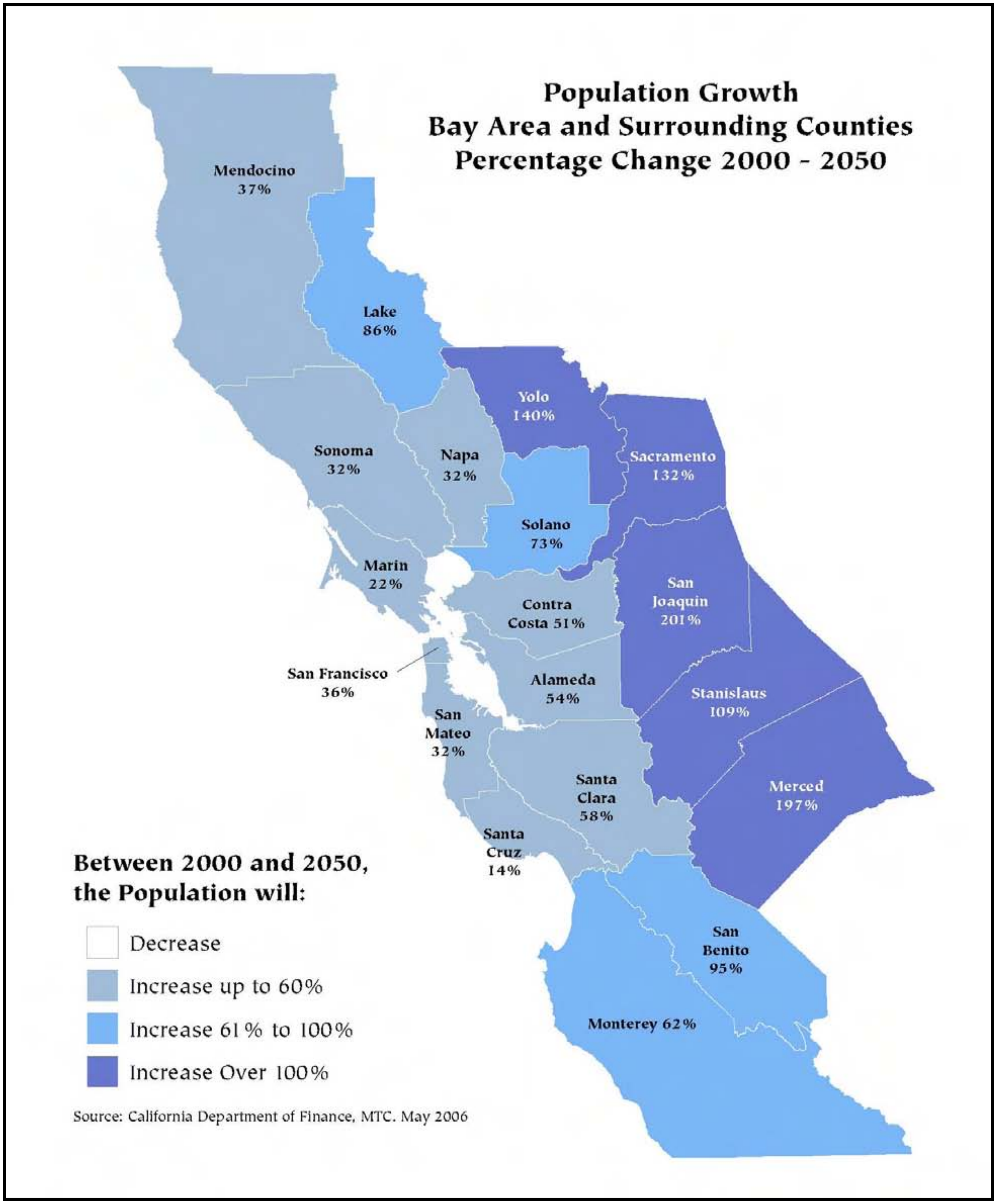
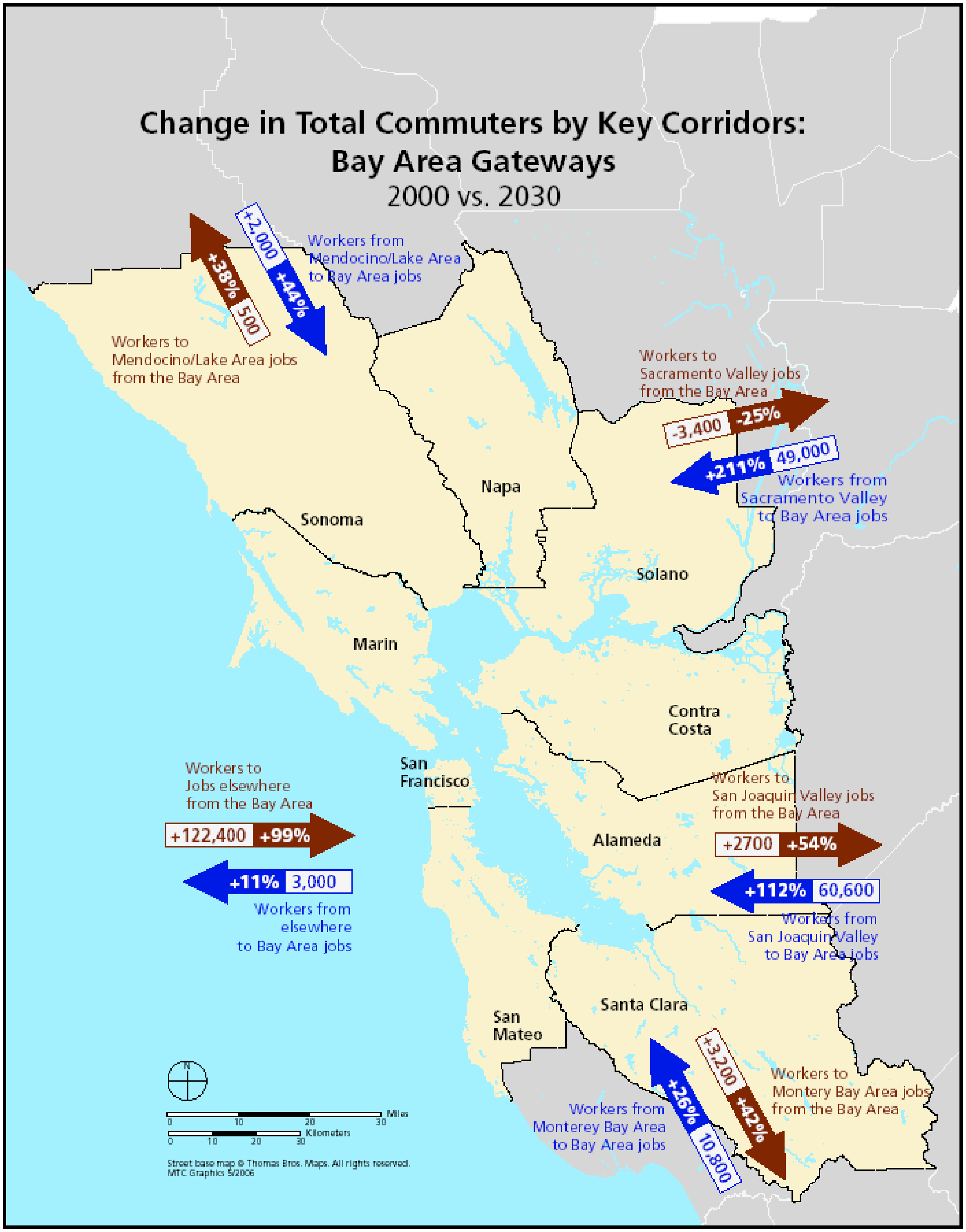
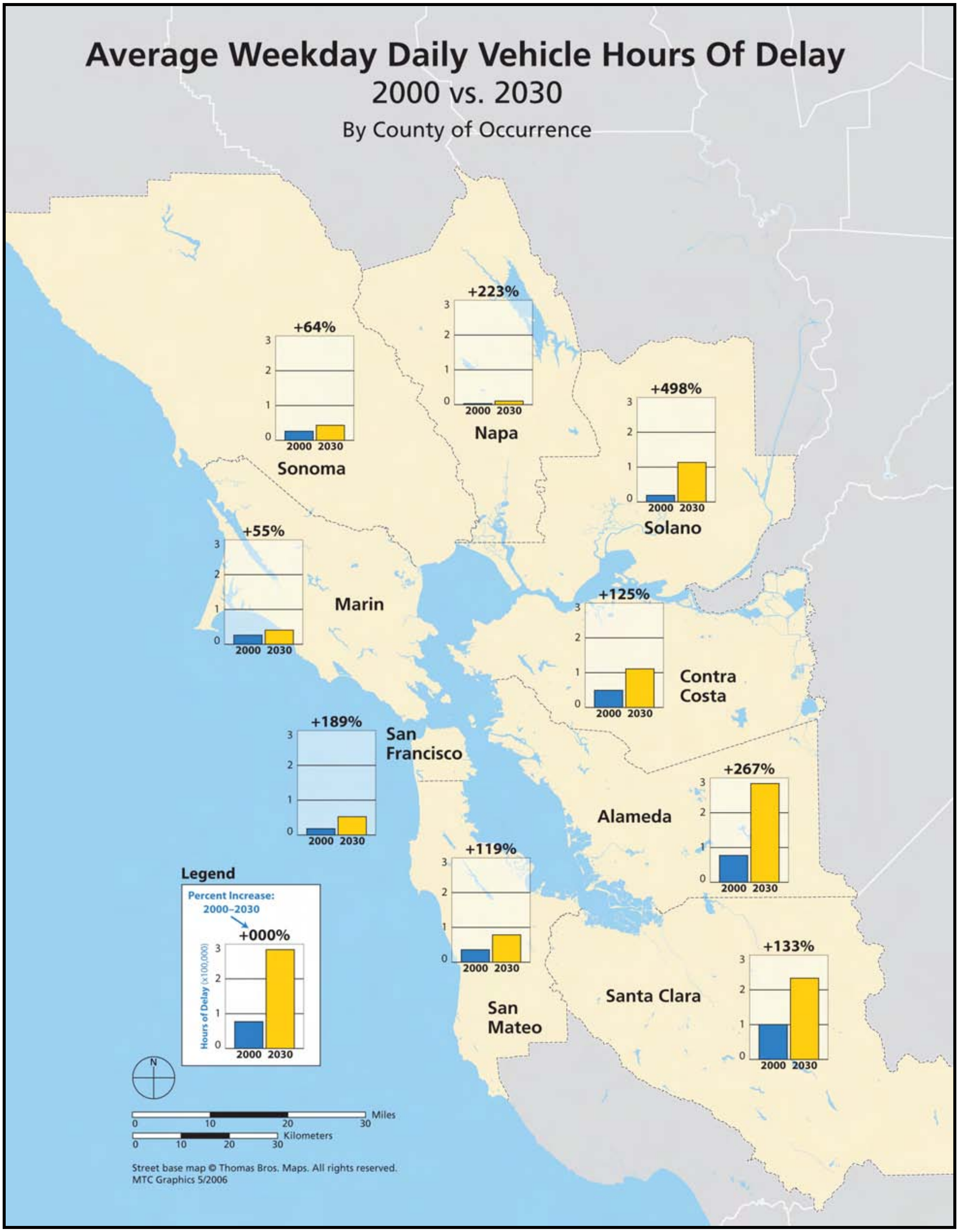


Figure 1.2-6
Regional Trips—High Growth Corridors (2000—2030)


Population Growth
Bay Area and Surrounding Counties
Percentage Change 2000 - 2050
Mendocino
37%
Lake
86%
Yolo
140%
Sonoma
32%
Napa
32%
Sacramento
132%
Solano
73%
Marin
22%
San
Joaquin
201%
Contra
Costa 51%
San Francisco
36%
Alameda
54%
Stanislaus
109%
San
Mateo
32%
Santa
Clara
58%
Merced
197%
Santa
Cruz
14%
Between 2000 and 2050,
the Population will:
Decrease
Increase up to 60%
Increase 61% to 100%
Increase Over 100%
Source: California Department of Finance, MTC. May 2006
San
Benito
95%
Monterey 62%


Change in Total Commuters by Key Corridors:
Bay Area Gateways
2000 vs. 2030
+2,000 +44%
Workers from Mendocino/Lake Area to Bay Area jobs
+38% 500
Workers to Mendocino/Lake Area jobs from the Bay Area
Workers to Sacramento Valley jobs from the Bay Area
-3,400 -25%
+211% 49,000
Workers from Sacramento Valley to Bay Area jobs
Napa
Sonoma
Solano
Marin
Contra Costa
San Francisco
Alameda
Workers to Jobs elsewhere from the Bay Area
+122,400 +99%
+11% 3,000
Workers from elsewhere to Bay Area jobs
Workers to San Joaquin Valley jobs from the Bay Area
+2700 +54%
+112% 60,600
Workers from San Joaquin Valley to Bay Area jobs
San Mateo
Santa Clara
+3,200 +42%
Workers to Montery Bay Area jobs from the Bay Area
Workers from Monterey Bay Area to Bay Area jobs
+26% 10,800
Street base map © Thomas Bros. Maps. All rights reserved.
MTC Graphics 5/2006


Average Weekday Daily Vehicle Hours Of Delay
2000 vs. 2030
By County of Occurrence
+64%
Sonoma
+223%
Napa
+498%
Solano
+55%
Marin
+125%
Contra Costa
+189%
San Francisco
+267%
Alameda
+119%
San Mateo
+133%
Santa Clara
2000 2030
Legend
Percent Increase: 2000–2030
+000%
Hours of Delay (x100,000)
Miles
Kilometers
Street base map © Thomas Bros. Maps. All rights reserved.
MTC Graphics 5/2006

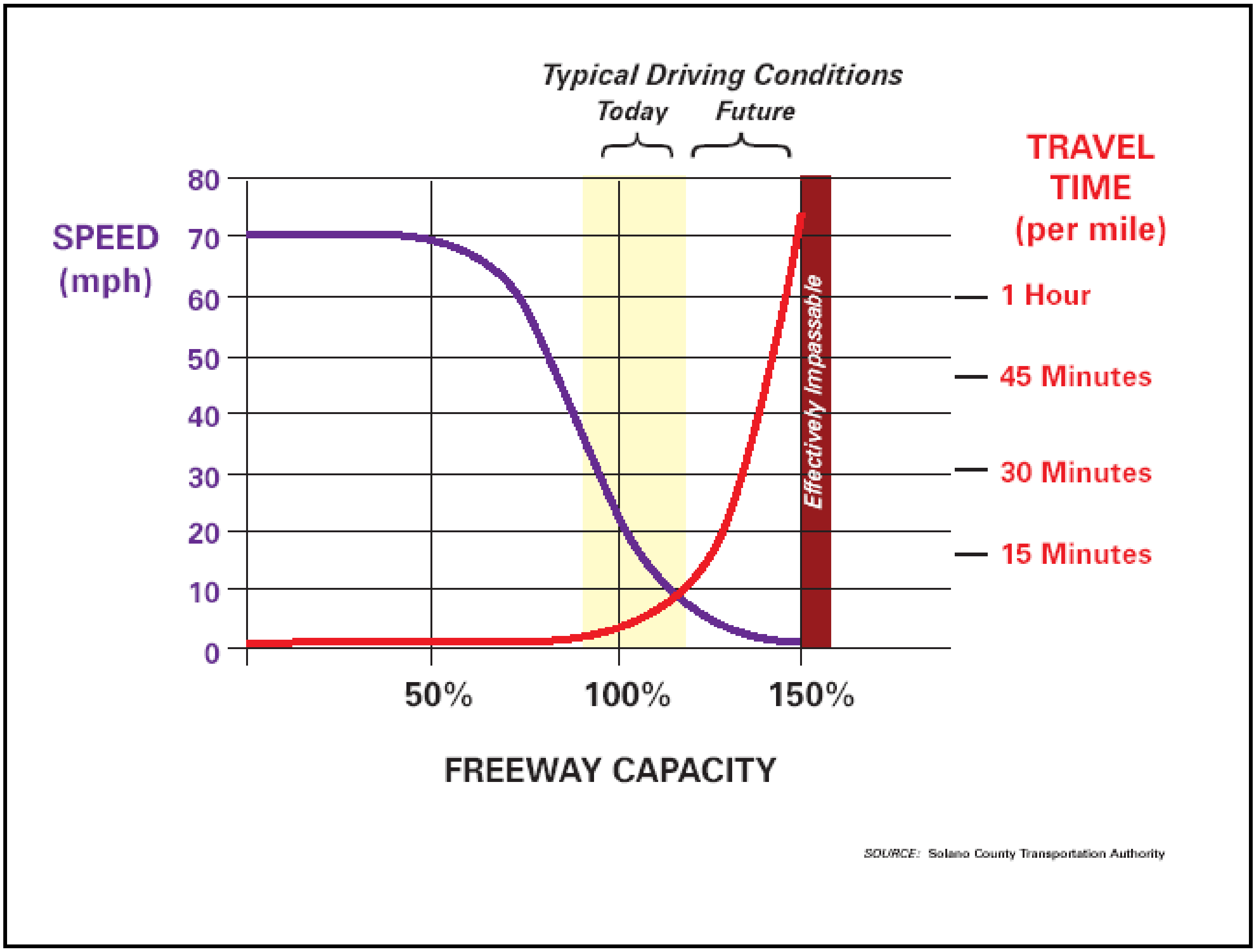


Figure 1.2-10
Freeway Capacity

The combination of significant population growth, dispersed development patterns (requiring a car for most trips), highway facilities that cannot keep pace with traffic demands, and large increases in interregional commuting, has and will continue to worsen congestion levels and the associated environmental and economic impacts.

Economic Implications

The adverse economic impacts of congestion and inadequate transportation/transit access are already apparent. The 150,000 daily hours of Bay Area commute congestion had an estimated cost of $2.6 billion in 2003 alone. This congestion would have been about 50% worse if not for the region's public transit system.

When transportation access to urban and suburban centers becomes too difficult, employers are likely to move jobs to areas where land prices are lower and workers' commutes might be shorter. Without better passenger rail access, major job growth will continue to decentralize and move to the Central Valley, and beyond.

Environmental Implications

Without an expanded rail network, the natural environment may also continue to suffer. More than 400,000 acres (ac) of land in the Bay Area are at risk from development. Promoting development in walkable communities near HST and other transit stations offers the best opportunity for taking development pressure off open space and farms. Demand for an additional 550,000 homes near transit in the Bay Area by 2030 is anticipated, but transit-oriented development only functions well when transit service is frequent and reliable enough that residents can reduce the number of vehicles they own and the number of car trips they take.

An additional growing environmental concern is global climate change, and the transportation sector is responsible for about 40% of California's greenhouse gas emissions, and up to 50% in the Bay Area. These emissions are directly proportional to the amount of fuel burned, so offering effective transportation choices that can reduce driving will be critical for cutting these emissions.

2 ALTERNATIVES

This chapter describes the network and alignment alternatives and station location options considered for the proposed California HST system in the Bay Area to Central Valley study region. This Program EIR/EIS is a program-level environmental document, and the analyses herein are intended to define broad differences between alternatives. The level of detail for alternatives is conceptual or general rather than site-specific (40 CFR § 1508.28; 14 CCR § 15385). Subsequent project-level environmental documents and analyses would assess site-specific engineering and environmental impacts for alternatives selected in this Program EIR/EIS.

The alternatives discussed in this chapter were developed considering previous studies defining the project and information gathered in the scoping process. All alternatives that have been considered in this Program EIR/EIS process are described in this chapter, including those rejected from further consideration and the basis for their rejection. The No Project/No Action (No Project), HST Network, and HST Alignment Alternatives are described in detail in this chapter, and their development is summarized.

Several terms specific to the project are defined below. See Chapter 15, "Glossary," for definitions of technical and other terms.

- Study Region: Bay Area to Central Valley region encompassing all six study corridors.
- No Project Alternative: Represents the region's (and state's) transportation system (highway, air, and conventional rail) as it is today and with implementation of programs or projects that are in regional transportation plans and have identified funds for implementation by 2030.
- Study Corridors: Six linear geographic belts or bands being considered for the HST system that connect different parts of the study region. They are distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections) and generally follow the route of a transportation facility.
- HST Network Alternatives: Represent different ways to implement the HST system in the study region with combinations of HST Alignment Alternatives and station location options. These HST Network Alternatives are identified in Chapter 2 and compared in Chapter 7.
- HST Alignment Alternatives: General location for HST tracks, structures, and systems for the HST system between logical points within study corridors; they are generally configured along or adjacent to existing rail transportation facilities. These HST Alignment Alternatives are described in Chapter 2, analyzed in Chapter 3, and compared and used to create HST Networks in Chapter 7.
- HST Alignment Segment: A portion of an alignment (often defined to distinguish subalternatives) that can be combined with other segments to form an alignment.
- Station Location Options: General locations that represent the most likely HST stations based on current knowledge, consistent with the objective to serve the state's major population centers.

2.1 Summary of Alternatives

This section provides a brief synopsis of the alternatives analyzed by the Authority and the FRA in this Program EIR/EIS.

2.1.1 No Project Alternative

The No Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it is today and would be after implementation of programs or projects that are currently in regional transportation plans and have identified funds for implementation by 2030.

2.1.2 High-Speed Train Network and Alignment Alternatives

HST Network Alternatives represent different ways to implement the HST system in the study region to better understand the implications of selecting certain HST Alignment Alternatives and station location options. The HST system would continue outside the study region to the major metropolitan areas in the state, as described in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). The Authority and the FRA developed a range of potential alignment alternatives and station location options in the study region (Figure 1.1-1). Informed by previous studies and the scoping process, the Authority and the FRA evaluated the potential HST Alignment Alternatives and identified those that best meet the project purpose and need, are reasonable, and are feasible.

The proposed HST system selected in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005) and further analyzed in this Program EIR/EIS is electrified steel-wheel-on-steel-rail dedicated service, with a maximum speed of 220 mph (350 kph). A fully grade-separated, access-controlled right-of-way would be constructed, except where the system would be able to share tracks at lower speeds with other compatible passenger rail services. Shared-track operations would use existing rail infrastructure in areas where construction of new separate HST facilities would not be feasible. Although shared service would reduce the flexibility and capacity of HST service because of the need to coordinate schedules, it would also result in fewer environmental impacts and a lower construction cost.

2.2 Chapter Organization

The remainder of this chapter is organized into the following three sections:

- Section 2.3 describes the development of the proposed HST system.
- Section 2.4 describes the No Project Alternative.
- Section 2.5 describes the HST Alternatives considered in this Program EIR/EIS, including the HST Network Alternatives, the HST Alignment Alternatives, station location options, and maintenance facility location options. Alignment alternatives and station location options considered and rejected are also described.

2.3 Development of Alternatives

This section describes the process used to evaluate conceptual alternatives presented in previous feasibility studies and identified through the scoping process for the HST system, leading to the set of HST Network Alternatives and HST Alignment Alternatives that are analyzed in this Program EIR/EIS. Key criteria used to distinguish among alternatives are described in Chapter 1, "Purpose and Need and Objectives," and include connectivity, right-of-way constraints and compatibility, ridership potential, constructability, and environmental impacts.

2.3.1 Background

Since 1994, three planning and feasibility studies and a statewide program EIR/EIS have been completed under the direction of the California Department of Transportation (Caltrans), the former California Intercity High Speed Rail Commission (Commission), and the Authority. The specific scopes of work of the feasibility studies differed, but they all focused on identifying potential HST technologies and corridors and broadly evaluated their feasibility. The three feasibility studies culminated in the Authority's final business plan (Business Plan) for an economically viable HST system that would serve major metropolitan areas of California (California High-Speed Rail Authority 2000). Also, in 1997, the FRA published *High-Speed Ground Transportation for America,* a national study examining the commercial feasibility of new high-speed ground transportation systems (Federal Railroad Administration 1997). This commercial feasibility study uniformly applied economic principles to weigh likely investment needs, operating performance, and social benefits of different types of train services in regional travel markets. The Authority followed these principles and in the Business Plan defined a practical approach to construct, operate, and finance an HST system that would yield solid financial returns to the state and provide potentially dramatic transportation benefits to all Californians. A preferred alignment and potential station locations were selected for most of the proposed statewide HST system as part of the final statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). However, between the San Francisco Bay Area and Central Valley, a broad corridor was identified for further evaluation.

These environmental, planning, and feasibility studies considered environmental constraints and potential impacts, with the objective of avoiding or minimizing impacts on sensitive resources where possible. Most of the study corridors considered follow existing highways or railroad lines, particularly in urban areas, to avoid or minimize environmental impacts. Many of the alignments for corridor and station locations emerged from regional and local agency input. Potential station locations were identified for operational and ridership forecasting purposes, and alternative sites were considered as part of the corridor evaluation. However, specific station sites were not selected. The studies were done consecutively, such that each subsequent study benefited from and built on previous work to further refine and develop potential station location options. The scope, timing, and products of each of the three studies, the Business Plan, and the statewide program EIR/EIS are described below. The relationship between the feasibility studies is illustrated in Figure 2.3-1.

A. LOS ANGELES TO BAKERSFIELD PRELIMINARY ENGINEERING FEASIBILITY STUDY (1994)

In 1994, Caltrans completed a study that analyzed the feasibility of constructing an HST system across the Tehachapi Mountains in southern California. The Tehachapi Mountains is one of the largest physical constraints (if not the largest physical constraint) to the development of a statewide HST network. The study produced an evaluation of the various HST technologies, as well as engineering drawings, cost estimates, and preliminary environmental analysis for potential alignments traversing the Tehachapi Mountains. The study also produced drawings and cost estimates for potential stations, developed operating plans, and estimated travel times for this segment of a statewide system. The study is documented in the *Los Angeles–Bakersfield Preliminary Engineering Feasibility Study Final Report* (California Department of Transportation 1994).

Alignments were studied using then-current aerial photographs and maps at a scale of 1 inch (in) equals 200 feet (ft). The feasibility study included preliminary engineering analysis of several key technical issues (e.g., structures, tunneling, and unit capital costs). The corridors studied traversed a variety of terrain (e.g., urban development, mountains, and valley floor). The study provided an important foundation for the subsequent statewide corridor evaluation studies.

The feasibility study considered a broad range of alternative alignments and then focused on the most viable routes. Two main corridors between Los Angeles and Bakersfield were considered feasible in terms of cost, travel time, potential ridership, and environmental constraints: Interstate 5 (I-5)/Grapevine and Palmdale–Mojave (Antelope Valley).

B. CORRIDOR EVALUATION AND ENVIRONMENTAL CONSTRAINTS ANALYSIS (1996)

The Commission conducted a three-phase study, which was completed in 1996. The first phase defined the most promising corridor alignments for linking the San Francisco Bay Area and Los Angeles (Figure 2.3-2). The second phase examined these alternative corridors between Los Angeles and the Bay Area in more detail. The third phase examined potential HST system extensions to Sacramento, San Bernardino/Riverside, Orange County, and San Diego.

The study identified potential station locations; estimated travel times; developed construction, operation, and maintenance cost estimates; analyzed environmental constraints and possible mitigation measures; and, in an iterative process with a ridership study prepared for the Commission, developed a conceptual operating plan. The corridors considered in all phases of this study are described in the *High-Speed Rail Corridor Evaluation and Environmental Constraints Analysis Final Report* (California Intercity High Speed Rail Commission 1996).

This analysis was completed concurrently with studies addressing four other aspects of a proposed high-speed rail system: ridership and revenue projections, institutional and financial options, economic impacts and benefit/cost analysis, and public participation. The corridors recommended for study by the 1996 analysis are shown in Figure 2.3-3.

C. HIGH-SPEED RAIL CORRIDOR EVALUATION (1999)

In September 1998, the Authority initiated a study to evaluate the viability of various corridors throughout the state for a statewide HST system. The Authority was legislatively mandated to move forward in a manner that was consistent with and continued the work of the Commission. Potential corridors were evaluated for capital, operating, and maintenance costs; travel times; and engineering, operational, and environmental constraints. This study is documented in the *California High-Speed Rail Corridor Evaluation Final Report* (California High-Speed Rail Authority 1999).

This study provided the Authority with a basis for recommending a potentially feasible network of HST corridors for further study. Although previous studies had been limited in the number of alternatives that could be analyzed in certain areas of the state, other potential corridors and new issues were identified in the 1999 study as regional and local agencies provided their input on the recommendations of the previous studies.

D. BUSINESS PLAN

The Business Plan presents a reasoned approach for constructing, operating, and financing an efficient and economically viable statewide HST system capable of speeds up to 220 mph (350 kph) that would be electrically powered and fully grade-separated and link California's major metropolitan areas. The Business Plan was based on the analysis from the *High-Speed Rail Corridor Evaluation* (1999), as well as ridership and revenue, cost-benefit, financial planning, and system integration studies.

The Business Plan concluded that "a high-speed train system is a smart investment in the state's future mobility. It will yield solid financial returns to the state and provide potentially dramatic transportation benefits to all Californians. It is a system that can be operated without public subsidy. The public's investment should be limited to that which is necessary to ensure the construction of the basic system."

The analysis and objectives summarized in the Business Plan found that an HST system would be able to:

- Return twice as much financial benefit to the state's citizens as it costs.

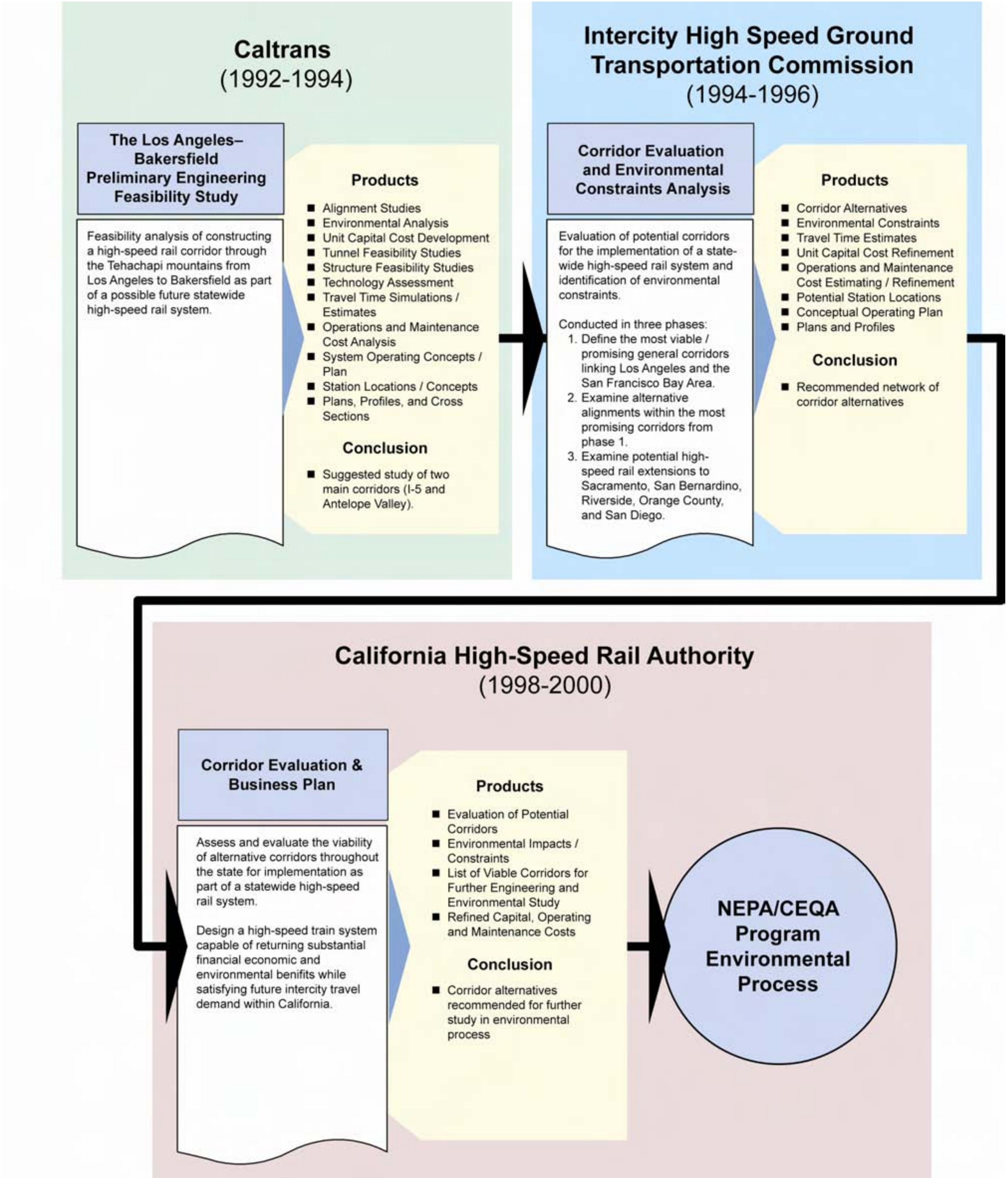


Figure 2.3-1
Relationship between Previous California High-Speed Train Studies


Sacramento
Placerville
Santa Rosa
Vallejo
Stockton
Oakland
San Francisco
SFO
Modesto
Redwood City/ Palo Alto
San Jose
Merced
Sonora
Yosemite Village
Bishop
Santa Cruz
Gilroy
Los Banos
Madera
Monterey
Salinas
Fresno
Giant Forest
Lone Pine
Hanford
Tulare County
Tulare
Death Valley Junction
King City
Coalinga
Lucia
San Simeon
Paso Robles
Morro Bay
San Luis Obispo
Bakersfield
Baker
Santa Maria
Barstow
Palmdale
Santa Barbara
Ventura
Burbank
Los Angeles Union Station
San Bernardino
Santa Monica
Riverside
Long Beach
Palm Springs
Indio
Irvine
Temecula
Oceanside
Brawley
El Centro
San Diego
Calexico
Coastal Corridor
I-5 Corridor
Central Valley Corridor

Figure 2.3-3
Corridors for Continued Consideration
(Commission Studies, 1996)

- Carry at least 32 million intercity passengers and another 10 million commuters annually.
- Generate about $900 million in revenues and return an operational surplus of more than $300 million per year.

The Authority recommended initiating a formal environmental review process with a systemwide program-level EIR/EIS on the HST network described in the Business Plan.

2.3.2 Statewide Program EIR/EIS

The Authority certified the final statewide program EIR/EIS, and the FRA issued a Record of Decision for the more than 700-mile-long HST system in November 2005. This statewide process took 4 years to complete at a cost of about $20 million. The HST Alternative was the selected system alternative and was identified as the environmentally preferred alternative under NEPA, as well as the environmentally superior alternative under CEQA. To serve the same number of travelers as the HST system was projected to carry by 2020, California would have to build nearly 3,000 lane-miles of freeway, plus five new airport runways and 90 departure gates at a cost two to three times more than the HST Alternative. The program EIR/EIS concluded that high-speed trains can decrease dependency on foreign oil, preserve energy, decrease air pollutants, and discourage sprawl while having less impact on the natural environment than expanding highways and airports.

Preferred alignments and potential HST station location options were selected for most of the statewide HST system as part of the final program EIR/EIS. Between the San Francisco Bay Area and Central Valley, a broad corridor was identified for further evaluation (Figure 1.1-1). In November 2005, the Authority and FRA initiated the preparation of this separate next-tier Program EIR/EIS to address the choice of a corridor/general alignment and station locations in the San Francisco Bay Area to the Central Valley region of the HST system.

A. SELECTED HIGH-SPEED TRAIN SYSTEM ALTERNATIVE

The HST Alternative for the over 700-mile-long HST system connecting the major metropolitan areas in California was selected by the Authority and FRA with the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005) and this prior decision forms the basis for the proposed action. HST alternatives considered in this Program EIR/EIS (Section 2.5) represent different ways to implement the HST system in the Bay Area to Central Valley study region. This section describes the characteristics of the HST system that were determined in the 2005 Authority and FRA decisions, to provide the framework necessary to evaluate the HST Alignment Alternatives and the HST Network Alternatives for this study region. Since the 2005 decision, a new high-speed rail ridership forecasting model, new travel demand forecasts, and a 2030 HST operating plan have been developed, as described in Section 2.3.3. These current models have updated and refined the selected HST Alignment Alternatives for further consideration of the HST system in this document.

<u>Travel Times and Frequency of Service</u>

Independent ridership and revenue forecasts (Charles River Associates 1996 and 2000) prepared for the Business Plan showed that competitive travel times and frequent service are essential to attract travelers to an HST system. For the HST system to be economically feasible, operating speeds over 200 mph (322 kph), high frequencies of service, and efficient operations are necessary. For this fundamental reason, the Authority and the FRA selected criteria that the proposed HST system would operate at speeds of up to about 220 mph (350 kph) and developed a conceptual service plan that makes the HST system highly competitive with travel by air or auto. It is important to note that maximum speeds cannot be achieved on many portions of the proposed system, particularly the heavily constrained urban areas (Figure 2.3-4). Express travel between downtown San Francisco and downtown Los Angeles could be accomplished in just over 2.5 hrs. The trip between downtown Los Angeles and downtown San Diego would take about 1 hour and 18 minutes. Table 2.3-1 shows current estimates of express travel times between a sample of the cities to be served.

Table 2.3-1
Optimal Express Travel Times (220 mph [350 kph])

Altamont Travel Time (hh:mm) / Pacheco Travel Time (hh:mm)	San Francisco	Oakland	San José	Sacramento	Fresno	Los Angeles	San Diego	
San Francisco	N/A	N/A	N/A	01:06	01:18	02:36	03:54	San Francisco
Oakland	N/A	N/A	N/A	00:53	01:04	02:23	03:40	Oakland
San José	00:30	00:22	N/A	00:49	01:01	02:19	03:37	San José
Sacramento	01:47	01:38	01:18	N/A	00:59	02:17	03:35	Sacramento
Fresno	01:20	01:12	00:51	00:53	N/A	01:24	02:42	Fresno
Los Angeles	02:38	02:30	02:09	02:11	01:24	N/A	01:18	Los Angeles
San Diego	03:56	03:48	03:27	03:29	02:42	01:18	N/A	San Diego
	San Francisco	Oakland	San Jose	Sacramento	Fresno	Los Angeles	San Diego	

N/A Not Applicable | Altamont Pass Test Alignment (white) | Pacheco Pass Test Alignment (gray)

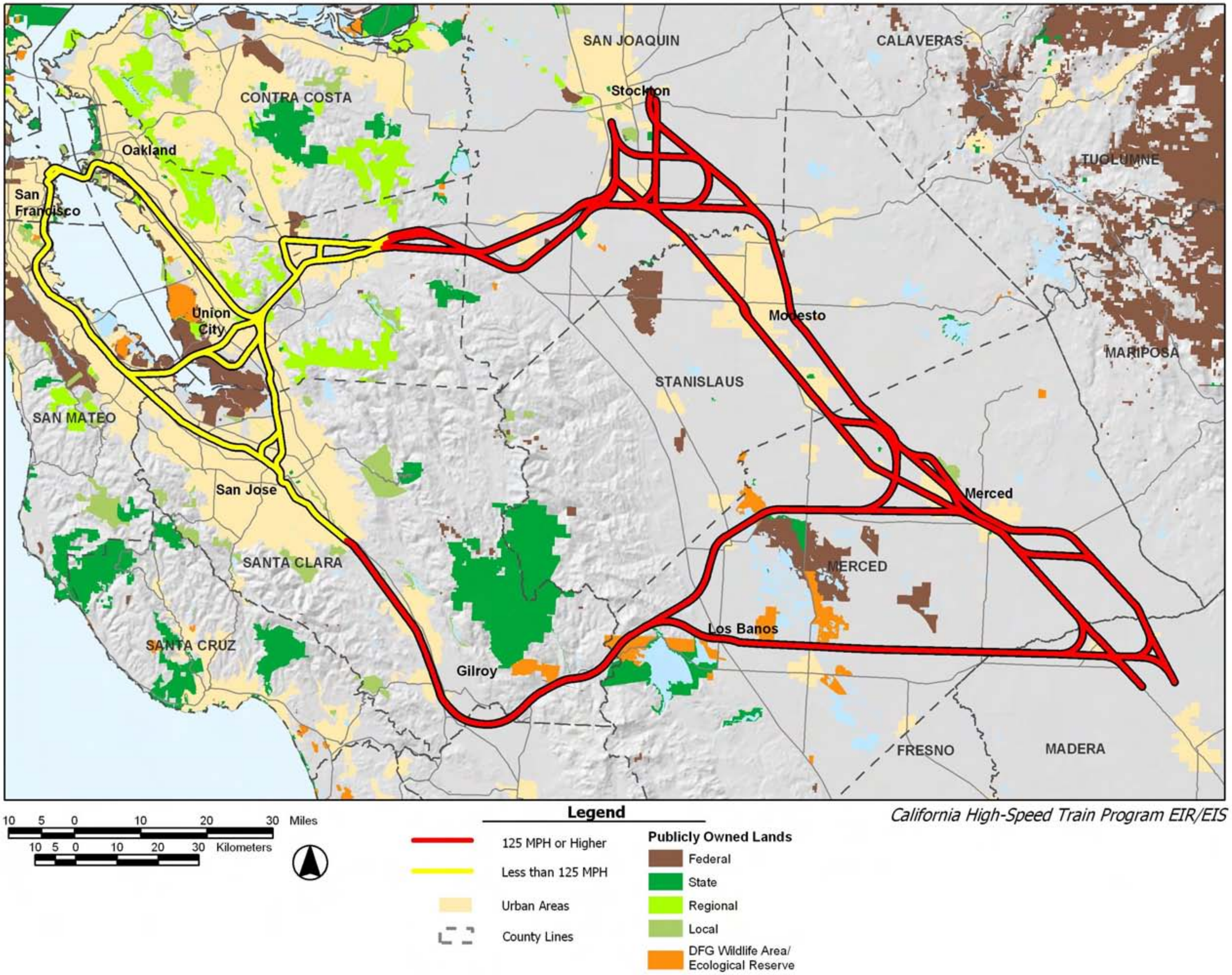
Note: Based on Altamont Pass Test Alignment B (I-580/UPRR) and Pacheco Pass Test Alignment B (Caltrain/Gilroy/Henry Miller/UPRR).

Ridership forecasts for the Pacheco Pass (terminating in San Francisco) and the Altamont Pass (terminating in San Francisco and San Jose) have been used as the *representative demand* for defining the intercity travel need for the HST Alignment Alternatives in this Program EIS/EIR.

The projected HST travel times account for alignment, train performance characteristics, acceleration and deceleration capabilities, and passenger comfort criteria. HST system operators and manufacturers of HST equipment were consulted in the development of the travel times and design criteria for the proposed HST system.

<u>Safety and Security</u>

The safe operation of the HST system would be of the utmost importance. To this end, the HST system would be a fully grade-separated and fully access-controlled guideway with intrusion monitoring systems. This means that the HST infrastructure (e.g., mainline tracks and maintenance and storage facilities) would be designed to prevent access by unauthorized vehicles, persons, animals, and objects. The capital cost estimates include allowances for appropriate barriers (fences and walls), state-of-the-art communication, access-control, and monitoring and detection systems. All aspects of the HST system would conform to the latest federal requirements regarding transportation security. The HST trainsets (train cars) would be pressure sealed to maintain passenger comfort regardless of aerodynamic changes along the line.



FLY CALIFORNIA

U.S. Department of Transportation Federal Railroad Administration

Figure 2.3-4
Potential Average Operating Speeds

Electrification

Trains would draw electric power from overhead wires connected to the commercial power grid and, in braking, would regenerate electricity back to the grid, thereby conserving power and reducing costs. The statewide program EIR/EIS energy analysis concluded that the HST system would have a net energy benefit as compared to the No Project Alternative but would result in an increase in electric power demand. This Program EIR/EIS assessed the total energy that would be needed from California's electricity grid to power and operate the proposed HST system from its commencement (a portion of the system) to full implementation. The HST system does not include the construction of a separate power source. The analysis concluded that sufficient electricity is expected to be available to power the proposed HST system, as segments are constructed and begin operating, because power generation is expected to grow to meet increased demand in the state, and the power needs of the proposed HST system represent a small part of that overall increase in demand.

The power supply would consist of a 2-by-25-kilovolt (kV) overhead catenary system for all electrified portions of the statewide system. Supply stations would be required at approximately 30-mile intervals. Based on the estimated power needs of this system, these stations would need to be approximately 20,000 square ft (200 ft by 100 ft). Switching stations would be required at approximately 15-mile intervals. These stations would need to be approximately 7,500 square ft (150 ft by 50 ft). Paralleling (booster) stations would be required at approximately 7.5-mile intervals. These stations would need to be approximately 5,000 square ft (100 ft by 50 ft). Each station would include a control house that would need to be approximately 800 square ft (40 ft by 20 ft). These facilities are not sited as part of the program-level of environmental review. However, the facilities defined fall well within the potentially affected environment areas considered in program-level studies. Facility placement, sizing, and spacing would be determined during subsequent project-level environmental review.

Potential for Freight Service

The proposed HST system could be used to carry small packages, parcels, letters, or any other freight that would not exceed typical passenger loads. This service could be provided either in specialized freight cars on passenger trains or on dedicated lightweight freight trains. In either case, the lightweight freight vehicles would be required to have the same performance characteristics as the passenger equipment. This type of freight could be accommodated without adjustment to the passenger operational plan or modification to the passenger stations and was therefore included in the funding scenario described in the Business Plan.

A high-speed freight service might also be provided on specialized medium-weight freight trains. This specialized freight equipment would have limited axle loads (19 metric tons compared to the conventional freight standard of 27 metric tons per axle), would operate at speeds of up to 125 mph (200 kph), and would be scheduled at night to avoid conflict with passenger or maintenance operations. A medium-weight freight service could carry high-value or time-sensitive goods such as electronic equipment and perishable items. Although such a service would not interfere with passenger operations, it would require loading and unloading facilities separate from the passenger stations. Additional pick-up and distribution networks for this type of freight might also be required. Although the Authority recognizes the potential for overnight medium-weight freight service on the proposed high-speed tracks, it has not been included in this analysis. Discussions with potential high-speed freight operators could be initiated as part of subsequent project development with appropriate analysis.

Performance Criteria

The Authority and the FRA previously defined performance criteria for the HST in the statewide program EIR/EIS for the HST system (California High-Speed Rail Authority and Federal Railroad

Administration 2005), drawing on many prior feasibility and corridor evaluation studies. To meet the travel time and service quality goals, the statewide HST system will be capable of speeds in excess of 200 mph (320 kph) on fully grade-separated tracks with state-of-the-art safety, signaling, and automated train control systems. These performance criteria are summarized in Table 2.3-2.

Table 2.3-2
HST Performance Criteria

Category	Criteria
System Design Criteria[1]	Electric propulsion system. Fully grade-separated guideway. Fully access-controlled guideway with intrusion monitoring systems. Track geometry must maintain passenger comfort criteria (smoothness of ride, lateral acceleration less than 0.1 g [G forces]).
System Capabilities	All-weather/all-season operation. Capable of sustained vertical gradient of 3.5% without considerable degradation in performance. Capable of operating parcel and special freight service as a secondary use. Capable of safe, comfortable, and efficient operation at speeds over 200 mph. Capable of maintaining operations at 3-minute headways. Capable of traveling from San Francisco to Los Angeles in approximately 2.5 hrs. Equipped with high-capacity and redundant communications systems capable of supporting fully automatic train control.
System Capacity	Fully dual track mainline with off-line station stopping tracks. Capable of accommodating a wide range of passenger demand (up to 26,000 passengers per hour per direction). Capable of accommodating normal maintenance activities without disruption to daily operations.
Level of Service	Capable of accommodating a wide range of service types (express, semi-express/limited stop, and local).

Description of High-Speed Train Technology

The selected HST Alternative (California High-Speed Rail Authority and Federal Railroad Administration 2005) consists of steel-wheel-on-steel-rail trains capable of meeting the Authority's performance criteria (Table 2.3-2) that would be able to share tracks at reduced speeds with other compatible train services. These high-speed trains are capable of maximum operating speeds up to 220 mph (350 kph) (Figure 2.3-5). All HST systems in operation around the world use electric propulsion with overhead catenary. These include the Train à Grande Vitesse (TGV) in France, the Shinkansen in Japan, and the InterCity Express (ICE) in Germany.

To operate at high speeds, a dedicated, fully grade-separated right-of-way is necessary with more stringent alignment requirements than those needed for lower-speed lines. Therefore, this state-of-the-art, high-speed, steel-wheel-on-steel-rail technology would operate in the majority of the statewide system in dedicated (exclusive track) configuration. However, where the construction of new separate HST infrastructure would be infeasible, shared track operations would use improved rail infrastructure and electrical propulsion. It would be possible to integrate HST systems into existing

1 *Engineering Criteria*, January 2004.

Intercity Express (ICE)

Shinkansen

Figure 2.3-5
VHS Technology Examples

conventional rail lines in the congested urban areas with resolution of potential equipment and operating compatibility issues by the FRA and the California Public Utilities Commission. Potential shared-use corridors would be limited to sections of the statewide system with extensive urban constraints. Shared-use corridors would meet the following general criteria in addition to the performance criteria:

- Uniform control/signal system.
- Four tracks at stations (to allow for through/express services and local stopping patterns).
- Three to four mainline tracks (depending on capacity requirements of HST and other services).
- Physical or temporal separation from conventional freight traffic.

Using this technology, the proposed HST system would be constructed with consistent dual tracking in a variety of construction sections (e.g., at grade, elevated structure, tunnel), as appropriate for the constraints of each specific section. These typical construction sections are illustrated in Figures 2.3-6, 2.3-7, and 2.3-8.

<u>Design Practices</u>

Design practices have also been identified that would be employed as the project is developed further in the project specific environmental review, final design, and construction stages. These practices will be applied to the implementation of the HST system to avoid, minimize, and mitigate potential impacts. Some key design practices are summarized below:

- Use of existing transportation corridors would be maximized. Nearly 70% of the adopted preferred HST alignments are either within or adjacent to a major existing transportation corridor (existing railroad or highway right-of-way).
- Tracks that are fully grade separated from all roadways would be used.
- Multi-modal transportation hubs would be used.
- Electric power, high-quality track interface, and smaller, lighter, and more aerodynamic trainsets would be used, which would result in less noise than existing commuter and freight trains because HST do not have the rumble associated with diesel engines and use a design that greatly minimizes track noise.
- Transit-oriented design (TOD) and smart growth land use policies would be used. Station area development principles that would be applied at the project-level for each HST station and the areas around the stations would include:
  - Higher density development.
  - A mix of land uses (retail, office, hotels, entertainment, residential, etc.) and housing types to meet the needs of the local community.
  - A grid street pattern and compact pedestrian-oriented design that promotes walking, bicycle, and transit access.
  - Context-sensitive building design that considers the continuity of the building sizes and coordinates the street-level and upper-level architectural detailing, roof forms, and rhythm of windows and doors.
  - Limits on the amount and location of development-related parking, with a preference that parking be placed in structures.
- Portions of the system would be in tunnel or on aerial structure, which would avoid and/or minimize impacts to surface water resources.

- Measures to avoid water infiltration would be taken.
- Underpasses or overpasses or other appropriate passageways would be designed to avoid, minimize, and/or mitigate any potential impacts to wildlife movement.
- In-line construction would be used for sensitive areas, as defined at the project level.

2.3.3 Formulation of Alternatives for the Bay Area to Central Valley Region

With the initiation of this Program EIR/EIS, the Authority and the FRA began the process of defining reasonable and feasible HST Alignment Alternatives and station location options in the study region. The process involved consideration of the purpose and need for the proposed action and consultation with public agencies and the public, as described below.

A. AGENCY AND PUBLIC INVOLVEMENT AND SCOPING

Agency and public input was obtained during the scoping process pursuant to CEQA and NEPA. The notice of preparation (NOP) was released November 14, 2005, and the notice of intent (NOI) was published in the Federal Register on November 28, 2005. Written comments were received in response to these notifications.

Scoping activities for this Program EIR/EIS were conducted between November 15 and December 16, 2005. Because of the geographic extent and complexity of the proposed project, a series of six scoping meetings were held throughout the region, along with other meetings, briefings, and involvement activities. Each scoping meeting had an afternoon session (from 3:00 to 5:00 p.m.) and an evening session (from 6:00 to 8:00 p.m.) to accommodate agencies, interested parties, and the general public.

The Program EIR/EIS scoping process identified areas of potential concern related to the proposed HST system in the study region. Many comments related to a preference for either Altamont Pass or Pacheco Pass alignment alternatives. Many comments indicated the need for an improved statewide transportation system that is reliable, cost effective, and easy to use. Many comments emphasized the need for an HST system to connect to existing transportation systems, including airports. Providing for potential freight service was also a frequent theme, as was the need to separate HST and heavy freight operations. Issues of concern about the environment typically focused on potential noise and visual impacts, safety, and impacts on air quality and sensitive habitats. The potential for growth inducement was also raised. The scoping process and outcomes, including comments and concerns, are documented in the *Bay Area to Central Valley Scoping Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006).

B. AGENCY INVOLVEMENT

Following the issuance of the NOI and NOP and the scoping meetings, the Authority and the FRA formed a working group of representatives from 27 federal and state agencies to assist in the environmental review process. The interagency group met during the Program EIS/EIR development to discuss major issues from the perspective of these agencies and to provide input to the lead agencies to help focus the analysis and streamline the review process.

The federal and state agency representatives included in this process were asked to provide input for the following specific areas:

- Scope of the Program EIR/EIS.
- Purpose and need statement.
- Technical methods of analysis and study area definition.

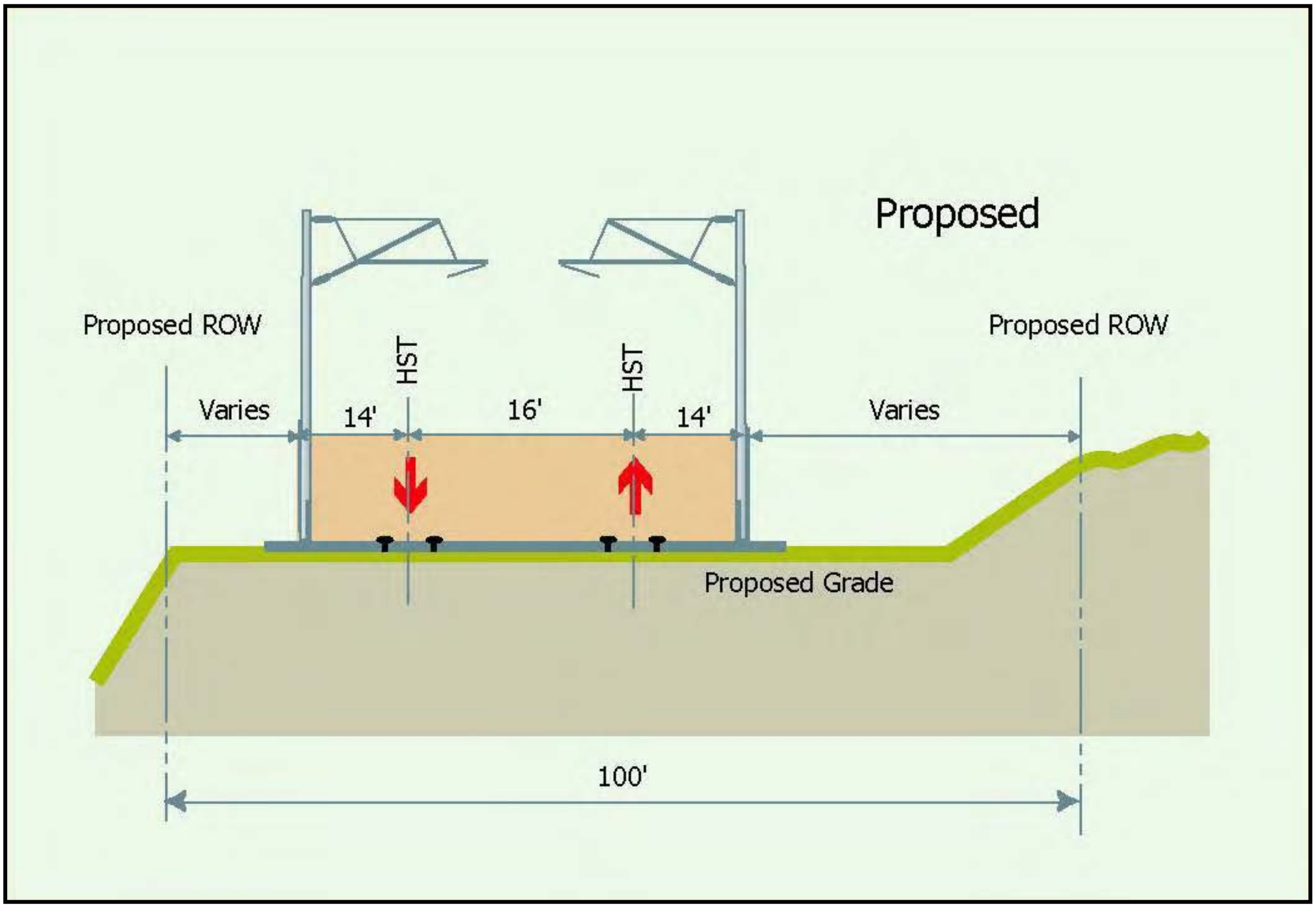


Figure 2.3-6
At-Grade Section

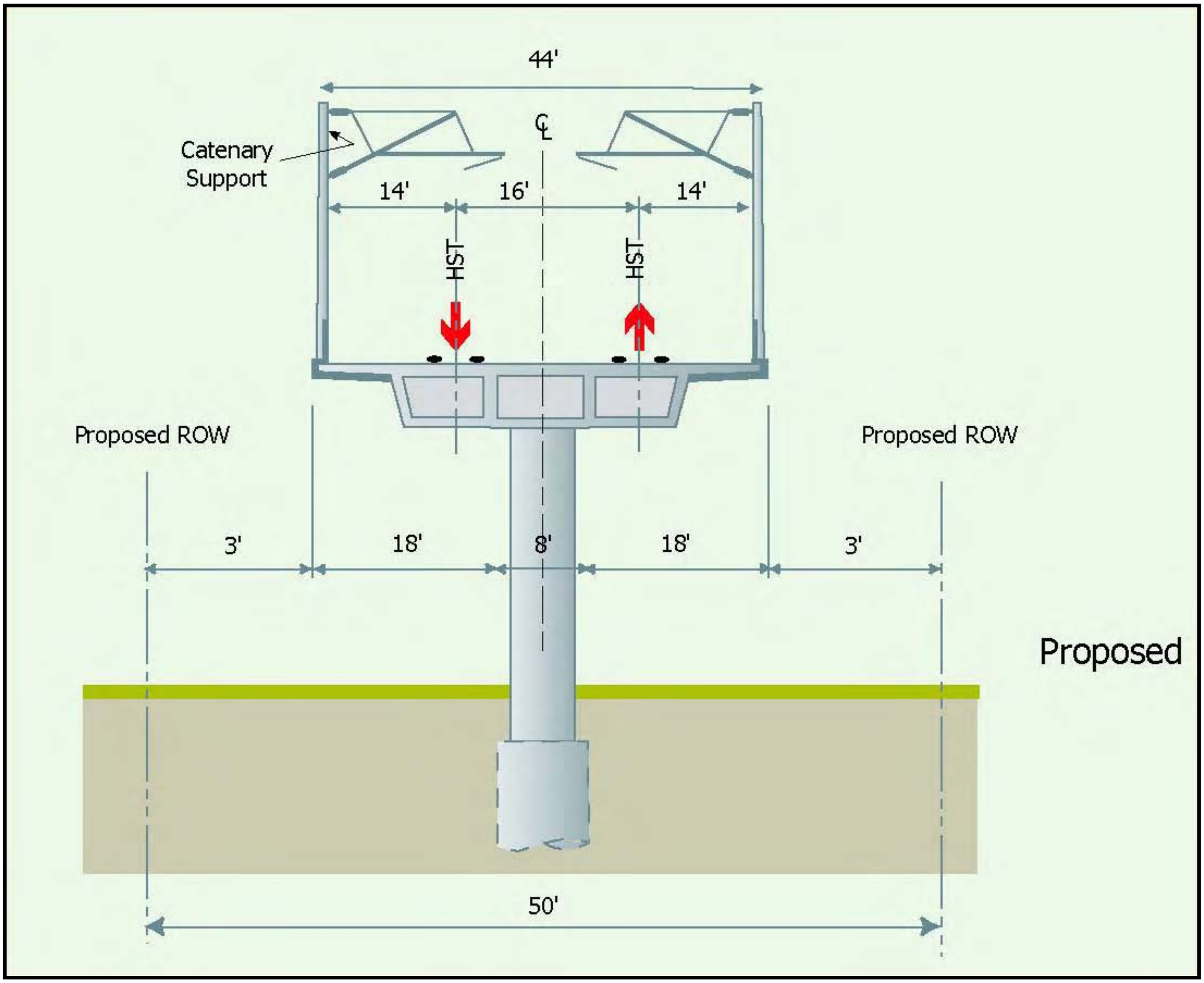


Figure 2.3-7
Elevated Structure

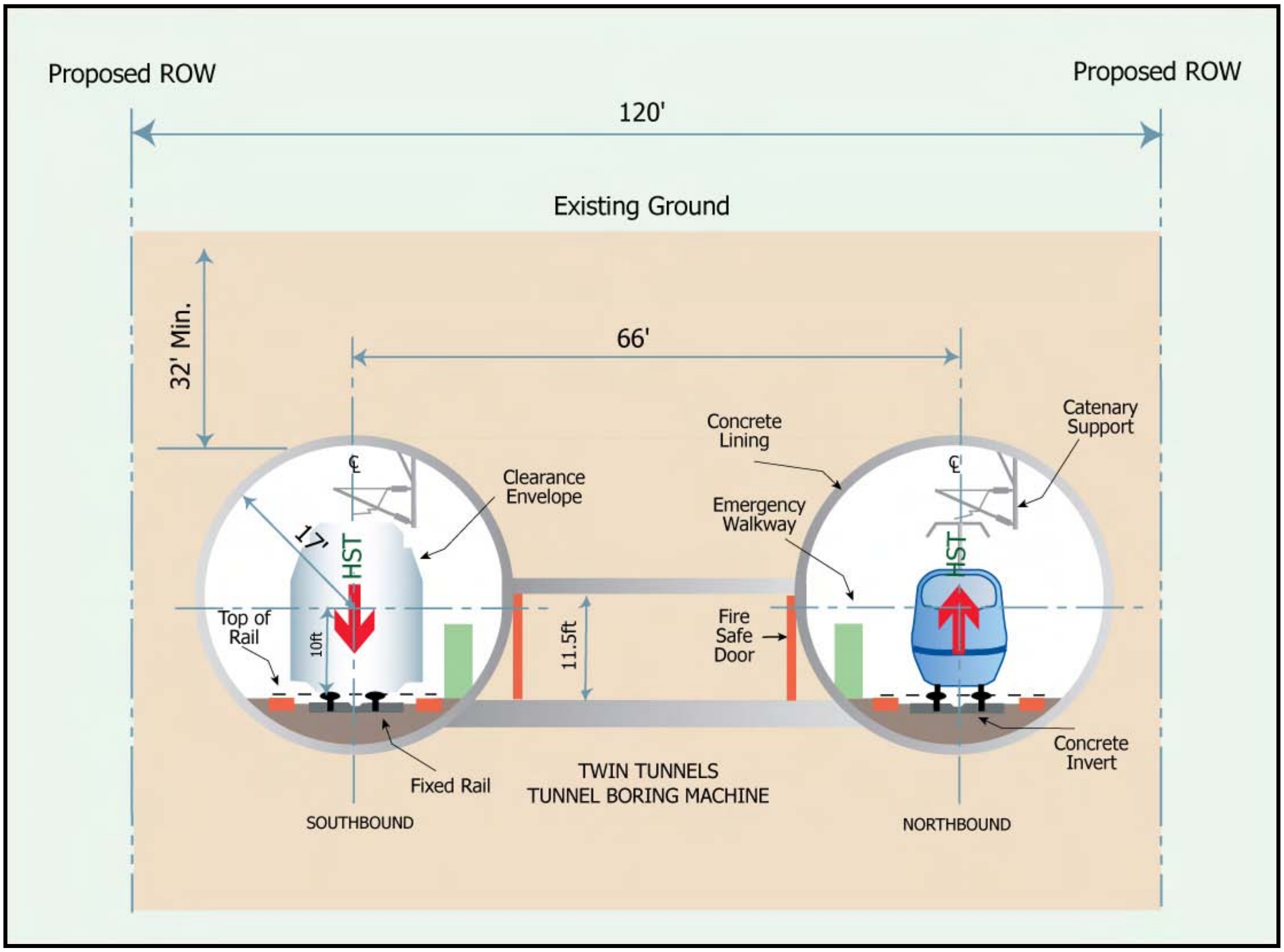


Figure 2.3-8
Twin Tunnels

- Substantive issues of particular concern.
- Sources of information and data relevant to their agencies.
- Avoidance, minimization, and mitigation strategies.
- Definition of alternatives to be analyzed in the Program EIR/EIS.
- Procedural requirements and permits or approvals necessary for subsequent phases of environmental review.

The Authority also invited input from regional and local agencies in areas potentially affected by the proposed HST system. Meetings of the Authority's governing board were also a forum for providing information about the environmental process. These meetings were held in major cities in the study region to provide a convenient opportunity for regional and local public participation and input.

As discussed in Section 1.1, the FRA is the lead federal agency for NEPA compliance, and federal cooperating agencies are the USACE and EPA. The FRA developed a memorandum of understanding (MOU) with the federal cooperating agencies to clarify expectations for the preparation and review of the Program EIR/EIS and for CWA Section 404 review. The federal cooperating agencies have met during the environmental review process to provide input to the Program EIR/EIS, and their involvement is expected to continue throughout the program environmental process.

C. TRAVEL DEMAND AND RIDERSHIP FORECASTS

Since previous ridership and revenue forecasts were prepared about 10 years ago for the Business Plan, a new intercity travel demand model was created by Cambridge Systematics for the MTC in partnership with the Authority to provide current and more refined ridership forecasts. New ridership forecasts were prepared using the new model in 2006 and 2007 to support continued development and environmental review of the proposed HST system. The model takes into account trends in travel demand, congestion, and other adverse travel conditions, which imply the market for intercity travel in California that the proposed HST system could serve will grow faster than the population by up to 46% over the next 30 years.

According to the base, or low, travel demand forecast prepared using the new model, the HST system would carry at least 88 million passengers per year by 2030 (Table 2.3-3). This estimate conservatively assumes current costs for air and automobile transportation would remain constant in real value. HST service plans were also adjusted to satisfy the new forecast for high-speed train travel demand. The proposed HST base ridership estimate also includes nearly 69,000 commuters riding every weekday by 2030, or about 25 million commuter passengers annually (out of the total 88 million annual riders). Analyses were also performed as part of the independent ridership and revenue forecasts (Cambridge Systematics 2007), using different assumptions for a 50% real increase in the costs for air and automobile travel, which resulted in a high forecast of potential ridership for the HST system of 117 million annual passengers for 2030 (36 million riders would be commuters) (Table 2.3-3).

Ridership for the HST system is now estimated to be between 88 million and 117 million passengers for 2030, with a potential for further ridership growth beyond 2030. These new ridership forecasts are higher than those analyzed in the previous program EIR/EIS for the HST system; however, this analysis is consistent with that provided in the previous document because the infrastructure and facilities footprints analyzed in that document would accommodate the new ridership forecasts. The purpose of and need for this project is to meet a part of California's future intercity travel demand in 2030 and beyond. Although the HST system would have the capacity to carry many more passengers than indicated in the high ridership forecast, by using longer trains, double-decker cars, or more frequent service (e.g., the Shinkansen system in Japan carries more than 300 million passengers annually), it is reasonable to assess the HST alternatives using forecast ridership rather than theoretical capacity.

For analysis of the proposed HST system in this Program EIR/EIS, both low and high forecasts were prepared for the No Project Alternative and two of the representative HST networks serving both San Francisco and San Jose (i.e., one for the Altamont corridor and one for the Pacheco corridor). The two representative HST networks defined the upper and lower bounds for the ridership forecasts. To assess relative changes between No Project and the HST alternatives where ridership is a governing factor, the appropriate forecasts were compared (i.e., high No Project to high HST or low No Project to low HST). The high ridership forecast of 117 million intercity trips, which includes the 36 million commuter trips figure, serves as the representative worst-case scenario for analyzing the potential environmental impacts from construction and operation of the HST system through 2030. This high forecast was generally used to define and develop the HST alternatives and is also referred to hereafter as the *representative demand*. In some specific analyses (e.g., energy, air quality, and transportation), the HST system would result in potential benefits. In those cases, analysis using the low ridership forecasts is used in this Program EIS/EIR.

Table 2.3-3
2030 Ridership Forecasts

Ridership Forecast	Year	Intercity Passengers Annually (millions)	Purpose
High [a]	2030	117 (includes 36 commuter trips)	Serves as a representative worst-case scenario for analyzing the potential for adverse environmental impacts from construction and operation of the HST system.
Low [b] (also called base)	2030	88 (includes 25 commuter trips) [c]	Used in analyses of beneficial effects from the HST system.

[a] Assumes a 50% real increase in costs for air and automobile transportation.
[b] Conservatively assumes current costs for air and automobile transportation.
[c] Included for analysis in 3.1, Traffic; 3.2, Travel Conditions; 3.3, Air Quality; and 3.5, Energy.

D. CONCEPTUAL SERVICE PLAN

To satisfy the travel time, service quality, and expected ridership (representative demand) criteria developed for the Business Plan, and accounting for the general characteristics of the corridors considered, the conceptual service plan must provide a wide variety of service options. A mix of express, semi-express, local, and regional trains would serve both intercity passengers and long-distance commuters. For HST service to be economically viable, train operations must be frequent and efficient.

According to the 2030 operating plan, a total of 124–139 weekday trains in each direction would be provided to serve the statewide HST travel market as forecast for the low- and high-end scenarios. Ninety-one to ninety-six of the trains would run between northern and southern California, and the remaining 33–43 trains would serve shorter distance markets. The basic service pattern would provide most passenger service between 6 a.m. and 8 p.m., with a few trains starting or finishing trips beyond these hours. One hundred and twenty-four to one hundred and thirty-nine trains per day could be a highly frequent operation; however, as shown below, when divided into five types of service, the frequency is greatly reduced. Frequencies would be further reduced to serve multiple end points. For example, for HST service between northern and southern California through the Central Valley, some trains would go to the Bay Area and others to Sacramento. Therefore, although there could be 19–25 local trains, only a portion of these would serve each endpoint. The following five types of intercity trains are planned:

- Express (16 trains per day): Trains running between Sacramento, San Jose, or San Francisco and Los Angeles or San Diego without intermediate stops.
- Semi-Express (17–26 trains per day): Trains running between Sacramento, San Jose, or San Francisco and Los Angeles and San Diego with intermediate stops at major Central Valley cities such as Modesto, Fresno, and Bakersfield.
- Suburban-Express (30–35 trains per day): Trains running between northern and southern California and locally within the major metropolitan areas (i.e., the San Francisco Bay Area and the Los Angeles area) at the beginning and end of the trip without intermediate stops in the Central Valley.
- Local (19–25 trains per day): Trains stopping at all stations. Some of these local trains might ultimately be operated as a "skip stop" or semi-express service, where trains would stop at only a portion of the possible stations on a specific line, to improve the service and better match patterns of demand.
- Regional (33–43 trains per day): Sacramento to San Francisco service and early morning service from the Central Valley to San Francisco or Los Angeles/San Diego.

E. HST ALIGNMENT ALTERNATIVES DEVELOPMENT

The development of the alternatives considered in this Program EIR/EIS incorporated the principles established for the HST Alternative selected in the statewide program EIR/EIS and set forth in the Business Plan to minimize capital and operating costs while maximizing total benefits. The FRA and the Authority recognized that the HST system would require a commitment of substantial resources and addressed the broad issues related to the development of a proposed HST system in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). Based on the information developed in the earlier studies discussed above and the selected HST Alternative, as well as through public and agency coordination and scoping, the Authority and the FRA were able to identify potential alternatives for implementation of the proposed HST system in the study region.

The Authority and the FRA began developing the alternatives by seeking to identify the most reasonable, practicable, and environmentally sensitive HST Alignment Alternatives and station locations for analysis in this Program EIR/EIS. As part of this process, alternatives previously considered were reevaluated, and a screening of potential alignment alternatives and station location options was conducted. This screening analyzed all reasonable and practical alignment alternatives and station location options within viable HST corridors.

The evaluation of potential HST Alignment Alternatives and station location options used the following standardized criteria: construction, environment, land use compatibility, right-of-way, connectivity/accessibility, and ridership/revenue.

The screening of alignment alternatives and stations comprised the following key activities:

- Review of past alignment and station location options identified within viable corridors from previous studies.
- Identification through the environmental scoping process of alignment alternatives and station location options not previously evaluated.

- Evaluation of alignment alternatives and station location options using standardized engineering, environmental, and financial criteria (described above) and evaluation methodologies at a consistent level of analysis.
- Identification of the ability of alignment alternatives and station location options to meet defined objectives.

The results of this analysis were documented in the *Draft Alignment Alternatives and Potential Station Locations Options Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006), presented at the Authority's March 22, 2006, Board Meeting, and in the *Additional Potential HST Alignment and Stations Considered but Rejected Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006) presented at the Authority's August 9, 2006, Board Meeting. Technical data, combined with public and agency input, provided the Authority and the FRA with the necessary information to focus further studies for the Program EIR/EIS on those alignment alternatives, station location options, and HST systems that represent a reasonable range of practicable alternatives to meet the project purpose and attain several objectives established by the Authority. Those objectives include:

- Maximize ridership and revenue potential.
- Maximize connectivity and accessibility.
- Maximize compatibility with existing and planned development.
- Maximize avoidance of areas with geologic and soils constraints.
- Maximize avoidance of areas with potential hazardous materials.
- Minimize operating and capital costs.
- Minimize impacts on natural resources.
- Minimize impacts on social and economic resources.
- Minimize impacts on cultural resources.

Complex issues associated with the tunneling were addressed as part of the statewide program EIR/EIS process. This work focused on the feasibility, construction methods, and cost assumptions associated with proposed tunneling for the HST system and resulted in the Authority's objective of minimizing the amount of tunneling required, particularly the use of long tunnels (more than 6 mi [10 km] long), due to cost, time of construction, and potential for delay. Tunnels more than 12 mi (19 km) long are considered infeasible for this project, and it is the Authority's objective to cross major fault zones at grade. The technical information produced as part of the statewide program EIR/EIS is documented in the *Tunneling Issues Report* (California High-Speed Rail Authority January 2004).

F. RELATED PROGRAMS AND STUDIES

The purpose of the proposed HST system includes "interfaces between the HST system and major commercial airports, mass transit and the highway network" (Section 1.2.1). Planned commuter rail improvements in the study region described below are related and would connect to the proposed HST system. These plans and projects have been considered in the development of the HST Alignment Alternatives and station location options.

<u>San Francisco Bay Area Regional Rail Plan</u>

Approved by Bay Area voters in March 2004, the Regional Measure 2 (RM2) Traffic Relief Plan provides funding to various transit operating assistance and capital projects and programs that have been determined to facilitate travel in the toll bridge corridors. One provision of RM2 provides for the preparation of a Regional Rail Plan to guide near- and long-term planning for an integrated and expanded passenger rail system that would also accommodate freight needs (Streets and Highways Code Section 30914 [c] [33]). Additionally, RM2 calls for the analysis of alternative California HST alignments between the Central Valley and the Bay Area, which have been used to inform this Program EIR/EIS. These two RM2 study elements have been integrated to provide a fully comprehensive San Francisco Bay Area Regional Rail Plan. RM2 provides a $4.5 million budget for the study.

The MTC, BART, Caltrain, and the Authority, along with a coalition of rail passenger and freight operators, have prepared this comprehensive Regional Rail Plan. As required by RM2, MTC adopted the Regional Rail Plan in September 2007 (available at http://www.mtc.ca.gov/planning/rail/).

The Regional Rail Plan examines ways to incorporate passenger trains into existing rail systems, improve connections to other trains and transit, expand the regional rapid transit network, increase rail capacity, coordinate rail investment around transit-friendly communities and businesses, and identify functional and institutional consolidation opportunities. The plan also includes a detailed analysis of potential high-speed rail routes between the Bay Area and the Central Valley consistent with the Authority's environmental review of the proposed rail lines. Overall, the plan looks at improvements and extensions of railroad, rapid transit, and high-speed rail services for the near term (5–10 years), intermediate term (10–25 years), and long term (beyond 25 years).

The Regional Rail Plan is intended to create a rail network that addresses the anticipated growth in transportation demand and help deliver the long-range vision of rail for the Bay Area. The Regional Rail Plan's network and services are intended to:

- Address the combined challenges of moving people and goods.
- Link people with commercial, employment, and residential centers.
- Expand capacity for goods movements to support the regional economy.
- Identify the most cost-effective investments.
- Serve as the backbone of an integrated regional transit network with seamless connections at key transit hubs to local transit services.
- Accommodate development of statewide high-speed rail, and enable operation of regional services along high-speed lines, and vice-versa.
- Include policies and incentives to encourage local governments to create well-designed, walkable communities with a mix of services near transit.
- Promote a governance structure that can develop regional system improvements and deliver coordinated, customer-oriented services.

MTC, BART, Caltrain, and the Authority staffs are managing the Regional Rail Plan. As required in RM2, a steering committee consisting of regional rail passenger operators, freight railroad operators, and county congestion management agencies provided direction during the plan development. The steering committee was the forum for coordinated review and comment on the plan prior to its submission to MTC for approval. An advisory group of regional specialists in the fields of academia, business, land use, and the environment also helped to refine the study's technical analysis. Outreach to freight and rail operators, public agencies, and community stakeholders was ongoing throughout the study process.

Capitol Corridor Rail Service

The Capitol Corridor, having recently completed track improvements between Oakland and San Jose that allowed an increase in service frequency, is planning to implement a next phase of capacity increasing projects in the Oakland to San Jose corridor and a series of track improvements aimed at reliability in the Oakland to Sacramento corridor. A track capacity enhancement project is also planned for the Auburn to Sacramento corridor which will allow, in a phased project implementation approach, service frequency increases in this portion of the corridor. Projects previously programmed by the State include the Capitol Corridor Joint Powers Authority's (CCJPA's) contribution to the San Jose 4th Main Track project and the Bahia Track Improvement project.

With the recent passage of Proposition 1B, a series of projects that jointly benefit both freight and passenger rail are identified. The projects may include a revised Alameda Creek crossing in the Niles Junction area which will allow transfer of freight rail traffic to and from the Altamont Pass from the Oakland Port in a more expeditious route than is done currently running freight through Fremont. This improvement coupled with improvements at a junction point in South Hayward will allow passenger trains (Capitol Corridor and the planned Dumbarton Rail service) to avoid freight conflicts for a portion of the route between Oakland and San Jose. Double tracking is also planned north of the South Hayward point which will provide for additional track capacity for freight and passenger trains. A costly project planned for the route at some point will be to upgrade or replace the bridge crossing between Martinez and Benicia to avoid the conflicts created when waterborne vessels require the current bridge to be lifted. The anticipated increases in freight traffic coupled with passenger rail service are expected to become so frequent that the delays caused by bridge liftings could create catastrophic delays for all forms of rail service.

Caltrain Corridor Commuter Rail Service

The Caltrain Joint Powers Board (JPB) forecasts a robust increase in Caltrain ridership driven by population increase, work force increase, and convenience and economic influences. Reports generated by the Caltrain discuss the "pull" demand composed of elective riders who could chose the automobile but elect to ride the commuter rail system as a preferred provider. According to the Caltrain JPB, this latent demand has been proven to be real based on the extraordinary growth in ridership realized in 2005 and 2006.

The first 5 years of the Caltrain capital program focuses on a program called the State of Good Repair. This program concentrates on optimizing the current system's performance. The activities in this program range from improvements to the signaling and communications systems to replacing old bridges, from improving the approach speeds and flexibility at the San Francisco terminus to eliminating the last of the hold-out stations. The product of this portion of the program is an optimal condition of the current system which will enable larger programs with minimal impact to performance.

The current method of Caltrain operation will reach its maximum capacity in less than 5 years, even with the system improvements previously mentioned. Electrification, which is required for connection to the Transbay Transit Center and to accommodate the HST on the line, presents the JPB with two implementation options to consider, each with fundamental performance differences. The first option is to purchase electrified locomotives to haul standard passenger coaches that currently run on Caltrain. This solution is relatively low risk for the JPB and supports operations to the Transbay Transit Center. However, this solution is problematic for the Authority because standard North American rail equipment is not compatible with HSTs currently in service around the world, and the HST would require high-level platforms.

The second option for the JPB is to procure electric multiple units (EMUs) that would be compatible with the European or Japanese HSTs that the Authority may select (non-FRA compliant). This option would support operations to the Transbay Transit Center and shared corridor operations with the HST and offer the JPB more flexible trains with better performance characteristics. The JPB has found this solution to be cost effective on a lifecycle basis, but there is greater risk to the JPB in that the Authority, CPUC, FRA, and Union Pacific Railroad (UPRR) must all reach agreement for implementation.

Altamont Commuter Express Service

The San Joaquin Regional Rail Commission, which owns and operates the Altamont Commuter Express (ACE), operates four daily roundtrips, Monday–Friday between Stockton and San Jose through the Altamont Pass. The 86-mile ACE corridor directly serves three counties and eight cities between the Central Valley and the Silicon Valley. The trains stop at three San Joaquin stations (Stockton, Lathrop/Manteca, and Tracy), four Alameda County Stations (Livermore [2], Pleasanton, and Fremont), and in Santa Clara County (Santa Clara [2] and San Jose).

ACE is working with the UPRR to complete a major signal upgrade project between Fremont and Stockton to improve reliability and speed on the route. Over the next 5-year period, ACE will be implementing capital projects that improve reliability and increase speeds in the Stockton to Fremont section of the corridor.

ACE is completing two planning/implementation studies.

- The *ACE Corridor Analysis Study* is focused on identifying improvements to ACE Service, which includes the potential purchase of a separate agency-owned corridor for the ACE service and short haul freight between the Port of Oakland and the Central Valley, and providing a better connection to BART. The draft corridor analysis study was completed in August 2007.
- The *Expansion Opportunities Analysis* is looking at the expansion opportunities for commuter rail service. Corridors that are being reviewed are:
  - Merced to Sacramento.
  - Stockton to Oakland (Delta Route).
  - Los Banos to Tracy.

Dumbarton Rail Project

The March 2004 voter approval of RM2 included funding to reconstruct the out-of-service Dumbarton rail line between Southern Alameda County and the San Francisco Peninsula. The reconstructed rail bridge across the bay would be the key component in the establishment of the commuter rail service between the Union City BART station and the Caltrain line on the peninsula.

New trackway connections would also need to be constructed in the vicinity of the Union City BART station to provide the transfer connection. Service would begin at Union City in the morning and would carry commuters to the west bay via Union Pacific tracks in Fremont and Newark, continuing on the publicly owned and reconstructed Dumbarton segment. Rail equipment comparable to current Caltrain rolling stock is expected to be employed.

The reconstructed Dumbarton segment includes embankment, trestle structure, and two swing bridges; most of the segment is single track with limited passing sidings. New stations would be built in Menlo Park and Newark as well as at the Intermodal Station at Union City. The connections of the Dumbarton Line to Caltrain in Redwood City would also be improved as part of the project. The project is currently being considered for phased implementation due to funding constraints and the inability to reach a track sharing agreement with the Union Pacific Railroad. The initial phase would include the reconstruction of the publicly owned right of way between Newark and Redwood City.

Rail service would operate from a Newark station across the reconstructed bridge to Redwood City and Caltrain. A second component of the project, the Union City Intermodal Station, would also be constructed and utilized by the Capital Corridor service.

Environmental studies are now under preparation; preliminary engineering is also underway to refine the estimated cost for rehabilitating the bay-crossing structures. Local land use plans, both adopted or under preparation, support TOD at the project station locations.

While the Dumbarton Rail project might be able to be completed prior to implementation of the HST system, it conflicts with the proposed HST system and the JPB's Caltrain Corridor EMU option. Conventional trains to be used for the Dumbarton rail service would not be compatible with HSTs currently in service around the world, nor with the similar EMUs proposed for use by the JPB. The rehabilitated Dumbarton Bridge would still be a single track bridge that could not accommodate HST service should the Altamont Corridor with a bay crossing be selected. Alternatively, if high density regional rail service is developed in the future along this route, a double track bridge across the bay would likewise be necessary.

G. PROJECT PHASING

Building an HST system of over 700 miles would tax the state's resources, such as its financial, human, and material needs, and the Authority must deal with both environmental and engineering challenges. Like all the other HST networks implemented throughout the world, the Authority has determined that California HST system must be built in phases that are carefully planned; each phase in turn must be built in stages.

In order to better utilize limited resources, the Authority selected the first phase (Phase 1) and will concentrate most of its resources to the construction of that phase[2]. While placing emphasis on Phase 1, the Authority will also continue with necessary planning, environmental studies, and other activities to advance and preserve those routes and stations that are not included in Phase 1.

The major factors considered in the development of the phasing plan include the following:

- Availability of funds.
- The utility of each phase.
- Time needed for construction.
- Availability of public and private partners.
- Need for right-of-way acquisition.

The phasing decision took into consideration the cost, ridership, and revenue data presented to the Board on April 18, 2007. The phasing decision is also based on the following needs and goals:

- Early utilization of some segments.
- Some degree of local and regional participation in the early construction and funding.
- Serving many regions.
- Significant operating surplus to include a private partner in the construction and operation.
- Development of a high-speed segment of around 100 miles for building, testing, and commissioning the high-speed trainsets, equipment, and systems.

[2] At the May 23, 2007, Authority meeting in Sacramento.

- Completion in less than 10 years from today.

Phase 1: Anaheim to Los Angeles to Merced and the San Francisco Bay Area

Phase 1 connects the major metropolitan areas of the state while serving the fastest growing region, the Central Valley. Phase 1 is the backbone of the proposed HST system, producing the highest potential ridership and revenue, which in all likelihood will attract substantial private sector financing. Within Phase 1, the Authority will capitalize on early improvements already planned and underway for certain corridors as well as developing a high-speed train segment in the Central Valley that will provide for the commissioning and testing of the equipment.

The San Diego to Los Angeles section of the HST system is a later phase because the SCAG is continuing its studies aimed at magnetic levitation (Maglev) HST service between Los Angeles, Ontario, and Riverside. Similarly, in the San Diego region, the San Diego Association of Governments (SANDAG) will be studying the potential use of Maglev technology between San Diego and Riverside. The section from Merced to Sacramento is a later phase due to the lower ridership potential than the connection to the Bay Area.

2.4 No Project Alternative

The No Project Alternative describes the study region without implementation of the HST system and is the basis for comparison of the HST Alignment Alternatives. The No Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it is currently and as it would be after implementation of programs or projects that are currently projected in RTPs, have identified funds for implementation, and are expected to be in place by 2030. This financially constrained level of infrastructure improvement (based on the expected federal, state, regional, and local funding) was analyzed in consideration of the considerable growth in population and transportation demand that is projected to occur by 2030. The No Project Alternative addresses the geographic area that serves the major destination markets for intercity travel and that would be served by the proposed HST system in the study region. This area extends generally from the San Francisco Bay Area and Sacramento through the Central Valley. Figure 2.4-1 illustrates the existing intercity transportation infrastructure that serves these major travel markets.

The No Project Alternative satisfies the statutory requirements under CEQA and NEPA for an alternative that does not include any new action or project beyond what is already committed. The No Project Alternative includes the existing and future statewide intercity transportation system based on programmed and funded improvements through 2030, according to the following sources of information.

- State Transportation Improvement Project (STIP).
- Regional Transportation Plans (RTPs), financially constrained projects for all modes of travel.
  - Transportation 2030 Plan for the San Francisco Bay Area, MTC, February 2005.
  - *2006 Metropolitan Transportation Plan,* Sacramento Area Council of Governments (SACOG), Adopted March 16, 2006.
  - *2004 Regional Transportation Plan*, Council of Fresno County Governments, Adopted July 22, 2004.
  - *2004 Regional Transportation Plan for Merced County*, Merced County Association of Governments (MCAG), Adopted August 19, 2004.
  - *2004 Regional Transportation Plan: Vision 2030*, San Joaquin Council of Governments.
  - *2004 Regional Transportation Plan*, Stanislaus Council of Governments, 2004.

- Airport plans
- Intercity passenger rail plans

The future improvements that would be part of the No Project Alternative are also included in the assumed future 2030 baseline conditions for the Study Region under the HST Network and Alignment Alternatives. The No Project Alternative includes highway, aviation, and conventional rail elements, as discussed below.

2.4.1 Highway Element

The No Project highway system that currently serves the intercity travel market in the study region proposed to be served by the HST Alternative includes the highways identified in Table 2.4-1 and illustrated in Figure 2.4-1. The No Project Alternative includes this existing highway system, as well as funded and programmed improvements on the intercity highway network based on financially constrained RTPs developed by regional transportation planning agencies. Intercity highway improvements included as part of the No Project Alternative include infrastructure projects, as well as intelligent transportation system (ITS) and other potential system improvements programmed to be in operation by 2030. The improvements consist primarily of individual interchange improvements and roadway widening projects on limited segments of the highway network. As such, the improvements do not cumulatively add considerable line capacity to the highway system. The intercity highway improvements included as part of the No Project Alternative are identified by county in Appendix 2-A. This list of projects is consistent with “the Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study” which supplied the ridership numbers for this EIR/EIS.

Table 2.4-1
Existing California Intercity Highway System

Interstate Highway	U.S. Highway	State Route
I-5	US-101	SR-14
I-80		SR-17
I-205		SR-24
I-280		SR-92
I-580		SR-99
I-680		SR-237
I-880		SR-237

2.4.2 Aviation Element

The air transportation system evaluated under the No Project Alternative consists of 5 airports that currently provide commercial service in the study region proposed to be served by the HST Alignment Alternatives (study area). The airports do not necessarily provide commercial service between the same intercity markets as the proposed HST system. These airports are illustrated in Figure 2.4-1 and listed below.

- San Francisco International Airport (SFO).
- Oakland International Airport (OAK).
- Norman Y. Mineta San Jose International Airport (SJC).
- Modesto City-County-Harry Sham Field (MOD).
- Merced Municipal/Macready Field (MCE).

Figure 2.4-1
Study Area Transportation System

The airport development process is distinct from the highway and rail development processes and is not documented in local/regional transportation plans or in the STIP. In addition, because many airport improvements are funded with a combination of public and private funds, there is limited formal public documentation identifying committed projects that are likely to be operational by 2030.

For this analysis and to conceptualize a 2030 No Project airport system, criteria for airport development were developed to review proposed projects and determine their likelihood for implementation and operation by the year 2030. Proposed airport improvements were evaluated based on a review of available documentation, interviews with airport planning and development professionals, local area knowledge, and public agency input. An airport improvement is deemed likely to be implemented and operational by 2030 if the improvement meets the following criteria:

- Has been identified in an approved or under-development airport master planning program, environmental document, regional aviation system planning document, or capital improvement program, and
- Is reasonably practical to place into operation by 2030.

By applying this approach, the airport improvements likely to be funded, programmed, and operational by 2030 are summarized in Table 2.4-2.

Only a portion of the programmed, funded, and potentially operational improvements for 2030 are related to California intercity trips entirely made within the state. The projected aviation improvements were adjusted to represent only the intra-California proportional share, based on the Passenger Survey for California Market Demand in the *Official Airline Guide [OAG]* (Parsons Brinckerhoff 2002) as summarized in Table 2.4-3. The addition of this proportion of improvements to the existing 2001 airport facilities and aviation system is represented in the No Project Alternative. Appendix 2-B provides a detailed description of the aviation element of the No Project Alternative.

Table 2.4-2
Assumed Total Programmed, Funded, and Operational Airport Improvements[a]

Airport	Passenger Terminal Size (square feet)	Runways	Gates	Primary Access Lanes	Parking Spaces (On-/Off-Site)
Bay Area					
Oakland (OAK)	320,000	0	12	2[c]	10,000
San Jose (SJC)	500,000	0	17	2	6,400

[a] Total improvements assumed to be programmed, funded, and operational by 2030.

[b] The City and County of San Francisco and the FAA have commenced preparation of an EIR/EIS for a runway expansion/reconfiguration at SFO that may occur before 2030. It is not assumed as part of the No Project improvements because it does not meet the criteria as established.

[c] Includes the Oakland Airport Connector project, which is under construction. The connector is a 3 (approx.)-mile people mover, operating on exclusive guideway connecting the Oakland International Airport to the BART Coliseum Station.

Sources: Master planning and environmental documents, regional aviation system planning documents, and interviews with local area airport staff and airport planners (Chapter 12).

Table 2.4-3
Assumed Programmed, Funded, and Operational Improvements
Adjusted for Trips inside California*

Airport	Passenger Terminal Size (square feet)	Runways	Gates	Highway Lanes	Parking Spaces (On-/Off-Site)
Bay Area					
Oakland (OAK)	192,000	0	7	1	6,010
San Jose (SJC)	245,000	0	8	1	3,140

* Adjusted to represent the proportional share of improvements by 2030 for intercity California trips only. Assumed intercity California trips are Oakland 60% and San Jose 49%

Sources: *Official Airline Guide Passenger Survey for California Market Demand*, August 2002 and Parsons Brinckerhoff 2002.

2.4.3 Conventional Passenger Rail and Bay Area Transit Elements

Existing intercity passenger rail service is provided on four principal corridors covering more than 1,300 route mi (2,092 route km) and spanning almost the entire state. The No Project passenger rail network is composed of two of these corridors (Capitol corridor and San Joaquin corridor) as illustrated in Figure 2.4-1 and described below. Within these corridors, the intercity passenger service shares track with freight and/or commuter services. The primary portions of these corridors serve the same intercity markets as the proposed HST Alignment Alternatives. All the intercity passenger rail system improvements identified in the STIP and the Caltrans California Intercity Rail Capital Program for implementation prior to 2030 are included in the No Project Alternative and are identified in Appendix 2-C-2. To increase levels of passenger service, the improvements consist of additional track capacity, maintenance and storage facilities, grade-crossing improvements, track and signal improvements, and expanded or upgraded passenger stations.

The transit projects assumed as part of the No-Build project are listed in Appendix 2-C-1. This project list is consistent with the “Future Baseline” list assumed for the “Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study,” which provided the ridership numbers for this EIR/EIS.

2.5 High-Speed Train Alternatives

HST Network Alternatives represent different ways to combine HST Alignment Alternatives and station location options to implement the HST system in the study region. This Program EIR/EIS focuses on analysis and describes overall effects related to HST Alignment Alternatives. Because there are many possible combinations of alignments and stations, representative HST Network Alternatives are considered and described to better understand the implications of selection of certain alignment alternatives and station location options. Representative network alternatives are shown in Table 2.5-1.

The network alternatives vary in their ability to meet the purpose and need and objectives of the HST system and provide additional data to inform the future identification of preferred alignment alternatives and station location options. Although HST Alignment Alternatives and station location options were screened and evaluated to identify those that are likely to be reasonable and practicable and to meet the project’s purpose and need, the representative network alternatives have not yet been so evaluated. The network alternatives were developed to enable an evaluation and comparison of how various combinations of alignment alternatives would meet the project’s purpose and need and how each would perform as a HST network (e.g., travel times between various station locations, anticipated ridership, operating and maintenance costs, energy consumption, and auto trip diversions). Extensive summary data about the network alternatives are presented in Chapter 7, and important differences are identified to inform decision makers and the public in the Summary.

The different system characteristics, as well as environmental factors of the network alternatives, present complex choices. Informed by public review and comment on the draft Program EIR/EIS, the Authority prepared the evaluation for consideration by the Authority board after the public comment period. Chapter 8 of this final Program EIR/EIS presents this evaluation and identifies the preferred HST Alignment Alternatives and station location options, as well as the Preferred HST Network Alternative.

Table 2.5-1
Summary Table of Representative High-Speed Train Network Alternatives

Network Alternatives	Alignments for Representative Alternative
Altamont Pass	
San Francisco and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Dumbarton (High Bridge)[1] Niles/I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connection (Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
Oakland and San Jose Termini	Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Francisco, Oakland, and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Dumbarton (High Bridge)[1] Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Jose Terminus	Niles /I-880 (Niles Junction to San Jose via I-880) [2] East Bay Connection (Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Francisco Terminus	Caltrain Corridor (San Francisco to Dumbarton) Dumbarton (High Bridge)[1] UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)

Network Alternatives	Alignments for Representative Alternative
Altamont Pass (continued)	
Oakland Terminus	Niles /I-880(West Oakland to Niles Junction) East Bay Connection (Dumbarton/Niles XN) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
Union City Terminus	Niles /I-880(Union City BART to Niles Junction) East Bay Connection (Dumbarton/Niles XN) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Francisco and San Jose – via SF Peninsula	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Dumbarton (High Bridge) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Francisco, San Jose, and Oakland – with no San Francisco Bay Crossing	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
Oakland and San Francisco – via Transbay Tube	Transbay Crossing – Transbay Transit Center Niles /I-880(West Oakland to Niles Junction) East Bay Connection (Dumbarton/Niles XN) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)
San Jose, Oakland, and San Francisco – via Transbay Tube	Transbay Crossing – Transbay Transit Center Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880)[2] East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont) Tracy Downtown (UPRR Connection) UPRR (Central Valley)

Pacheco Pass	
San Francisco and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
Oakland and San Jose Termini	Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
San Francisco, Oakland, and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
San Jose Terminus	Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
San Jose, San Francisco, and Oakland – via Transbay Tube	Transbay Crossing – Transbay Transit Center Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR
San Jose, Oakland, and San Francisco – via Transbay Tube	Transbay Crossing – Transbay Transit Center Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection BNSF - UPRR

Pacheco Pass with Altamont Pass (Local Service)	
San Francisco and San Jose Termini	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Dumbarton (High Bridge) UPRR (Niles to Altamont)[3] Tracy Downtown (UPRR Connection)[4] UPRR (Central Valley) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection
Oakland and San Jose Termini	Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) East Bay Connections (Dumbarton/Niles XN & Dumbarton/Niles XS) UPRR (Niles to Altamont)[3] Tracy Downtown (UPRR Connection)[4] UPRR (Central Valley) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection
San Francisco, Oakland, and San Jose Termini (without Dumbarton Bridge)	Caltrain Corridor (San Francisco to Dumbarton) Caltrain (Dumbarton to San Jose) Niles /I-880(West Oakland to Niles Junction) Niles /I-880 (Niles Junction to San Jose via I-880) East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS) UPRR (Niles to Altamont)[3] Tracy Downtown (UPRR Connection)[4] UPRR (Central Valley) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection
San Jose Terminus	Niles /I-880 (Niles Junction to San Jose via I-880) [2] East Bay Connection (Dumbarton/Niles XS) UPRR (Niles to Altamont)[3] Tracy Downtown (UPRR Connection)[4] UPRR (Central Valley) Pacheco (San Jose to Western Valley) Henry Miller (Western Valley to BNSF/UPRR) Henry Miller UPRR Connection

1 Does not include Dumbarton Wye South to Caltrain segment.

2 Does not include Niles Junction to Niles Wye South (Niles/I-880 5A) segment.

3 Does not include “express tracks” through Pleasanton station.

4 Does not include “express tracks” through Tracy station.

2.5.1 HST Alignment Alternatives and Station Location Options

Informed by previous studies and the scoping process, the Authority and the FRA evaluated potential HST Alignment Alternatives in the study region and defined those that best meet the project purpose, which is *to provide a reliable high-speed electrified train system that links the major Bay Area cities to the Central Valley, Sacramento, and Southern California, and that delivers predictable and consistent travel times. Further objectives are to provide interfaces between the HST system and major commercial airports, mass transit and the highway network and to relieve capacity constraints of the existing transportation system in a manner sensitive to and protective of the Bay Area's and California's unique natural resources.* The study region is shown in Figure 1.1-1. The Authority and FRA conducted a screening evaluation to identify potential alignment alternatives and station location options that are anticipated to be practicable, reasonable, and feasible for further consideration in this Program EIR/EIS. These alignment alternatives and station location options are shown in Figure 2.5-1 and described as part of this section.

The screening evaluation included the following activities:

- Review of alignment alternatives and station location options identified in previous studies in the study region.
- Identification of alignment alternatives and station location options not previously evaluated.
- Evaluation of alignment alternatives and station location options using standardized engineering, environmental, and financial criteria and evaluation methodologies.
- Evaluation of alignment alternatives and station location options against defined objectives.

The alignment and station-screening evaluation was combined with public and agency input that together provided the Authority and the FRA with the necessary information to identify a reasonable range of alignment, station location, and HST corridor options. The evaluation of potential HST Alignment Alternatives and station location options within viable corridors used the following standardized criteria:

- Construction: Substantial engineering and construction complexity as well as excessive initial and/or recurring costs were considered criteria for project impracticability because they present logistical constraints.
- Environment: A high potential for considerable impacts to natural resources including water resources, streams, floodplains, wetlands, and habitat of threatened or endangered species was considered a criterion for failing to meet project objectives.
- Land Use Compatibility: Substantial incompatibility with current or planned local land use as defined in local plans was considered a criterion for failing to meet project objectives.
- Right-of-Way: A lack of available right-of-way or extensive right-of-way needs that would result in excessively high acquisition costs for a corridor, technology, alignment, or station were considered criteria for project impracticability.
- Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway, or transit systems) that would impair the service quality and could reduce ridership of the HST system was considered a criterion for failing to satisfy the project purpose.
- Ridership/Revenue: Longer trip times or suboptimal operating characteristics that would result in low ridership and revenue were considered criteria for failing to satisfy the project purpose.

Table 2.5-2 presents the relationship of objectives and criteria applied in the screening evaluation. The objectives and criteria used in this evaluation represent further refinement of those used in previous studies and incorporated the HST system performance goals and criteria. Alignment alternatives and station location options were considered and compared based on these established objectives and criteria.

Table 2.5-2
High-Speed Rail Alignment and Station Evaluation Objectives and Criteria

Objective	Criteria
Maximize ridership/revenue potential	Travel time Length Population/employment catchment area
Maximize connectivity and accessibility	Intermodal connections
Minimize operating and capital costs	Length Operational issues Construction issues Capital cost Right-of-way issues/cost
Maximize compatibility with existing and planned development	Land use compatibility and conflicts Visual quality impacts
Minimize impacts on natural resources	Water resources impacts Floodplain impacts Wetland impacts Threatened and endangered species impacts
Minimize impacts on social and economic resources	Environmental justice impacts (demographics) Farmland impacts
Minimize impacts on cultural and parks/wildlife refuge resources	Cultural resources impacts Parks and recreation impacts Wildlife refuge impacts
Maximize avoidance of areas with geologic and soils constraints	Soils/slope constraints Seismic constraints
Maximize avoidance of areas with potential hazardous materials	Hazardous materials/waste constraints

Engineering criteria, such as operational, construction, and right-of-way issues, were evaluated qualitatively. The screening evaluation criteria are consistent with the criteria applied in the previous studies. The criteria related to HST operations are based on accepted engineering practices, the criteria and experiences of other railway and HST systems, and the comments of HST manufacturers.

The broad objectives and criteria related to the environment used for evaluation reflect the objectives of NEPA and CEQA and are consistent with the objective of the CWA Section 404(b)(1) to provide consideration of alternatives to minimize impacts on waters of the United States. The environmental constraints and impacts criteria focus on environmental issues that can affect the location or selection of alignments and stations.

The results of the alignment and station evaluation are described in the *Draft Alignment Alternatives and Potential Station Location Options Report* (California High-Speed Rail Authority and Federal Railroad Administration 2006), which was presented at the March 22, 2006, Authority Board meeting, and the *Additional Potential HST Alignments and Stations Considered but Rejected Report,* which was presented

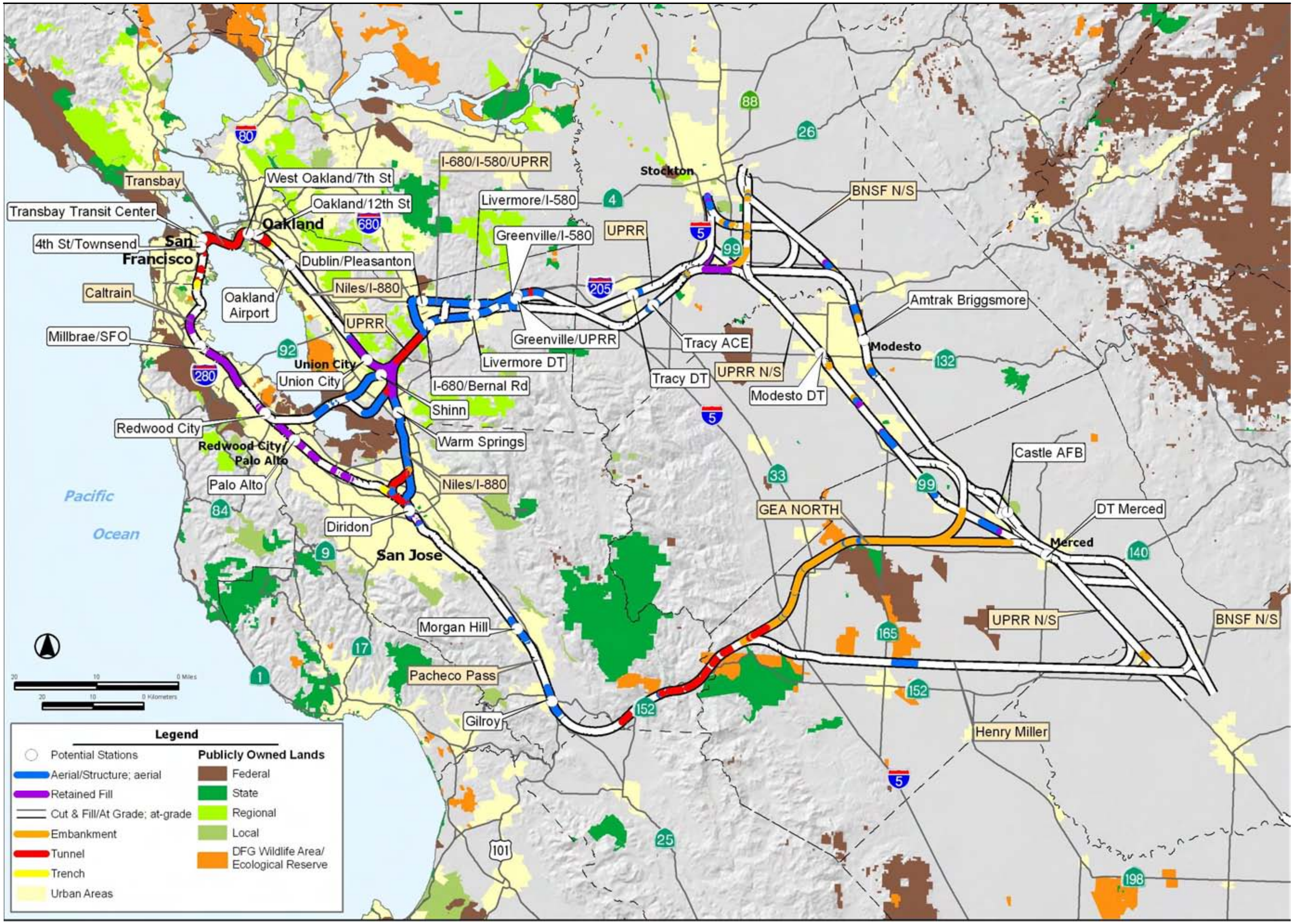


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Figure 2.5-1
Bay Area to Central Valley—High-Speed Train Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

at the August 9, 2006, Authority Board meeting. Some alignment alternatives and station location options were considered and removed from further study.

- For most of the alignment alternatives and station location options not carried forward, failure to meet the general project purpose and objectives and practicability constraints were the primary reasons for elimination.
- Environmental criteria were considered a reason for elimination when an alignment alternative or station location option had considerably more probable environmental impacts than other practicable alignment alternatives or station location options for the same corridor.
- General project purpose and objectives were considered in terms of ridership potential, connectivity and accessibility, incompatibility with existing or planned development, and severe operational constraints.
- Practicability constraints were considered in terms of cost, constructability, right-of-way constraints, and other technical issues. To assess the constructability of tunnels, some specific thresholds were established to help guide the evaluation. Continuous tunnel lengths of more than 12 mi (19 km) were considered impracticable, and the crossing of major fault zones at grade was also identified as a necessary criterion. For other practicability considerations (e.g., right-of-way constraints, construction issues, costs) thresholds could not be established for this program-level evaluation and impracticability was determined based on professional judgment.

Environmental constraints are identified for alignment alternatives only if they constituted primary reasons for elimination. The remaining alignment alternatives and station location options were determined to generally meet the objectives described in the purpose and need and are analyzed in detail in this Program EIR/EIS.

Proposed HST Alignment Alternatives are generally configured along or adjacent to existing rail transportation facilities, instead of creating new transportation corridors. Although a wide range of options have been considered, the Authority's initial conceptual approach, previous corridor evaluations, and the evaluation conducted as part of this Program EIR/EIS have consistently shown a potential for fewer substantial environmental impacts along existing highway and rail facilities than on new alignments through both developed and undeveloped areas. Although increasing the overall width of existing facilities could have potential impacts on the amount of land disturbed similar to those of creating new facilities, creating new facilities would also introduce potential incompatibility and severance issues in both urban communities and rural settings (farmlands, open spaces).

The station location options described in this section were identified generally and represent the most likely sites based on current knowledge, consistent with the objective to serve the state's major population centers. There is a critical tradeoff between accessibility of the system to potential passengers and the resulting HST travel times (i.e., more closely spaced stations will lengthen the travel times for local service as well as express services). The station locations shown here are spaced approximately 50 mi (80 km) apart in rural areas and 15 mi (24 km) apart in the metropolitan areas. Additional or more closely spaced stations would negatively affect travel times and the ability to operate both express and local services.

Several key factors were considered in identifying potential station stops, including speed, cost, local access times, potential connections with other modes of transportation, ridership potential, and distribution of population and major destinations along the route. Again, the ultimate locations and configurations of stations cannot be determined until the project-level environmental process has been completed.

As part of the development of the *Bay Area Regional Rail Plan* (Section 2.3.3), some HST Alignment Alternatives are being were considered for regional rail "overlay" services that would be implemented by other transportation agencies in cooperation with the Authority. Overlay services would involve operating regional commuter trains on the HST infrastructure and serving additional non-HST regional rail stations. These regional rail stations and services are not integral to the HST system and are not alternatives in this Program EIR/EIS; however, they are considered in the cumulative analysis of HST Alignment Alternatives as related but separate potential projects.

To facilitate this analysis, the study area was divided into six corridors within the study region:

- San Francisco to San Jose.
- Oakland to San Jose.
- San Jose to Central Valley.
- East Bay to Central Valley.
- San Francisco Bay Crossings.
- Central Valley Alignment.

These corridors connect different parts of the study region and are fundamentally different and distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections). The HST Alignment Alternatives and station location options considered in each corridor of the study region are discussed below. Table 2.5-3 shows the HST Alignment Alternatives, which are made up of alignment segments. Table 2.5-3 also lists the segments by map name and location description. Figure 2.5-2 illustrates the segment breakdown of each of the alignment alternatives. The analyses in Chapter 3, “Affected Environment, Environmental Consequences, and Mitigation Strategies,” compile and report information about the affected environment and environmental consequences for each alignment alternative and segment as outlined in the tables. The purpose of Chapter 7, “High-Speed Train Network and Alignment Alternatives Comparisons,” is to summarize and compare the physical and operational characteristics and potential environmental consequences associated with the HST Network Alternatives and for the various HST Alignment Alternatives within the six corridors. The HST Alignment Alternatives and station location options are described below.

Table 2.5-3
Summary Table of Alignment Alternatives and Station Location Options

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	Caltrain 1	Transbay Transit Center to 4th/Townsend
			Caltrain 2	4th/Townsend to Millbrae/SFO
			Caltrain 3	Millbrae/SFO to Redwood City
			Caltrain 4	Redwood City to Caltrain
	1 of 1	Dumbarton to San Jose	Caltrain 5	Caltrain to Dumbarton Wye
			Caltrain 6	Dumbarton Wye to Palo Alto
			Caltrain 7	Palo Alto to Santa Clara
			Caltrain 8	Santa Clara to Diridon Station
Station Location Options				
Transbay Transit Center				

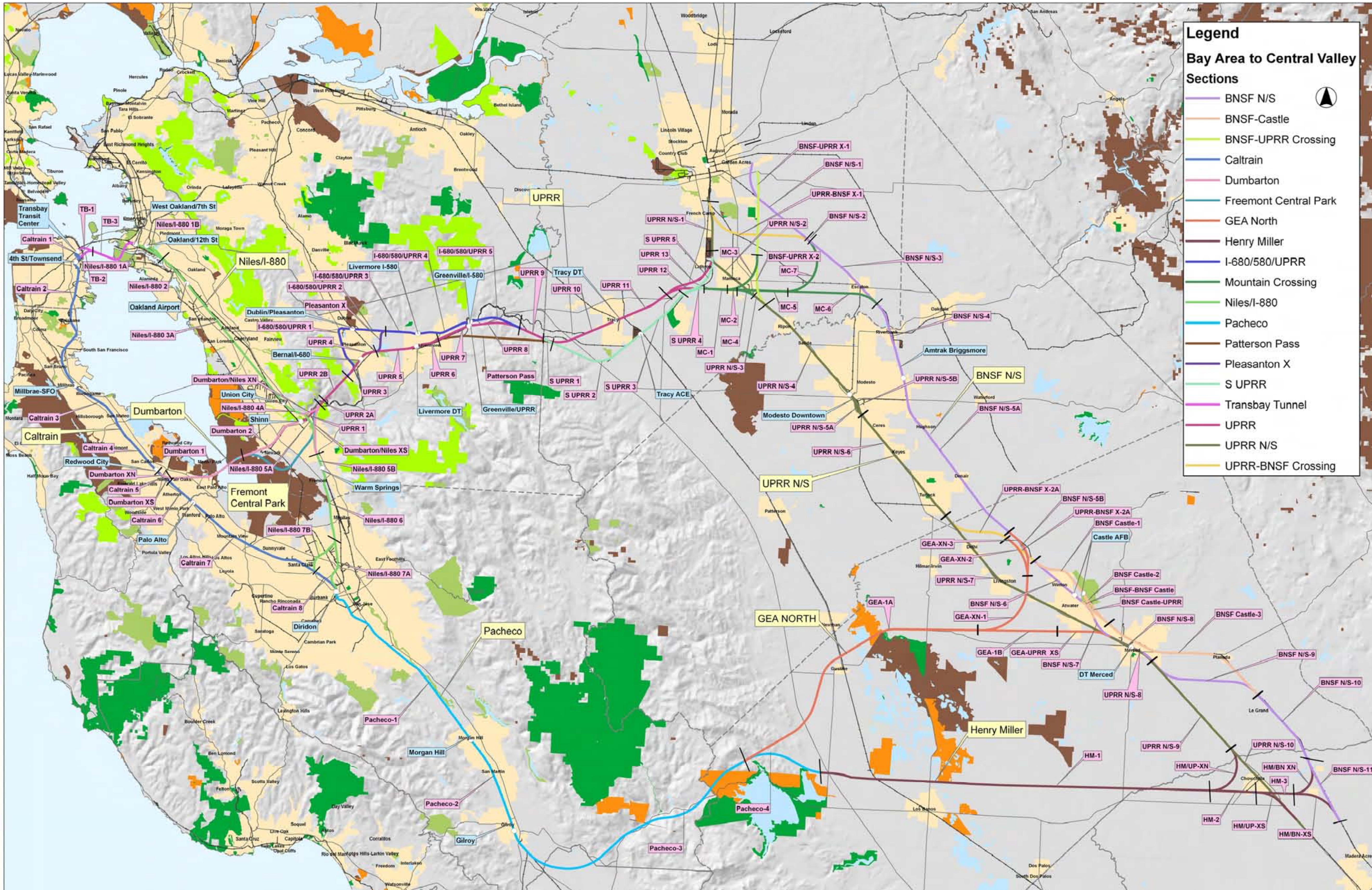

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Figure 2.5-2
Alignment Segments and Station Location Options That Compose the High-Speed Train Alignment Alternatives

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
4th and King (Caltrain)				
Millbrae/SFO				
Redwood City (Caltrain)				
Palo Alto (Caltrain)				
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	Niles/I-880 1A	West Oakland to Jack London Square
			Niles/I-880 2 (A &B)	Jack London Square to Oakland Coliseum
			Niles/I-880 3A	Oakland Coliseum to Union City (BART)
			Niles/I-880 4A	Union City (BART) to Niles Junction
		12th Street/City Center to Niles Junction	Niles/I-880 1B	12th Street/City Center to Jack London Square Niles
			Niles/I-880 2 (A & B)	Jack London Square to Oakland Coliseum
			Niles/I-880 3A	Oakland Coliseum to Union City (BART)
			Niles/I-880 4A	Union City (BART) to Niles Junction
	1 of 2	Niles Junction to San Jose via Trimble	Niles/I-880 5A	Niles Junction to Niles Wye (S)
			Niles/I-880 5B	Niles Wye (S) to Warm Springs
			Niles/I-880 6	Warm Springs to Trimble Rd.
			Niles/I-880 7B	Trimble Rd. Option
			Caltrain 8	Santa Clara to Diridon Station
		Niles Junction to San Jose via I-880	Niles/I-880 5A	Niles Junction to Niles Wye (S)
			Niles/I-880 5B	Niles Wye (S) to Warm Springs
			Niles/I-880 6	Warm Springs to Trimble Rd.
			Niles/I-880 7A	I-880 – Trimble Rd. to Diridon
Station Location Options				
West Oakland/7th Street				
12th Street/City Center				
Coliseum/Airport				
Union City (BART)				
Fremont (Warm Springs)				
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	Pacheco 1	Diridon to Morgan Hill
			Pacheco 2	Morgan Hill to Gilroy
			Pacheco 3	Gilroy to San Luis Reservoir
	1 of 3	Henry Miller	Pacheco 4	San Luis Reservoir to Valley Floor

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
		(UPRR Connection)	HM-1	Western Valley to Henry Miller UP Wye
			HM-2	Henry Miller UP North Wye to UP South Wye
			HM/UP-XN	Henry Miller Wye North to UPRR
			HM/UP-XS	Henry Miller Wye South to UPRR
		Henry Miller (BNSF Connection)	Pacheco 4	San Luis Reservoir to Valley Floor
			HM-1	Western Valley to Henry Miller UP Wye
			HM-2	Henry Miller UP North Wye to UP South Wye
			HM-3	Henry Miller UP South Wye to BNSF Wyes
			HM/BN-XN	Henry Miller Wye North to BNSF
			HM/BN-XS	Henry Miller Wye South to BNSF
		GEA North	GEA-1	San Luis Reservoir to Atwater Wye
			GEA-BNSF XN	GEA Atwater Wye North to BNSF
			GEA-UPRR XS	GEA Atwater Wye South to Merced UP
Station Location Options				
San Jose (Diridon)				
Morgan Hill (Caltrain)				
Gilroy (Caltrain)				
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	UPRR 2 (A & B)	Niles Canyon to Sunol
			I-680/580/UPRR 1	Sunol to Dublin/Pleasanton BART
			I-680/580/UPRR 2	Dublin/Pleasanton BART to El Charo Road
			I-680/580/UPRR 3	El Charo Road to Livermore (I-580)
			I-680/580/UPRR 4	Livermore (I-580) to Greenville
			I-680/580/UPRR 5	Greenville to Altamont Pass
			UPRR 9	Altamont Pass to County Line
		I-580/UPRR	UPRR 2 (A & B)	Niles Canyon to Sunol
			UPRR 3	Sunol to Pleasanton
			UPRR 4	Pleasanton to El Charo
			Pleasanton X	UPRR to I-580 connector
			I-680/580/UPRR 3	El Charo Road to Livermore (I-580)
			I-680/580/UPRR 4	Livermore (I-580) to Greenville
			I-680/580/UPRR 5	Greenville to Altamont Pass
			UPRR 9	Altamont Pass to County Line
		Patterson Pass/UPRR	UPRR 2 (A & B)	Niles Canyon to Sunol
			UPRR 3	Sunol to Pleasanton

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
			UPRR 4	Pleasanton to El Charo
			UPRR 5	El Charo to Livermore
			UPRR 6	Livermore to Patterson Pass cut off
			Patterson Pass	Patterson Pass
		UPRR	UPRR 2 (A & B)	Niles Canyon to Sunol
			UPRR 3	Sunol to Pleasanton
			UPRR 4	Pleasanton to El Charo
			UPRR 5	El Charo to Livermore
			UPRR 6	Livermore to Patterson Pass cut off
			UPRR 7	Patterson Pass cut off to Greenville
			UPRR 8	Greenville to Altamont Pass
			UPRR 9	Altamont Pass to County Line
	1 of 4	Tracy Downtown (BNSF Connection)	UPRR 10	County Line to Tracy Downtown
			UPRR 11	Tracy Downtown to I-205
			UPRR 12	I-205 to S. UPRR
			UPRR 13	I-205 to Lathrop – northern
			MC-1	Southwestern Manteca
			MC-2	Southeastern Manteca
			MC-5	Northern Escaton Wye to BNSF
			MC-6	Southern Escaton Wye to BNSF (part 1)
			MC-7	Southern Escaton Wye to BNSF (part 2)
		Tracy ACE Station (BNSF Connection)	S UPRR 1	County Line to South of Tracy
			S UPRR 2	South of Tracy to Tracy ACE Station
			S UPRR 3	Tracy ACE Station to I-205
			S UPRR 4	I-205 to Southeast of Manteca
			S UPRR 5	I-205 to Lathrop – Southern
			MC-1	Southwestern Manteca
			MC-2	Southeastern Manteca
			MC-5	Northern Escaton Wye to BNSF
			MC-6	Southern Escaton Wye to BNSF (part 1)
			MC-7	Southern Escaton Wye to BNSF (part 2)
		Tracy ACE Station (UPRR Connection)	S UPRR 1	County Line to South of Tracy
			S UPRR 2	South of Tracy to Tracy ACE Station
			S UPRR 3	Tracy ACE Station to I-205
			S UPRR 4	I-205 to Southeast of Manteca
			MC-1	Southwestern Manteca

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
			MC-2	Southeastern Manteca
			MC-3	Eastern Manteca UPRR South to BNSF
			MC-4	Manteca to Escaton Wye
		Tracy Downtown (UPRR Connection)	UPRR 10	County Line to Tracy Downtown
			UPRR 11	Tracy Downtown to I-205
			UPRR 12	I-205 to S. UPRR
			UPRR 13	I-205 to Lathrop – northern
			MC-1	Southwestern Manteca
			MC-2	Southeastern Manteca
			MC-3	Eastern Manteca UPRR South to BNSF
			MC-4	Manteca to Escaton Wye
	2 of 2	East Bay Connections	Dumbarton/Niles XN	Niles to Union City – Niles Wye (E) to Niles Wye (N)
			Dumbarton/Niles XS	Niles to Fremont – Niles Wye (E) to Niles Wye (S)
Station Location Options				
Pleasanton (I-680/Bernal Rd)				
Pleasanton (BART)				
Livermore (Downtown)				
Livermore (I-580)				
Livermore (Greenville Road/UPRR)				
Livermore (Greenville Road/I-580)				
Tracy (Downtown)				
Tracy (ACE)				
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	TB-1	Transbay Transit Center tube to SF Bay
			TB-3	SF Bay to West Oakland
		Trans Bay Crossing – 4th & King	TB-2	4th/Townsend tube to SF Bay
			TB-3	SF Bay to West Oakland
	1 of 6	Dumbarton (High Bridge)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1 (High Bridge)	Dumbarton Bay Crossing to Don Edwards
			Dunbarton-2	Don Edwards to Shinn (Centerville Line)
			UPRR 1	Shinn to Niles Wye (E)
		Dumbarton	Dumbarton XN	Dumbarton Wye North to Caltrain

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
		(Low Bridge)	Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1 (Low Bridge)	Dumbarton Bay Crossing to Don Edwards
			Dumbarton-2	Don Edwards to Shinn (Centerville Line)
			UPRR 1	Shinn to Niles Wye (E)
		Dumbarton (Tube)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1 (Tube)	Dumbarton Bay Crossing to Don Edwards
			Dunbarton-2	Don Edwards to Shinn (Centerville Line)
			UPRR 1	Shinn to Niles Wye (E)
		Fremont Central Park (High Bridge)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1	Dumbarton Bay Crossing to Don Edwards
			Fremont Central Park (High Bridge)	Don Edwards to Niles (E) via Fremont Central Park
		Fremont Central Park (Low Bridge)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1	Dumbarton Bay Crossing to Don Edwards
			Fremont Central Park (Low Bridge)	Don Edwards to Niles Wye (E) via Fremont Central Park
		Fremont Central Park (Tube)	Dumbarton XN	Dumbarton Wye North to Caltrain
			Dumbarton XS	Dumbarton Wye South to Caltrain
			Dumbarton 1	Dumbarton Bay Crossing to Don Edwards
			Fremont Central Park (Tube)	Don Edwards to Niles Wye (E) via Fremont Central Park
Station Location Options				
Union City (Shinn)				
Central Valley	1 of 6	BNSF – UPRR	BNSF N/S 1	North Stockton South to UPRR Connection
			BNSF N/S 2	BNSF Parallel to UPRR tracks
			BNSF N/S 3	Parallel tracks South through Escaton
			BNSF N/S 4	Escaton South to Amtrak Briggsmore
			BNSF N/S 5	Amtrak Briggsmore to UPRR/BNSF Connection
			BNSF N/S 6	UPRR/BNSF Connection to Atwater

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c] Map Name (Figure 2.5-2)	Segment[c] Location Description
			BNSF N/S 7	Atwater to Downtown Merced
			UPRR N/S 8	Merced South to BNSF Connection
			UPRR N/S 9	BNSF Connection South to Henry Miller Wye
			UPRR N/S 10	BNSF Henry Miller Wye
		BNSF	BNSF N/S 1	North Stockton South to UPRR Connection
			BNSF N/S 2	BNSF Parallel to UPRR tracks
			BNSF N/S 3	Parallel tracks South through Escaton
			BNSF N/S 4	Escaton South to Amtrak Briggsmore
			BNSF N/S 5	Amtrak Briggsmore to UPRR/BNSF Connection
			BNSF N/S 6	UPRR/BNSF Connection to Atwater
			BNSF N/S 7	Atwater to Downtown Merced
			BNSF N/S 8	Merced South to UPRR Connection
			BNSF N/S 9	UPRR Connection East to Castle Connection
			BNSF N/S 10	Castle Connection to Henry Miller Wye
			BNSF N/S 11	Henry Miller Wye
		UPRR N/S	UPRR N/S 1	French Camp to Lathrop
			UPRR N/S 2	Lathrop through Manteca
			UPRR N/S 3	Manteca South to BNSF/UPRR
			UPRR N/S 4	BNSF/UPRR South to Modesto
			UPRR N/S 5(A or B)	UPRR Modesto South – Western Option
			UPRR N/S 6	South Modesto to BNSF Connection
			UPRR N/S 7	BNSF Connection South to Merced
			UPRR N/S 8	Merced South to BNSF Connection
			UPRR N/S 9	BNSF Connection South to Henry Miller Wye
			UPRR N/S 10	BNSF Henry Miller Wye
		BNSF Castle	BNSF N/S 1	North Stockton South to UPRR Connection
			BNSF N/S 2	BNSF Parallel to UPRR tracks
			BNSF N/S 3	Parallel tracks South through Escaton
			BNSF N/S 4	Escaton South to Amtrak Briggsmore
			BNSF N/S 5	Amtrak Briggsmore to UPRR/BNSF Connection
			BNSF Castle 1	From BNSF southeast to Castle AFB

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c] Map Name (Figure 2.5-2)	Segment[c] Location Description
			BNSF Castle 2	Castle AFB South to BNSF connect
			BNSF Castle 3	BNSF South of Castle to UPRR Connect
			BNSF N/S 10	Castle Connection to Henry Miller Wye
			BNSF N/S 11	Henry Miller Wye
		UPRR – BNSF Castle	UPRR N/S 1	French Camp to Lathrop
			UPRR N/S 2	Lathrop through Manteca
			UPRR N/S 3	Manteca South to BNSF/UPRR
			UPRR N/S 4	BNSF/UPRR South to Modesto
			UPRR N/S 5(A OR B)	UPRR Modesto South – Western Option
			UPRR N/S 6	South Modesto to BNSF Connection
			UPRR – BNSF X2	North South Connection East of Stockton (South Portion)
			BNSF Castle 1	From BNSF southeast to Castle AFB
			BNSF Castle 2	Castle AFB South to BNSF connect
			BNSF Castle 3	BNSF South of Castle to UPRR Connect
			BNSF N/S 10	Castle Connection to Henry Miller Wye
			BNSF N/S 11	Henry Miller Wye
		UPRR – BNSF	UPRR N/S 1	French Camp to Lathrop
			UPRR N/S 2	Lathrop through Manteca
			UPRR N/S 3	Manteca South to BNSF/UPRR
			UPRR N/S 4	BNSF/UPRR South to Modesto
			UPRR N/S 5(A OR B)	UPRR Modesto South – Western Option
			UPRR N/S 6	South Modesto to BNSF Connection
			UPRR – BNSF X2	BNSF crossing to UPRR – Southeast of Turlock
			BNSF N/S 6	UPRR/BNSF Connection to Atwater
			BNSF N/S 7	Atwater to Downtown Merced
			UPRR N/S 8	Merced South to BNSF Connection
			UPRR N/S 9	BNSF Connection South to Henry Miller Wye
			UPRR N/S 10	BNSF Henry Miller Wye
Station Location Options				
Modesto (Downtown)				
Briggsmore (Amtrak)				
Merced (Downtown)				

Corridor	Possible Alignments[a]	Alignment Alternative[b]	Segment[c]	
			Map Name (Figure 2.5-2)	Location Description
Castle AFB				

[a] Several alignment alternatives will be selected to create representative HST Network Alternatives (Chapter 7).

[b] Not every segment in an alignment would necessarily be selected to be considered as part of a network alternative.

[c] A segment may be part of more than one alignment alternative.

A. BAY AREA TO CENTRAL VALLEY ALIGNMENT ALTERNATIVES AND STATION LOCATION OPTIONS CARRIED FORWARD

The alignment alternatives and station location options analyzed in this Program EIR/EIS are shown in Figure 2.5-1. Several operating scenarios for combinations of terminus stations were investigated, with HST Network Alternatives ranging from one to three termini (San Francisco, Oakland, and San Jose) for direct HST service to the Bay Area. Conceptual designs were developed for all of the alignment alternatives and station location options carried forward. These designs are illustrated in plan and profile sheets (Appendix 2-D), cross sections (Appendix 2-E), and station fact sheets (Appendix 2-F). Conceptual designs are based on *Engineering Criteria* (California High-Speed Rail Authority and Federal Railroad Administration 2004). Maps illustrating the horizontal alignment and profile type (aerial, at grade, or tunnel) are shown in Figure 2.5-3.

The relation of each of the alignment alternatives to other existing transportation facilities is also a key aspect of the conceptual designs. This information defines the general physical characteristics of the alternatives for consideration in the environmental technical analyses presented in this Program EIR/EIS. Figure 2.5-4 illustrates the alignment characteristics (relation to existing corridors and proposed configurations) for the alignment alternatives carried forward.

San Francisco to San Jose

The alignment alternatives and station location options in this corridor carried forward for further consideration are illustrated in Figure 2.5-5 and discussed below.

Alignment Alternatives Carried Forward

- Caltrain Alignment (Shared-Use Four-Track): From San Francisco, this alignment alternative would follow south along the Caltrain rail alignment to Dumbarton and from there to San Jose. This alignment alternative assumes that the HST system would share tracks with Caltrain commuter trains. The entire alignment would be grade separated. Station location options would include a station in the lower level of the proposed new Transbay Transit Center in San Francisco or a station at 4th and King Streets, a station in Millbrae to serve SFO, and a station in either Redwood City or Palo Alto. The Caltrain shared-use alignment would take advantage of the existing rail infrastructure and would be mostly at-grade.

Station Location Options Carried Forward

San Francisco

- Transbay Transit Center: This potential station location would serve the Caltrain shared-use alignment as a downtown terminal station.
- 4th and King (Caltrain): This potential station location would serve the Caltrain shared-use four-track alignment as a downtown terminal station.

San Francisco International Airport

- Millbrae: This potential station would serve as a connection with SFO.

Mid-Peninsula

- Redwood City (Caltrain): This potential station location would provide accessibility and serve the population between San Jose and San Francisco.
- Palo Alto (Caltrain): This potential station location would provide accessibility and serve the population between San Jose and San Francisco.

Oakland to San Jose

The alignment alternatives and station location options in this corridor carried forward for further consideration are illustrated in Figure 2.5-6 and discussed below. Figure 2.5-6A shows greater detail around Niles Junction.

Alignment Alternatives Carried Forward

- Niles Subdivision Line to I-880 (Niles/I-880): From Oakland, this alignment alternative would travel south following the UPRR's Niles Subdivision Line (i.e., Hayward Line) transition to the UPRR's Warm Springs Subdivision (Milpitas Line) at Niles Junction and then transition to the I-880. Station location options include Oakland, Oakland Airport and Union City (BART) or Fremont (Warm Springs).

  The alignment would be at-grade along the Niles Subdivision Line and on an aerial structure in the median of I-880. The I-880 HST portion would mostly be on an aerial configuration from Fremont to San Jose. This alignment would require the construction of columns and footings in the wide median of I-880.

- Niles Subdivision Line to I-880 to Trimble Road (Niles/I-880/Trimble Rd.): From Oakland, this alignment alternative would travel south following the UPRR's Niles Subdivision Line (i.e., Hayward Line), transition to the UPRR's Warm Springs Subdivision (Milpitas Line) at Niles Junction and then transition to I-880 and then to Trimble Road. Station location options include Oakland, Oakland Airport, and Union City (BART) or Fremont (Warm Springs).

  The alignment would be at-grade along the Niles Subdivision Line and on an aerial structure in the median of I-880. The I-880 HST portion would mostly be on an aerial configuration from Fremont to San Jose. The Trimble Road segment would be on an aerial structure and in a tunnel (where adjacent to San Jose International Airport). This alignment would require the construction of columns and footings in the wide median of I-880.

Station Location Options Carried Forward

Oakland

- West Oakland: This potential station location would serve Oakland the Niles/I-880 Alignment.
- 12th Street/City Center: This potential station location would serve Oakland from the Niles/I-880 Alignment

Oakland International Airport

- Coliseum/Airport BART Station: This potential station location would serve the Oakland Airport from the Niles/I-880 Line.

Southern Alameda County

- Union City (BART): This potential station location would serve the population centers between Oakland and San Jose from the Niles/ I-880 Line.
- Fremont (Warm Springs): This potential station location would serve the population centers between Oakland and San Jose from the Niles/ I-880 Line.

San Jose to Central Valley

The alignment alternatives and station location options in this corridor carried forward for further consideration are illustrated in Figure 2.5-7 and discussed below.

Alignment Alternatives Carried Forward

Pacheco Pass Alignments

- Caltrain/Pacheco/Henry Miller Avenue: This alignment alternative would extend south along the Caltrain/UPRR rail corridor through the Pacheco Pass and a portion of the Grasslands Ecological Area (GEA) along Henry Miller Road and then across the San Joaquin Valley. Station location options include the existing San Jose (Diridon) Station and Gilroy (near the existing Caltrain Station) or Morgan Hill (near the existing Caltrain Station).
- Caltrain/Pacheco/GEA North/Merced: This alignment alternative would extend south along the Caltrain/UPRR rail corridor through the Pacheco Pass, pass through the northern portion of the GEA and then across the San Joaquin Valley. Station location options include the existing San Jose (Diridon) Station and Morgan Hill (near the existing Caltrain Station) or Gilroy (near the existing Caltrain Station).

Station Location Options Carried Forward

San Jose

- San Jose (Diridon): This potential station location would serve all alignments (Caltrain/Monterey Highway rights-of-way) out of San Jose.

South Santa Clara County

- Morgan Hill (Caltrain): This potential station location would serve all the Pacheco Pass alignment alternatives.
- Gilroy (Caltrain): This potential station location would serve all the Pacheco Pass alignment alternatives.

East Bay to Central Valley

The alignment alternatives and station locations in this corridor carried forward for further consideration are illustrated in Figure 2.5-8 and discussed below.

Alignment Alternatives Carried Forward

Altamont Pass

- UPRR: This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680 then use the UPRR alignment through Pleasanton and Livermore before transitioning to the I-580 corridor through the Altamont Pass to Tracy. Station location options include the Pleasanton (Bernal/I-680) Station, Livermore (near downtown), or Livermore (Greenville Rd.) and Tracy (downtown) or Tracy (ACE).
- I-580/UPRR: This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680 then use the UPRR alignment through Pleasanton before transitioning to the I-580 corridor through Livermore and the Altamont Pass to Tracy. Station location options include the Pleasanton (Bernal/I-680) Station, Livermore (I-580), or Livermore (Greenville Rd.) and Tracy (downtown) or Tracy (ACE).
- I-580/I-680/UPRR: This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680 then use the I-680 alignment before transitioning I-580 corridor (at the I-580/I-680 junction). Station location options include the Pleasanton (BART) Station, Livermore (I-580), or Livermore (Greenville Rd.) and Tracy (downtown) or Tracy (ACE).

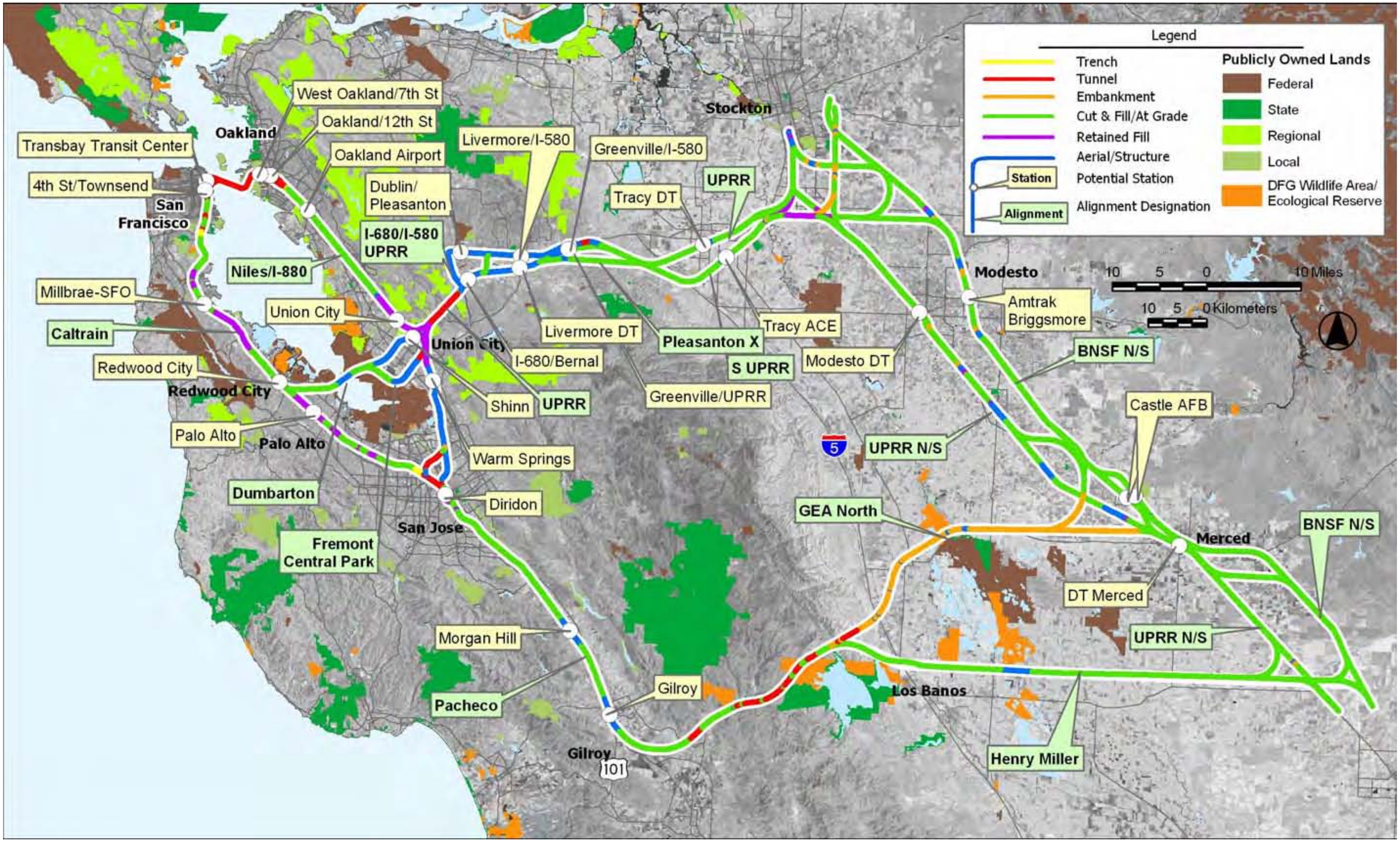

Figure 2.5-3
Profile Characteristics

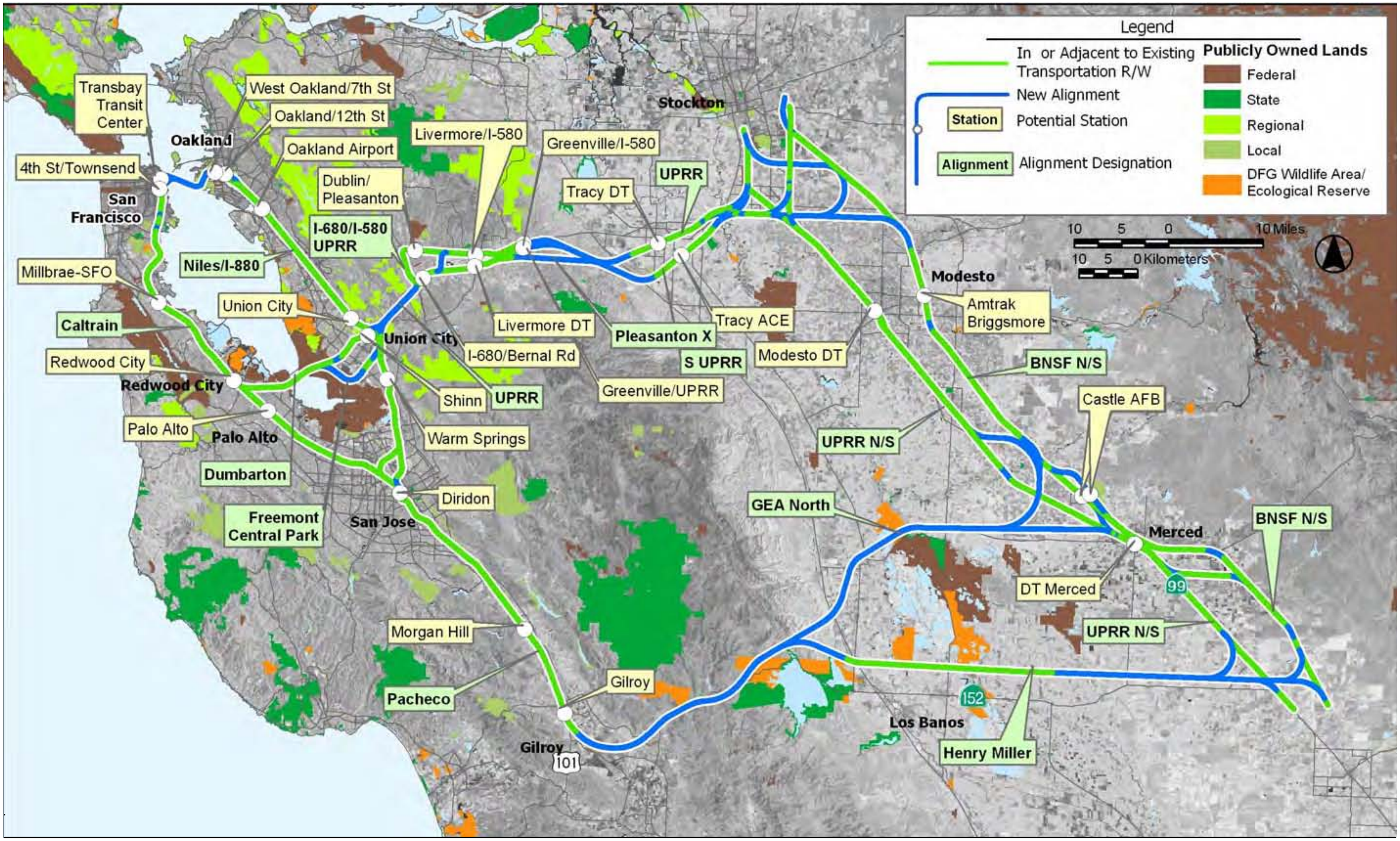

Figure 2.5-4
Relation to Existing
Transportation Corridors

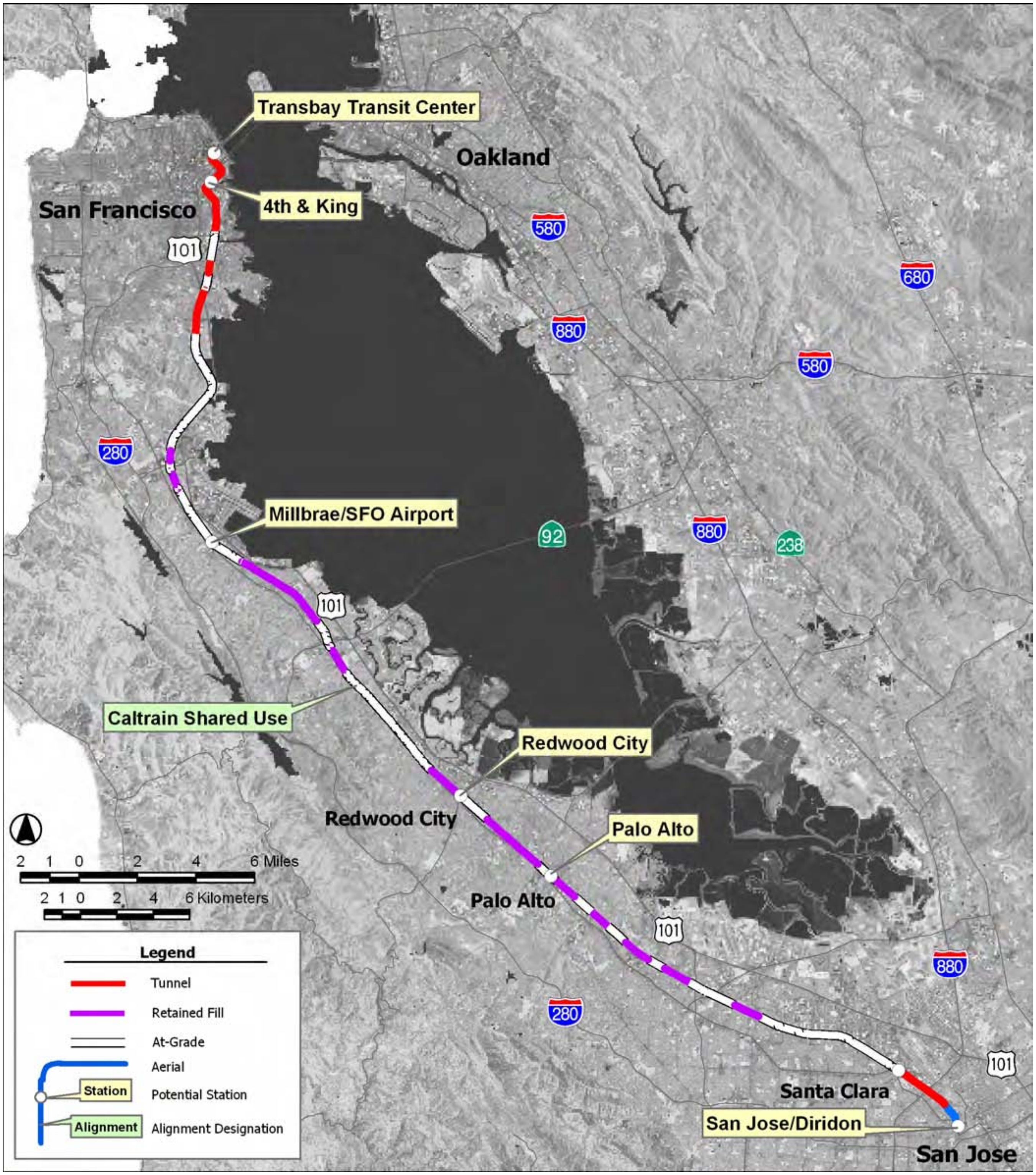

Figure 2.5-5
San Francisco to San Jose—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

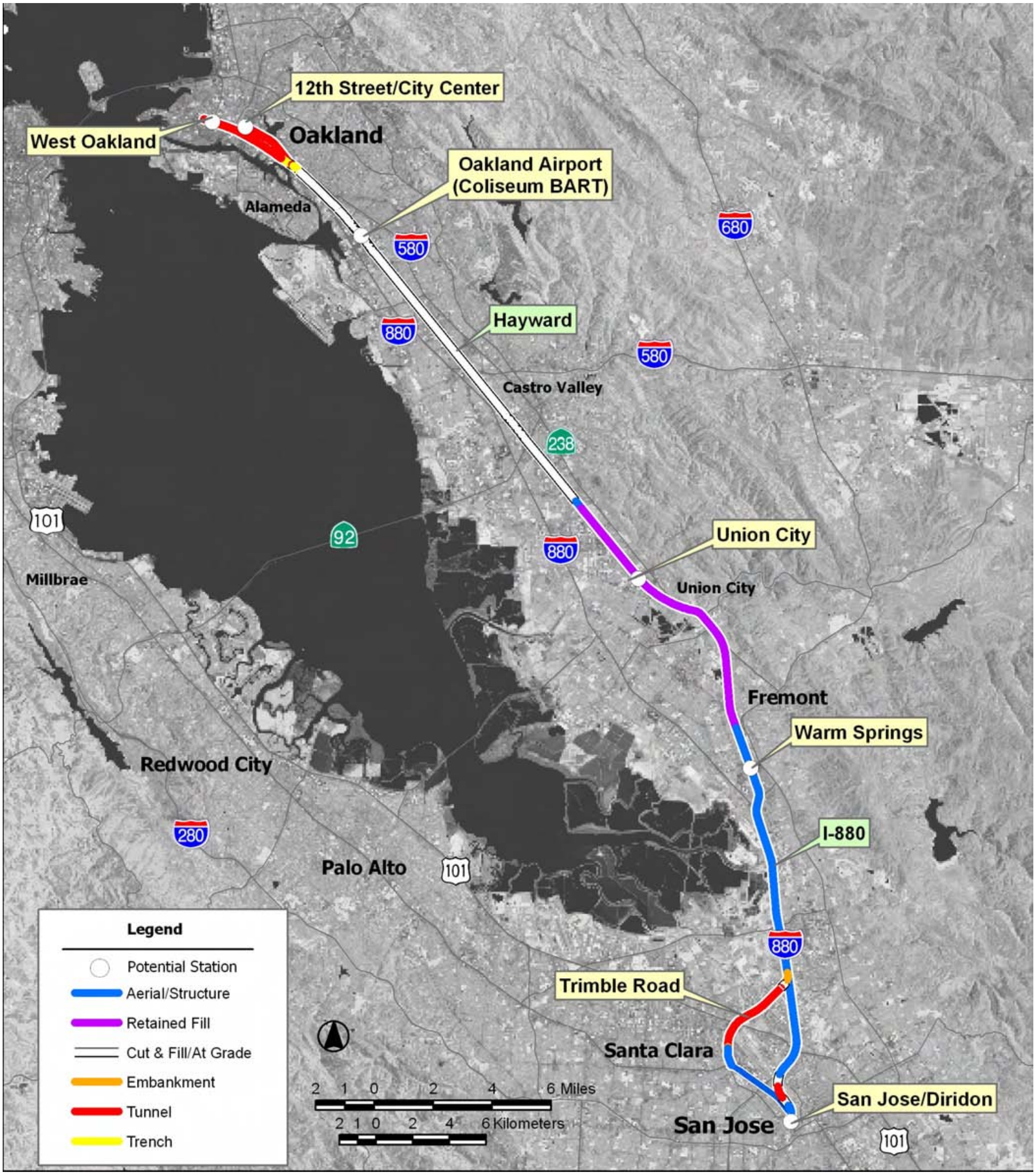

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Figure 2.5-6
Oakland to San Jose—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

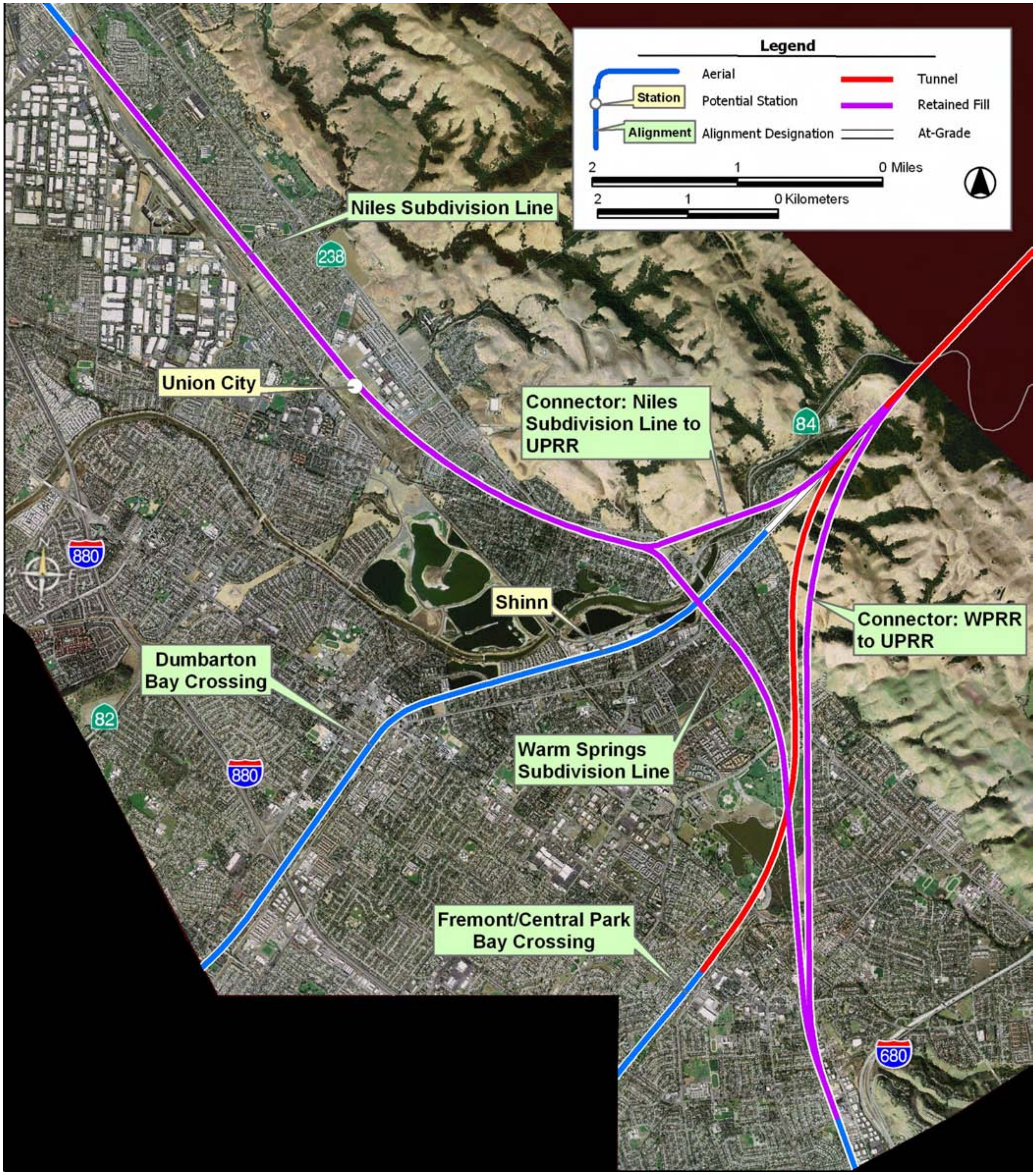

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Figure 2.5-6A
Niles Junction—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

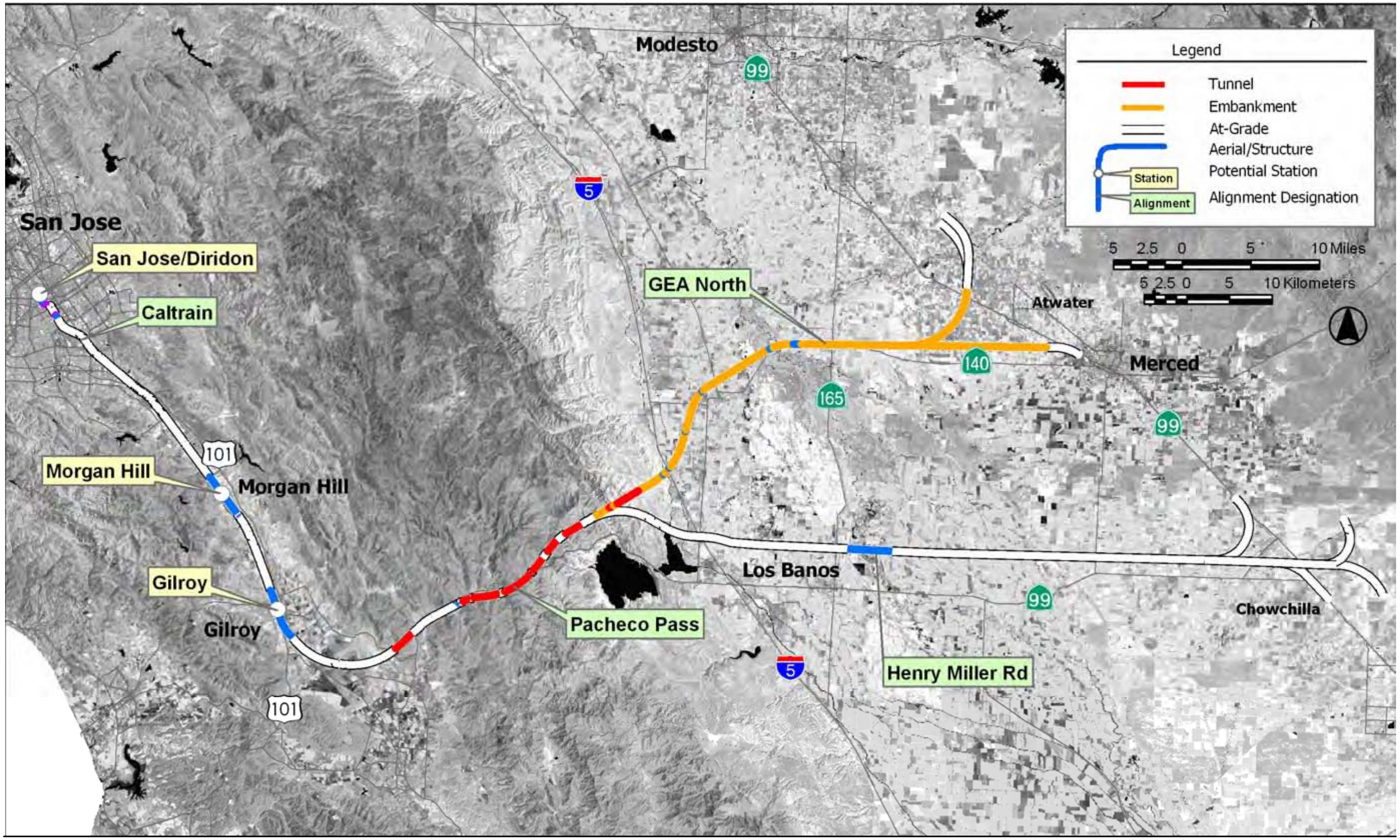

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Figure 2.5-7
San Jose to Central Valley—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

- Patterson Pass/UPRR: This alignment alternative would extend east via a relatively direct routing (mostly in tunnel) between Niles Junction and I-680 then use the UPRR alignment through Pleasanton and Livermore before transitioning to the I-580 corridor through the Patterson Pass between Livermore and Tracy. Station location options include the Pleasanton (Bernal/I-680) Station, Livermore (near downtown), and Tracy (downtown) or Tracy (ACE).

Station Location Options Carried Forward

Tri-Valley

- Pleasanton (1-680/Bernal Road): This potential station location would serve the Altamont I-580/UPRR alignment alternative and the Altamont UPRR alignment alternative.
- Pleasanton (BART): This potential station location would serve the Altamont I-580/I-680/UPRR alignment alternative.
- Livermore (Downtown): This potential station location would serve the Altamont UPRR alignment alternative.
- Livermore (I-580): This potential station location would serve the Altamont I-580/I-680/UPRR alignment alternative and the Altamont I-580/UPRR alignment alternative.
- Livermore (Greenville Road/UPRR): This potential station location would serve the Altamont UPRR alignment alternative.
- Livermore (Greenville Road/I-580): This potential station location would serve the Altamont I-580/I-680/UPRR alignment alternative and the Altamont I-580/UPRR alignment alternative.

Tracy

- Tracy (Downtown): This potential station location would serve all Altamont Pass alignment alternatives.
- Tracy (ACE): This potential station location would serve all Altamont Pass alignment alternatives.

San Francisco Bay Crossings

The alignment alternatives carried forward in this corridor for further consideration are illustrated in Figures 2.5-9 and 2.5-10 and discussed below.

Alignment Alternatives Carried Forward

- New Transbay Tube: This alignment alternative would connect the Oakland (West Oakland or 12th Street City Center) and San Francisco (Transbay Transit Center or 4th and King) HST stations via a new transbay tube. This alignment alternative could serve either Altamont Pass or Pacheco Pass alignment alternatives.
- Dumbarton Rail Crossing (Centerville): This alignment alternative would serve the Altamont Pass alignment alternatives and link the East Bay to the Peninsula in the vicinity of the existing Dumbarton Rail Bridge. Between Niles Junction and the Dumbarton Bridge, this alignment would use the Centerville rail alignment. Possible designs for this alignment include use of an improved Dumbarton Rail Bridge (low level), a new high-level bridge, and a new transbay tube.
- Dumbarton Rail Crossing (Fremont Central Park): This alignment alternative would serve the Altamont Pass alignment alternatives and link the East Bay to the Peninsula in the vicinity of the existing Dumbarton Rail Bridge. Between Niles Junction and the Dumbarton Bridge, this alignment would use an existing utility alignment and a new alignment through the Don Edwards Natural Wildlife Refuge. This alignment would require tunneling under Fremont Central Park. Possible designs for this alignment include use of an improved Dumbarton Rail Bridge (low level), a new high-level bridge, and a new transbay tube.

Station Location Options Carried Forward

Southern Alameda County

- Union City (Shinn): This potential station would serve the population centers between Oakland and San Jose only for Altamont Pass (East Bay to Central Valley) alignment alternatives using the Dumbarton Rail Crossing (Centerville) connection to the San Francisco Peninsula.

Central Valley

The alignment alternatives and station location options in this corridor carried forward for further consideration are illustrated in Figure 2.5-11 and discussed below.

Alignment Alternatives Carried Forward

- BNSF Rail Line: This alignment alternative would connect with either the Altamont or Pacheco Pass alignment alternatives. This north-south alignment would link the Bay Area to Central Valley population centers, Sacramento, and southern California. Station location options include Modesto (Briggsmore) and Merced (Downtown and Castle AFB).
- UPRR Line: This alignment alternative would connect with either the Altamont or Pacheco Pass alignment alternatives. This north-south alignment would link the Bay Area to Central Valley population centers, Sacramento, and southern California. Station location options include Modesto (Downtown) and Merced (Downtown and Castle AFB).

Station Location Options Carried Forward

Modesto

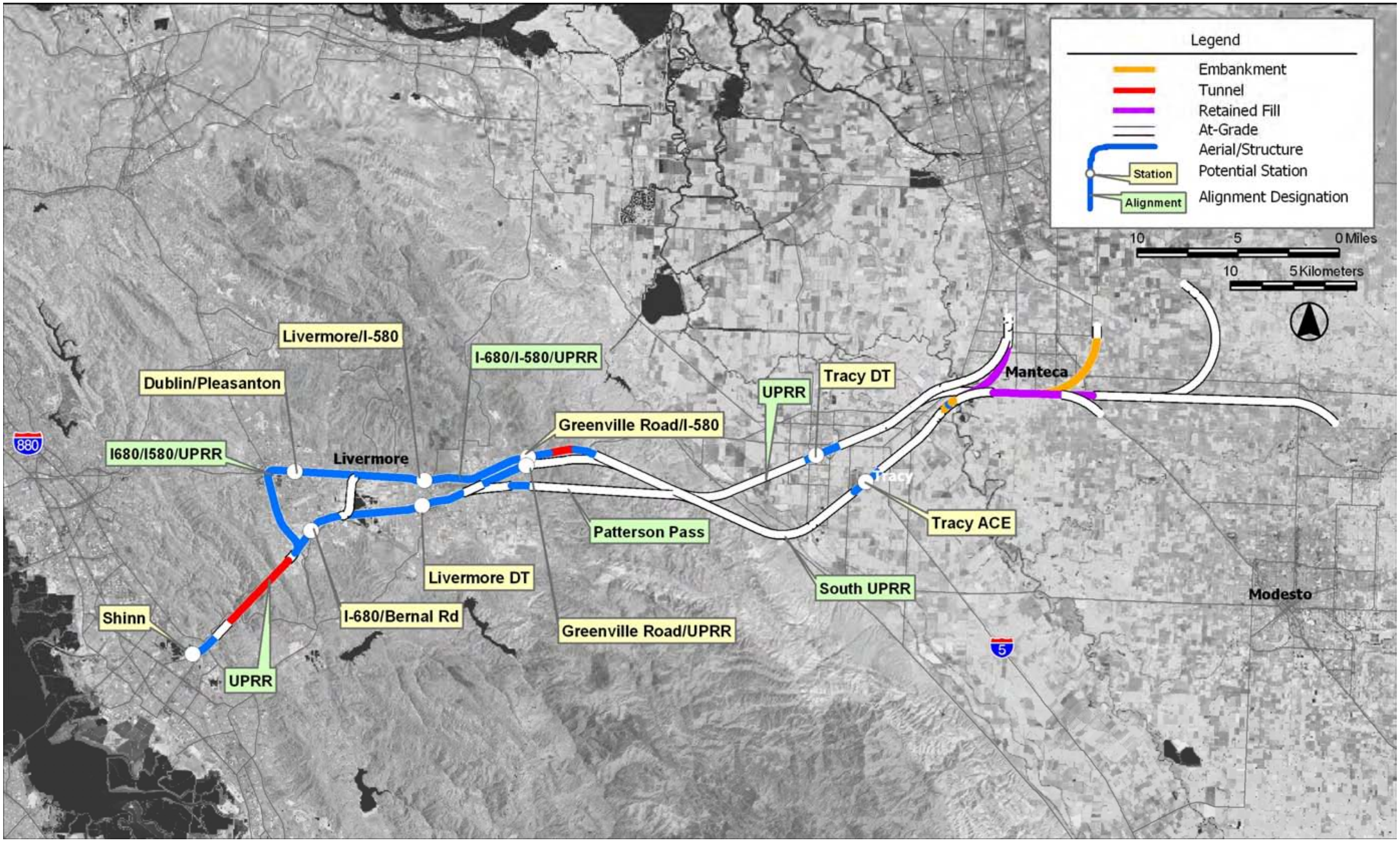
- Downtown Modesto: This potential station location would serve the Altamont Pass and Pacheco Pass alignment alternatives using the UPRR alignment alternative.
- Briggsmore (Amtrak): This potential station location would serve Altamont Pass and Pacheco Pass alignment alternatives using the BNSF alignment alternative.

Merced

- Downtown Merced: This potential station location would serve all Altamont Pass and Pacheco Pass alignment alternatives.
- Castle AFB: This potential station would serve all Altamont Pass and Pacheco Pass alignment alternatives.

2.5.2 Alignment Alternatives and Station Locations Considered and Rejected

The following HST Alignment Alternatives and station location options were considered but rejected from further consideration in the statewide program EIR/EIS for the HST system (California High-Speed Rail Authority and Federal Railroad Administration 2005) and this Program EIR/EIS process (Figure 2.5-12). The reasons for elimination of each of the alignments evaluated are categorically summarized in Table 2.5-4 and further described in Appendix 2-G.



FLY CALIFORNIA Without ever leaving the ground

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Figure 2.5-8
East Bay to Central Valley—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

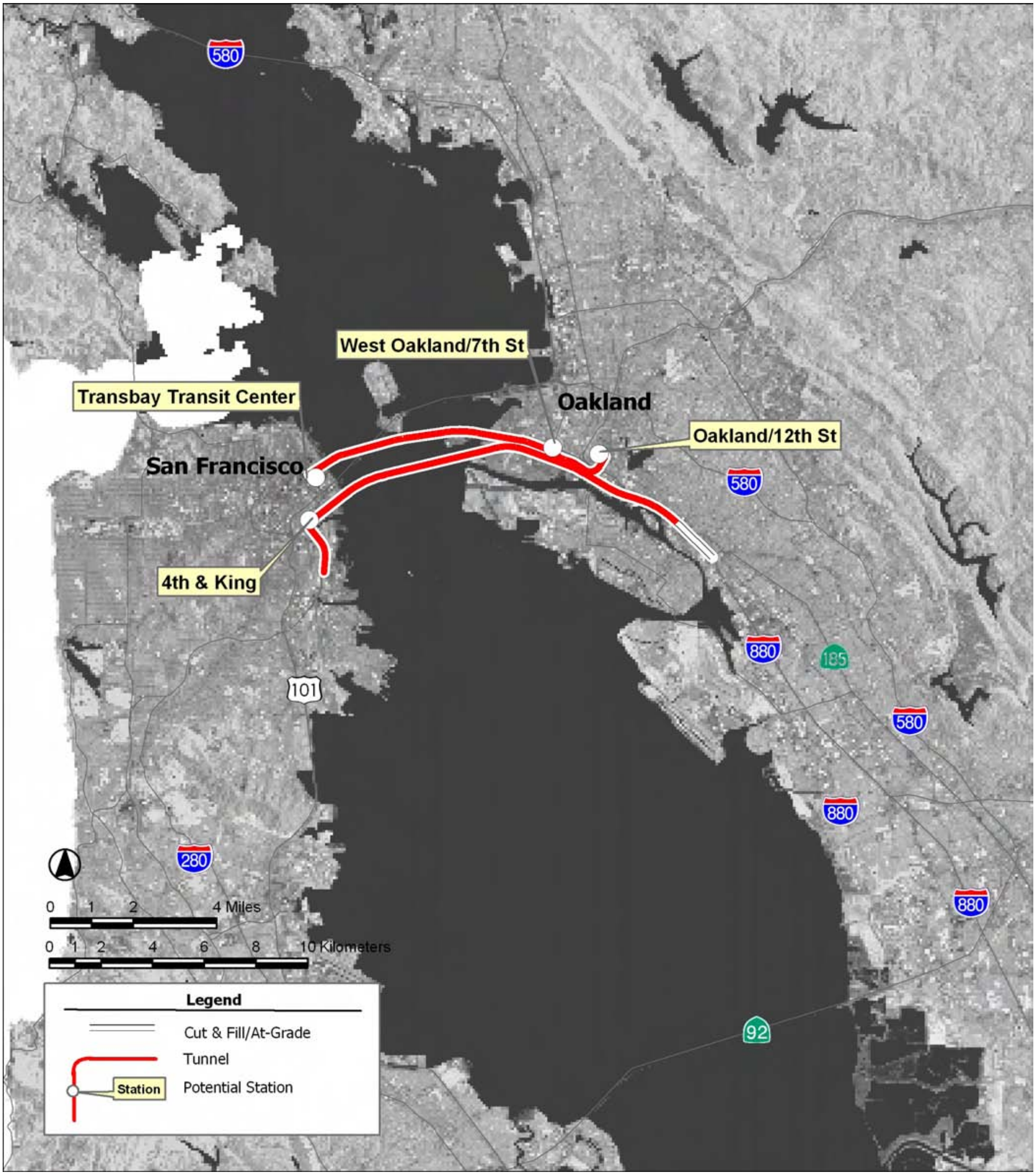

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Figure 2.5-9
San Francisco Bay Crossings (Transbay)—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

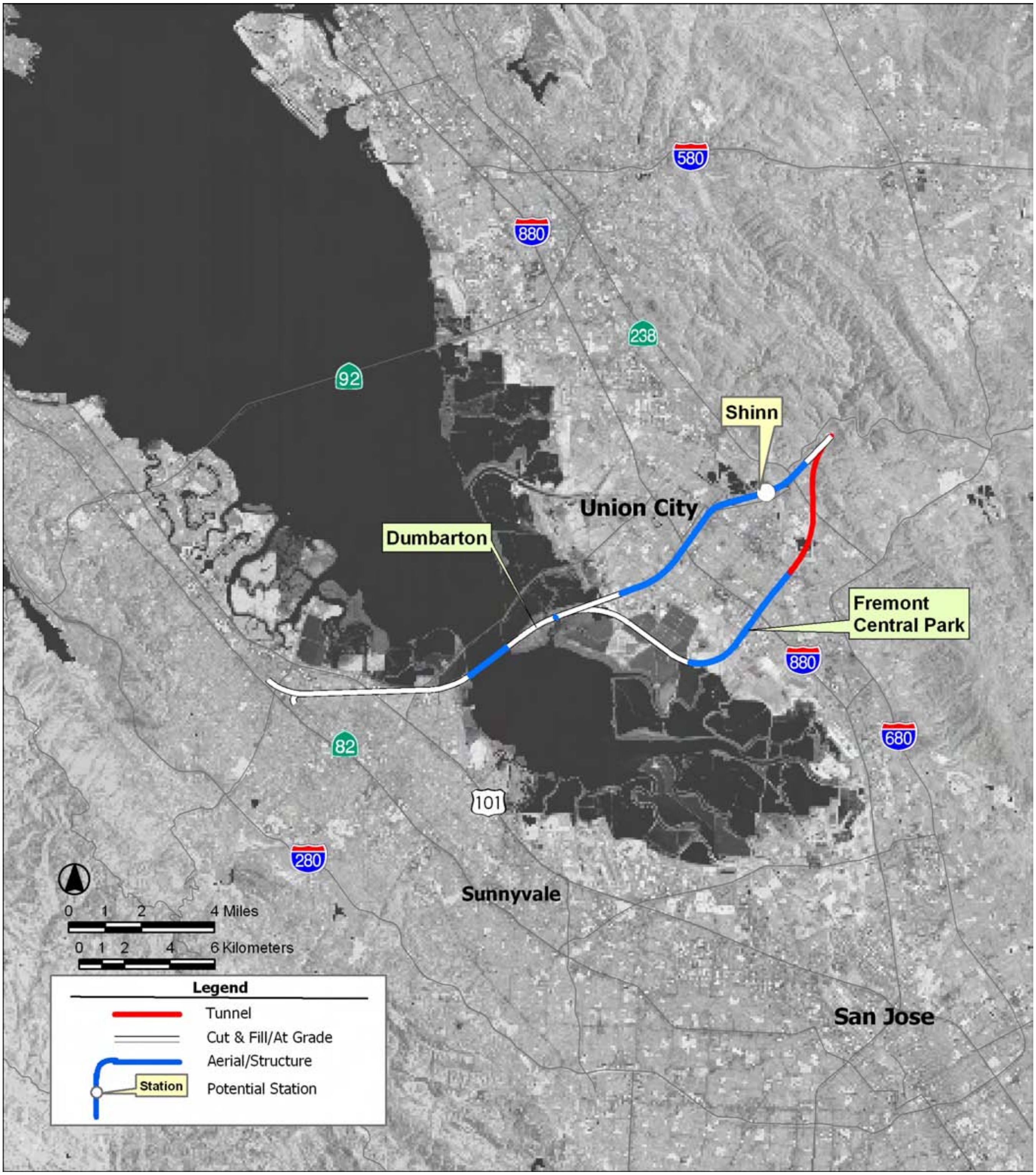

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Figure 2.5-10
San Francisco Bay Crossings (Dumbarton)—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

Table 2.5-4
Bay Area to Merced: High-Speed Train Alignment Alternatives and
Station Location Options Considered and Eliminated

Alignment or Station	Reason for Elimination							
	Construction	Incompatibility	Right-of-Way	Connectivity / Accessibility	Revenue / Ridership	Alignment Eliminated*	Environment	Environmental Concerns
San Francisco to San Jose								
US-101 Alignment (exclusive guideway)	P	S	P				P	Visual, land use (right-of-way acquisition) impacts
Caltrain Corridor (exclusive guideway)	P	P	P				P	Visual, land use (right-of-way acquisition), cultural resources impacts
I-280 Alignment	P		P				P	Visual, land use (right-of-way acquisition) impacts
Station Locations								
Millbrae–SFO (US-101)						P		
Redwood City (US-101)						P		
Santa Clara (Caltrain)					P			Station area would be served by Diridon Station only 3 miles away
Oakland to San Jose								
Mulford Line	P	P	P				P	Visual, land use, wetlands, parklands impacts
I-880 (Note: Only Oakland to Fremont portion to be eliminated)	P		P					
Former WPRR Rail Line to Mulford Line (WPRR/Niles/Mulford alignment)	P						P	Wetlands, parklands impacts
Hayward Line via tunnel to Mulford Line (Hayward/Tunnel/Mulford alignment)	P	S	P				P	Wetlands, parklands, land use impacts; seismic constraints
Former WPRR Rail Line via tunnel to Mulford Line (WPRR/Tunnel/Mulford)	P	S	P				P	Wetlands, parklands, land use impacts; seismic constraints
Former WPRR Rail Line to Hayward Line to I-880 (WPRR/Hayward/I-880)	P							
Former WPRR (Warm Springs to San Jose)	P		P					
Tunnel under Fremont Central Park	P						S	Seismic constraints, parklands
Station Locations								
Lake Merritt		P		P				
Jack London Square	P			P				
I-880 Hegenberger						P		
Coliseum BART (WPRR)						P		
Mowry Avenue	P					P		
San Jose to Central Valley								

Alignment or Station	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue / Ridership	Alignment Eliminated*	Environment	Environmental Concerns
Merced Southern alignment (Central Valley Portion of San Jose-Merced section for Diablo Range Direct alignments)							P	San Luis National Wildlife Refuge impacts
Direct Tunnel Alignment (Northern or Southern Connection to Merced	P						S	Seismic constraints
Diablo Range Direct Alignments (Northern Alignment and alignments through Henry Coe State Park)	P						P	Parklands, habitat fragmentation, high value aquatic resources, visual, noise impacts
Caltrain/Morgan Hill/Foothill/Pacheco Pass Alignment	P	P		P			P	Visual, land use impacts
Caltrain/Morgan Hill/East US-101/Pacheco Pass Alignment		P		P				
Caltrain/Morgan Hill/Pacheco Pass Alignment	P		P					
Station Locations								
Morgan Hill (Foothills)				P		P		
Morgan Hill (east of US-101)				P		P		
Los Banos					P		P	Water resources, threatened and endangered species, growth related impacts
East Bay to Central Valley								
SR-84/South of Livermore		S		S			P	Natural resources, habitat and endangered species, agricultural lands, water resources impacts
SR-84/I-580/UPRR		S		S			P	Natural resources, habitat and endangered species, agricultural lands, water resources impacts
I-580: Bay Fair to Pleasanton	P		S					Construction, logistical constraints, right-of-way
Station Locations								
Pleasanton (I-680/SR-84)				S		P		
Livermore (Greenville Rd/SR-84/UPRR)				S		P		
Livermore (Isabel/SR-84)				S		P		
Central Valley Alignments								
West of SR-99				P			P	Farmlands, water resources, floodplains, severance impacts
East of SR-99				P			P	Farmlands, water resources, floodplains, severance impacts

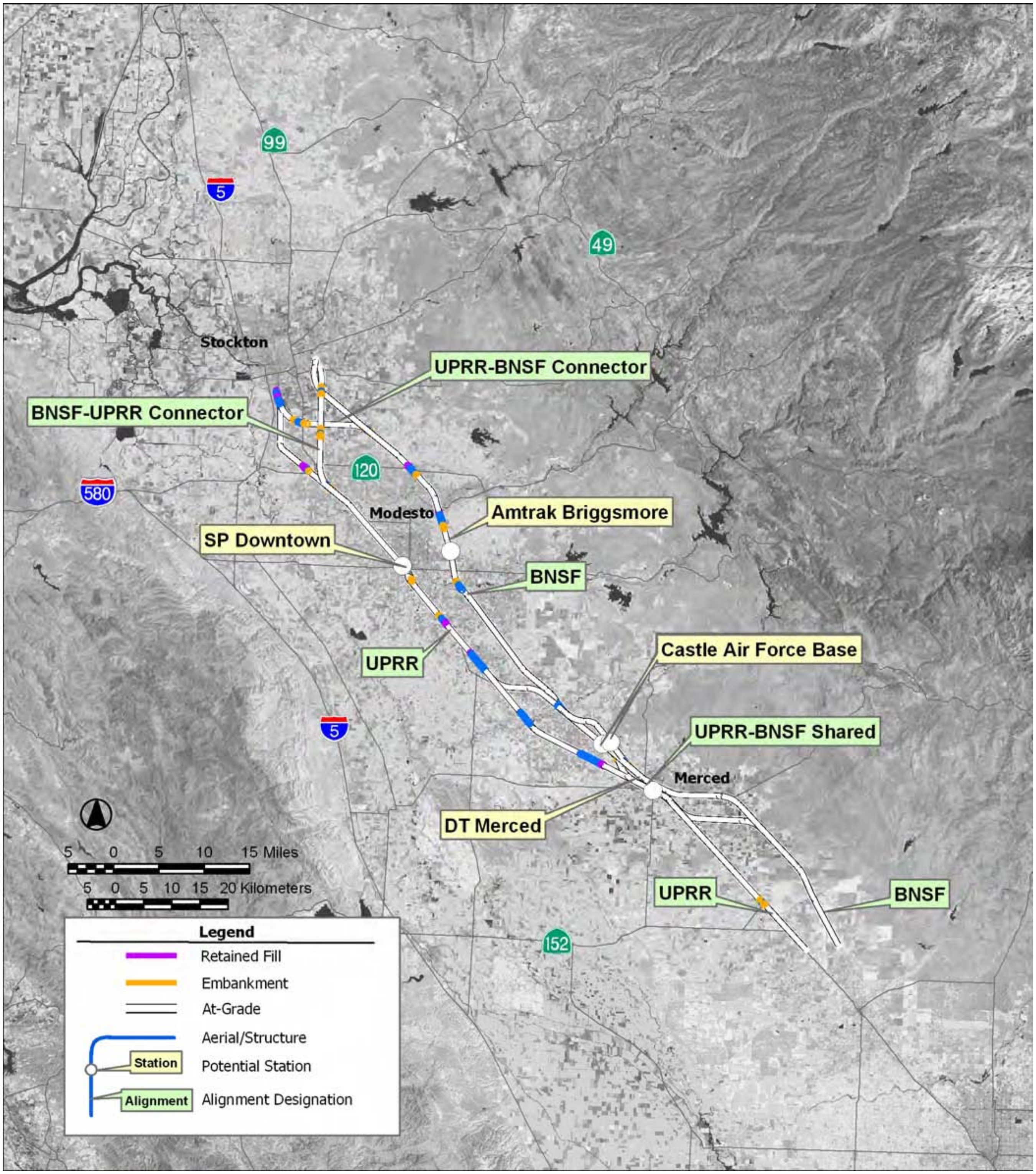

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Figure 2.5-11
Central Valley Alignment—Alignment Alternatives and Station Location Options Carried Forward for Further Consideration

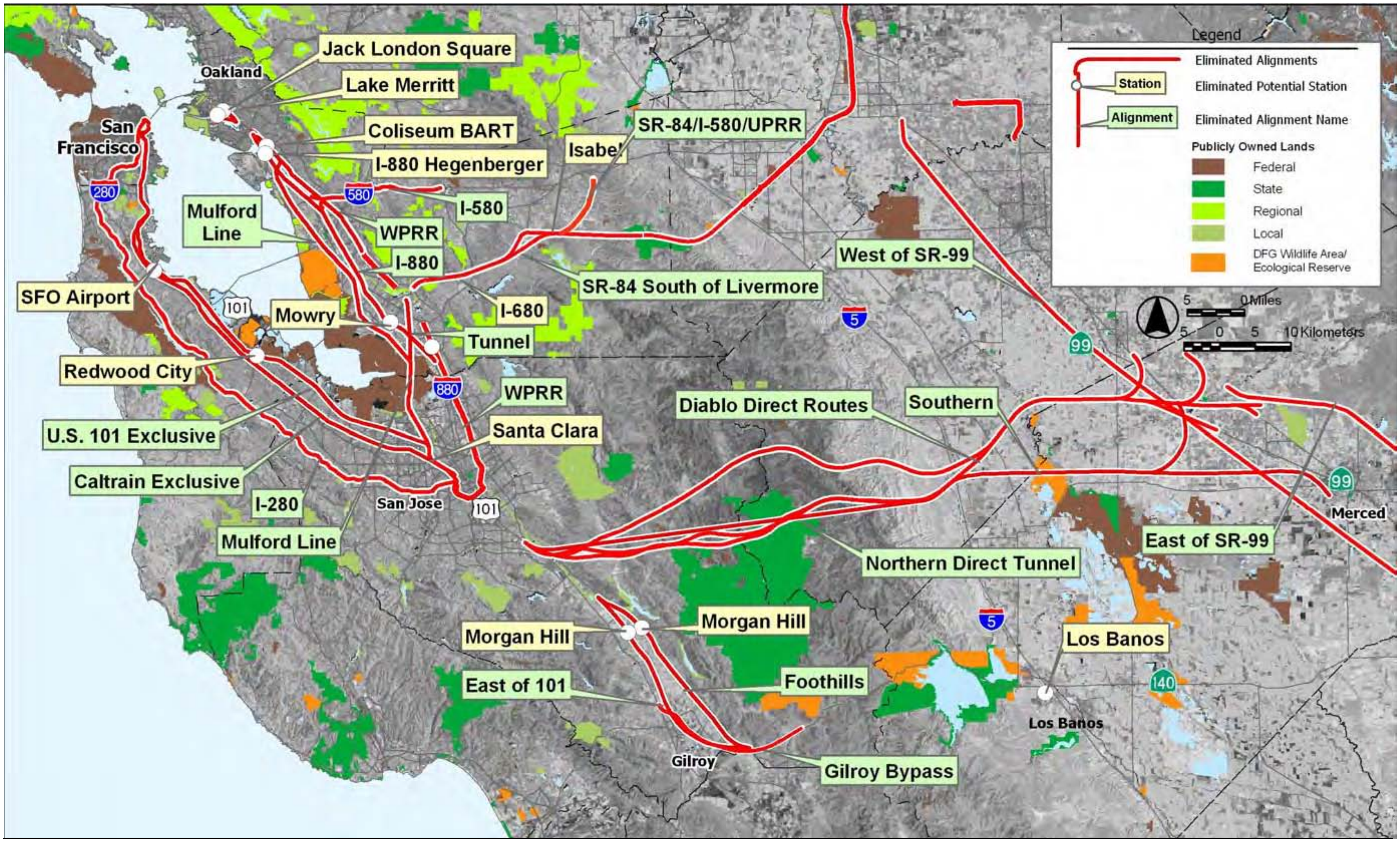

Figure 2.5-12
Alignment Alternatives and Station Location Options Considered but Eliminated from Further Consideration

Alignment or Station	Reason for Elimination							
	Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated*	Environment	Environmental Concerns
Definitions:								

Reason: Primary (P) and secondary (S) reasons for elimination.

Construction: Engineering and construction complexity and initial and/or recurring costs would render the project impracticable and logistical constraints.

Environment: High potential for considerable impacts to natural resources, including water resources, streams, floodplains, wetlands, and habitat of threatened or endangered species, would fail to meet project objectives.

Incompatibility: Incompatibility with current or planned local land use as defined in local plans would fail to meet project objectives.

Right-of-Way: Lack of available rights-of-way or extensive right-of-way needs would result in high acquisition costs and/or delays that would render the project impracticable.

Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway, and/or transit systems) would impair the service quality, could reduce ridership of the HST system, and would fail to meet the project purpose.

Ridership/Revenue: The alignment/station would result in longer trip times and/or have suboptimal operating characteristics and would have low ridership and revenue and would fail to meet the project purpose.

Alignment Eliminated: Station or connection eliminated because the connecting alignment was eliminated.

* Alignment Eliminated column applies only to station locations. If an alignment is eliminated, a specific station location may no longer be necessary.

2.5.3 Maintenance and Storage Facilities

Representative maintenance and storage facilities that would be necessary to support the HST fleet have been considered in this Program EIR/EIS. A rail system simulation model was used to develop an overall operating and maintenance concept, based on an HST system with termini in both San Francisco and Oakland, that would be responsive to the forecast representative demand and that could deliver the levels of HST service desired. Only general track locations and infrastructure configurations were developed for these facilities for this Program EIR/EIS. Other possible sites would be considered when detailed system requirements, land use, and site information are available at the project level. The specific facilities considered in this Program EIR/EIS are listed below and illustrated in Figure 2.5-13.

- West Oakland: One site for a fleet storage/service and inspection/light maintenance facility could be located two blocks northwest of where Peralta Street intersects Mandela Parkway and southeast of where the alignment is parallel to I-880.
- Merced: One site for a fleet storage/service and inspection/light maintenance facility could be located near Castle AFB.

Because of the constraints of existing urban development around some of the terminus station locations, it is assumed that only minimal storage and very basic service, inspection, and light maintenance functions would be integrated into the station infrastructure. The majority of the fleet storage and service, inspection, maintenance, and repair requirements are assumed to be supported at two types of independent facilities that were defined and generally sited.

A. FLEET STORAGE/SERVICE AND INSPECTION/LIGHT MAINTENANCE

Fleet Storage/Service and Inspection/Light Maintenance Facility

The desirable configuration for this facility would include tracks for "lay-up" (parking) for trainsets, a service and inspection (S&I) facility for inspection and light maintenance, and a train washer located on the yard approach track for exterior cleaning prior to daily train storage. In addition, adjacent to the S&I facility, on a separate track, would be a wheel truing facility capable of accommodating two cars at a time. There would also be provision for an employee administrative and comfort area.

Main Repair and Heavy Maintenance Facility

The conceptual configuration for this heavy maintenance complex includes a wheel-truing area, an S&I area, a running repair facility, support shops, material inventory and distribution area, component change-out area, overhaul shop, heavy repair facility, and exterior maintenance shop. The following descriptions are examples of the types of areas, shops, and functions that have been considered for the conceptual configuration of the main repair and maintenance facility.

Wheel-Truing Area

The wheel-truing area is configured to accommodate two cars. It is used to return wheel diameter parity and profile due to the stresses of track wear, drift, spalling, and wheel flat spots. The wheel truing machine is mounted under the floor for ease of operation. Rail cars are pulled over the machine to expedite turnaround time. Candidate vehicles for wheel truing are typically identified during a programmed maintenance inspection.

Service and Inspection Area

The service and inspection area is configured as a two track "run-through" facility. Tracks are equipped with observation pits and door level platforms for ease of inspection and light repair, providing access to under car, interior floor, and roof levels. Located between this area and the main maintenance area is a "runaround" track that would allow direct access/egress to both sides of the shop.

The Running Repair Area

The running repair area is configured with raised rail mounted on post structures and observation pits with depressed side floors. The posted, raised rail provides access to under car components requiring repair or replacement. Side floor and roof height platforms are also assumed in this configuration. The observation pit is equipped with a lift device to facilitate the removal and replacement of larger, heavier component units. Platforms provided at the car body side height provide access to glass, door, and interior and exterior repair requirements. A platform at the roof level provides access to the pantograph, resistor grids, and a/c components for servicing activities as required.

Support Shops

Based on the needs of specific fleet design parameters examples of shop areas and functions include the following:

- Truck Shop: equipped with a storage track and turntables for the efficient transition of trucks requiring service and trucks ready for installation. Direct access is provided to the Component Cleaning Area, (located on an exterior wall) to prepare the trucks for overhaul/heavy repair. This area includes truck hoists to facilitate efficient repair, disassembly, and reassembly. Additional turntables and connecting tracks would be provided in this area to provide for the required maneuverability of truck assemblies.

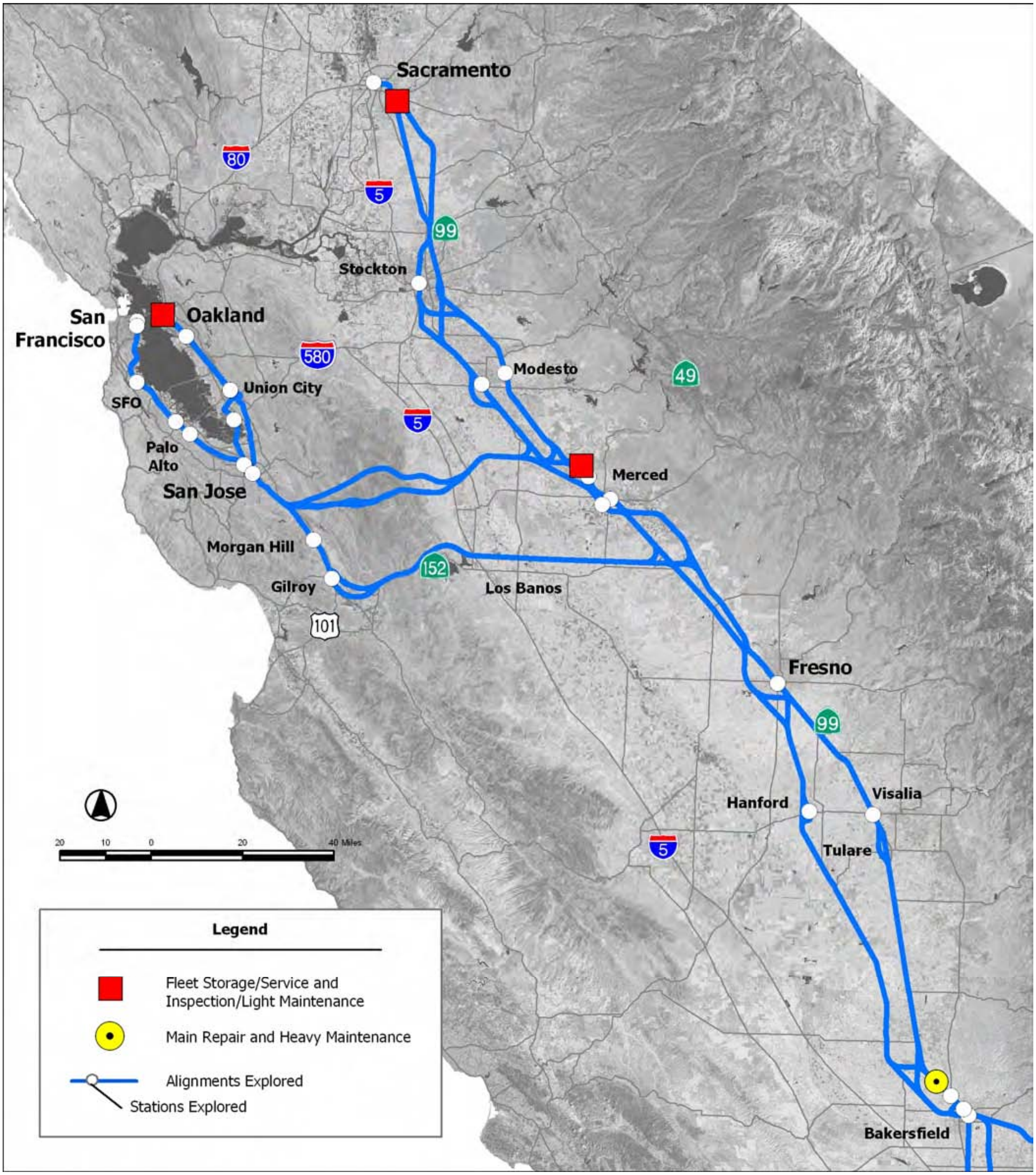

Figure 2.5-13
Support Facilities Considered (North)

- Component Cleaning Area: This enclosed work area, located on an exterior wall, would be used to pre-clean large components such as rail vehicle trucks, air compressors, and air conditioning units (condensers and evaporators) prior to disassembly and repair or shipment.
- Brake Shop: This area would be used to clean, disassemble, repair, reassemble, and test brake units and all brake actuators.
- Air Room: This facility would be used to clean, inspect, troubleshoot, repair, rebuild, paint, and test all types of brake valves and brake system components. The work area would be divided into four separate sections: the valve cleaning room, the repair area, the valve painting area, and the valve test area. The repair and test operations are performed in enclosed, temperature-controlled rooms. Repair operations are performed in individual workstations.
- Clean Room/Electronics Shop: This enclosed, temperature controlled room would be equipped to clean, troubleshoot, repair, and test trainset electronic components such as panels, relays, inverters, battery chargers, circuit cards, and selected control units. Repair activities are generally performed at individual workstations using specialized electronic test equipment.
- HVAC Unit Repair Shop: This area would be used to repair the components associated with air conditioning units.
- Pantograph Repair Area: This area would be located on a suspended platform at the roof level of a rail car for the removal and installation of electric propulsion energy collection components.
- Battery Room: This area supports the disassembly, cleaning, testing, and reassembly of multi-cell battery units.
- Wheel Shop: This area supports the fabrication and repair of wheel and axle sets. Machine technology resident in this shop includes a mounting press, demount press, wheel bore, and axle lathes.

Material Inventory and Distribution Area

This area serves as the distribution point in the Main Maintenance and Repair Facility for the material required to maintain, repair, clean, service, and provide for the state of good repair of the high-speed rail fleet. The area includes a loading dock for highway vehicles, space for the storage of transitional components (wheel sets, air compressors, etc.), and equipment (cranes, forklifts, pallet shelving etc.) associated with the efficient storage and distribution of rail car components and equipment.

Component Change-Out Area

This area is configured as a four track “run-through” facility. The hoist section of this area has the capacity to lift eight coupled rail cars on two separate tracks. Located between these tracks are two tracks configured for the removal and installation of rail car trucks. Car body posts hold the rail vehicle in place while the trucks are removed and positioned on one of the four available truck turntables for efficient transition into the Truck Shop.

Overhaul Area

This area is utilized in the life cycle maintenance program. Rail cars undergo rebuild and major component replacement on either a time or mileage based cycle. Systems and subsystems are removed, rebuilt, and replaced.

Heavy Repairs

This area accommodates repairs to a rail car that requires it to be out of service for an extended length of time.

Exterior Maintenance Shop

This area provides for the cosmetic and minor body damage repair, touch-up, and periodic re-painting of vehicle exteriors.

One fleet storage/service and inspection/light maintenance facility would be needed for each major branch of the statewide HST system (i.e., Bay Area, Sacramento, and southern California). These facilities would need to be sited as near as possible to the terminal stations. Main repair and heavy maintenance facilities are generally located near the main trunk line of the system (Los Angeles to Merced), where the majority of trains would pass on a daily basis. Only one main repair and heavy maintenance facility would be necessary.

3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION STRATEGIES

3.0 Introduction

This chapter addresses potential impacts on environmental resources, treating each resource in a separate subsection. CEQA encourages state agencies to prepare joint CEQA-NEPA documents and also to rely on EISs prepared for compliance with NEPA to satisfy CEQA requirements where possible and appropriate. The Authority and the FRA have used their best judgment in preparing this combined Program EIR/EIS to satisfy both CEQA and NEPA requirements, and, as a result, it contains more information than is mandated by either the federal or state statutory and regulatory requirements. Including this information is appropriate because of the complex and unusual nature of, and the technical issues involved in, the project, the proposed HST system. In addition, Chapter 9, "Unavoidable Adverse Environmental Impacts," includes summary information on certain CEQA requirements discussed in this chapter.

Each environmental resource section of this chapter includes potential mitigation strategies that would be further refined during project-level design and analysis for sections of the HST system. Specific design features are outlined that will be applied during the implementation of the HST system to avoid, minimize, or mitigate potential impacts.

The Authority has focused on avoiding and minimizing potential impacts through rigorous planning and thoughtful design. The Authority has minimized overall impact potential by defining alignments to stay within existing public and railroad rights-of-way to the extent feasible, while still accommodating the appropriate features and design standards for the alternatives. The program level of environmental analysis provides a means to avoid and minimize adverse environmental impacts in the review and refinement of HST Alignment Alternatives and station location options, and identifies mitigation strategies for further consideration in project-level documents. The potential impacts associated with the implementation of the proposed HST system, many of which will be highly site specific, would be further addressed during subsequent project-level environmental review. During project-level review more precise information will be available regarding the location and design of proposed facilities. Using the level of design and engineering detail to be provided during project-level analyses, the Authority will implement approved mitigation strategies; further investigate ways to avoid, minimize, and mitigate potential impacts; and identify site-specific mitigation for sections of the HST system.

3.0.1 Purpose and Content of This Chapter

The purpose of this chapter is to describe existing environmental conditions in the areas that would be affected by the proposed HST Alignment Alternatives and the No Project Alternative, evaluate potential environmental impacts associated with constructing and operating the HST Alignment Alternatives, and present potential program-level mitigation strategies to avoid or reduce those impacts. The analysis presented in this chapter addresses the general effects of a program of actions that would make up the proposed HST system in the Bay Area to Central Valley study region. This chapter describes the general differences in potential environmental consequences between the No Project Alternative and the HST Alignment Alternatives identified in Chapter 2. The analysis also identifies key differences among the potential impacts associated with the various HST Alignment Alternatives and station location options, to support the selection of preferred alignments and station location options in the Bay Area to Central Valley study region.

Chapter 7, "High-Speed Train Network and Alignment Alternatives Comparisons," summarizes and compares the physical and operational characteristics and potential environmental consequences associated with the various HST Alignment Alternatives and describes the differences among the HST

Network Alternatives. A preferred HST Network Alternative and preferred alignment was identified following public and agency comment on the draft Program EIR/EIS and is defined in Chapter 8.

Many sources were used in the preparation of this document. References to these sources are cited in text and in Chapter 14.

3.0.2 Organization of This Chapter

This chapter is organized into sections by resource topic. The resource topics are grouped as follows.

- Transportation and related topics-air quality, noise and vibration, energy, and electromagnetic interference.
- Human environment-land use and community impacts, parklands, farmlands and agriculture, aesthetics and visual resources, socioeconomics, utilities and public services, and hazardous materials/wastes.
- Cultural resources (archaeological resources, historic properties) and paleontological resources.
- Natural environment-geology and seismic hazards, hydrology and water resources, and biological resources, including wetlands.
- Section 4(f) and 6(f) resources (certain types of publicly owned parklands, recreation areas, wildlife/waterfowl refuges, and historic sites).

Each resource topic section contains the following information.

- Regulatory requirements and methods of evaluation.
- Affected environment.
- Environmental consequences.
- Role of design practices in avoiding and minimizing effects. Mitigation strategies and CEQA significance conclusions.
- Subsequent analysis.

The methods of evaluation and regulatory requirements discussions for each resource topic describe the assumptions, approach for evaluation, and criteria used to identify potential impacts as significant (potentially requiring mitigation) and identify the relevant statutes and CEQA, NEPA, or regulatory agency guidelines relevant to future project approvals or decisions for that resource topic. The methods of impact evaluation were developed with input from state and federal resource agencies. The agencies acknowledge that this is a planning-level EIR/EIS aimed at making broad decisions to help determine the corridors and alignments to carry forward for project-level environmental evaluation. Key differences in potential impacts of each of the alignment alternatives are described.

As described in Chapter 2, "Alternatives," ridership for this system was estimated to vary between 90 million and 117 million passengers (32 million riders would be long-distance commuters) for 2030. For this Program EIR/EIS, the higher ridership forecast of 117 million intercity trips, including 32 million long-distance commute trips, provides a reasonable representation of total capacity and serves as a representative worst-case scenario for analyzing the potential environmental impacts from the physical and operational aspects of the alternatives in 2030. This higher forecast is generally used as a basis for defining the alternatives and is referred to hereafter as the representative demand. In some specific analyses (e.g., energy, air quality, transportation), high-end forecasts would result in potential benefits.

In those cases, additional analysis is included to address the impacts associated with lower ridership forecasts.

The affected environment discussions summarize the information that provides the basis for analysis of potential environmental impacts on each environmental resource. Information in the affected environment discussions is presented for each of the six identified corridors in the study region. The six corridors are San Francisco to San J:Jse, Oakland to San J:Jse, San Jose to Central Valley, East Bay to Central Valley, San Francisco Bay Crossings, and Central Valley. Because the proposed HST system would not be operational until the year 2020, the affected environment discussions describe both the existing conditions as of 2006 and, where appropriate and not overly speculative, the anticipated 2030 conditions that would pertain when the project becomes operational. For disciplines where projections of future changes in existing conditions would be overly speculative, the existing 2006 conditions were used as a proxy for the 2030 conditions. For some disciplines-such as transportation, energy, air quality, and land use-future conditions are routinely projected in adopted regional or local planning documents or are forecast by public agencies. In these cases, the existing conditions and the projected 2030 conditions were used as the basis for impact analysis. The technical studies addressing each resource topic provided key information for the preparation of the affected environment discussions.

The environmental consequences discussions describe the potential environmental impacts (both adverse and beneficial) of the HST Alignment Alternatives in comparison to the No Project Alternative. Each discussion begins by comparing existing conditions with 2030 No Project conditions to describe the consequences of the No Project Alternative and how environmental conditions are expected to change during the timeframe required to bring the proposed HST system online. Po described above, existing (2006) conditions were used as a proxy for 2030 No Project conditions where 2030 baseline information was unavailable, could not be projected, or would be overly speculative. Using 2030 No Project conditions as a basis for comparison, the analysis of impacts then addresses direct and indirect impacts for the proposed HST Alignment Alternatives, as well as potential cumulative impacts. Measures that already have been included as part of the proposed HST Alignment Alternatives to reduce or avoid potential environmental impacts were incorporated into this analysis; examples include locating the alignment within an existing transportation corridor and tunneling to avoid surface disruption in sensitive areas, such as parklands and wildlife habitat areas. The impact analyses compare logical segments of the alignment alternatives and station location options with one another.

For many of the environmental resources, broad study areas were defined to describe a wide context of the existing resources in proximity to proposed improvements. For example, the study area for floodplains extends 100 ft (30.5 meters [m]) on either side of the centerline of the alignment considered. However, the right-of-way necessary for the improvements considered is much smaller (e.g., only 25 ft [7.6 m] on either side of centerline for HST). Potential HST alignment floodplain impacts are described for the 50 ft (25 m) in total width typically needed for the track structures.

Potential impacts on public services, such as traffic and circulation and utilities, are also addressed in Chapter 3. However, specific issues will be addressed only during subsequent project-level environmental review, when more precise information will be available regarding location and design of the facilities proposed (e.g., elevated, at-grade, access locations, station design features, and fencing type and location). The detail of engineering associated with the project-level environmental analysis will allow the Authority to identify system requirements and further investigate ways to avoid, minimize, and mitigate potential effects on the provision of such services.

A. RELATIONSHIP OF THIS CHAPTER TO OTHER CHAPTERS

- The impacts of the HST system were analyzed using a multistep process and are presented accordingly in several chapters.
- This chapter presents the potential impacts of HST Alignment Alternatives, which are the building blocks for creating representative network alternatives.
- Chapter 7, “High-Speed Train Network and Alignment Alternatives Comparisons,” compares the total estimated impacts for the 21 HST Network Alternatives, which represent different ways to

implement the HST system in the study region using combinations of HST Alignment Alternatives and station location options.

- Chapter 5 presents the potential growth effects of the HST system, and Chapter 9 presents the potential unavoidable adverse impacts.

For more information on the relationship between HST Alignment Alternatives and Network Alternatives and for definitions of specific terms, such as study region and station location option, see Chapter 2, "Alternatives."

B. DESIGN FEATURES/PRACTICES AND MITIGATION STRATEGIES

As currently planned, the proposed HST system would avoid and minimize potential negative environmental consequences. Conceptual designs of the HST system meet the project objectives (Chapter 1, "Purpose and Need and Objectives") and design criteria (California High Speed Rail Authority 2004), which set specific goals to avoid and minimize negative environmental consequences. In addition, design and construction practices have been identified that would be employed as the project is developed further in project-level environmental review, final design, and construction stages. Although many of these practices are explicitly included in the project description and included in the capital cost estimates for the project, their application to avoidance and minimization of p:ltential impacts may not be readily apparent. Thus, for each environmental resource topic (section of Chapter 3), applicable design and construction practices and resulting features related to the potential impacts identified in that section are discussed.

The mitigation strategy discussions describe potential approaches that can be identified at a program level for use to avoid, minimize, or reduce potentially significant environmental impacts.

Finally, each resource topic section includes a subsequent analysis discussion summarizing directions for more detailed study during project-level environmental review and documentation.

3.1 Traffic, Transit, Circulation, and Parking

This section describes the transportation study area in the study region and existing traffic and circulation conditions. It also identifies the potential traffic, transit, circulation, and parking impacts of the HST system in each identified corridor and at each HST station location option and compares the impacts of the HST system with the No Project Alternative at these locations.

3.1.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

NEPA and CEQA require that potential impacts of a proposed HST system on the traffic, transit, and circulation of the study region be examined as part of the program EIR/EIS process.

B. METHOD OF EVALUATION OF IMPACTS

The traffic, transit, circulation, and parking analyses focus on a broad comparison of potential impacts on traffic, transit, circulation, and parking along stations for the HST Alignment Alternatives and station location options. Potential impacts are compared to the No Project Alternative.

Highways, roadways, passenger transportation services (e.g., bus, rail, and transit facilities), goods movement, and parking issues are evaluated in this analysis. Transportation facilities, highways, and roadways included in the analysis serve as the primary means of existing (or planned future) access to the rail station location options. These facilities are within 1 mile (mi) (1.6 kilometers [km]) of the suburban rail stations location options or 0.25 mi (0.40 km) of downtown station location options.

Initial analysis identified primary routes to be considered for highways (as designated in the No Project Alternative) and for all modes of access to the HST station location options. Once primary routes were identified, screenlines or cordons combining segments of the primary access routes were established. These segments reasonably represent locations for evaluating the aggregate baseline traffic and public passenger transportation conditions (using data for 2005 and 2030) in the generalized peak hour. The use of screenlines or cordons rather than detailed traffic analysis is appropriate for the broad scale and program level of this analysis of roadway conditions in the vicinity of proposed HST station location options throughout the study region. Screenlines in the vicinity of proposed HST station location options were selected to represent typical peak-hour conditions.

To capture the effects of diversions to HST on intercity highway, intercity highway links were selected in each transportation corridor likely to be affected by HST. The data used in the evaluation of traffic volumes and capacities on the intercity highway links are typical values, based on averages over time and represented in traffic forecasting tools used by the regional transportation planning agencies. As such, the conditions indicated in the evaluation may not always reflect the experiences of travelers at any particular place at any specific time. For example, localized capacity restrictions (e.g., bottlenecks at a given interchange) are not well represented in those regional traffic models. In addition, incidents on the road, such as accidents and vehicle breakdowns (nonrecurring congestion), are not represented in regional traffic models. This unpredictable type of incident is responsible for the majority of congestion in urban highway networks. This section also reports intercity links by relatively long sections of highway that average out variations that occur at specific locations. The result of these limitations of the methods and data used in this analysis is that many times the levels of service shown in the evaluation may be more optimistic than what would actually be experienced on the roadway under the forecasted conditions. Thus, it is important to consider the differences between the alignment alternatives and station locations options being compared rather than focus on the absolute value of the indicators (i.e., volume-to-capacity ratio [V/C] or level of service [LOS]) (Table 3.1-1).

V/C is a standard level of service measure for roadways, defined as the number of vehicles that travel on a transportation facility divided by the full vehicular capacity of that facility (the number of vehicles the facility was designed to convey).

The impact analysis that follows is discussed under three different scenarios. The three scenarios, or conditions, are:

1. Existing (year 2005) or baseline conditions.

2. Future (year 2030) without the proposed HST project, or No Project conditions.

3. Future (year 2030) with the proposed HST project with two sets of alignment scenarios (Pacheco Pass compared to Altamont Pass alternatives).

Steps or methods used to arrive at the required data are outlined below.

- Intercity Links— Existing conditions were established for intercity highway links based on available counts of existing weekday peak-hour traffic volumes (California Department of Transportation 2005). Future No Project and project conditions were determined from forecasts of 2030 intercity traffic with and without the HST alternatives. This process involved a comparison of existing and forecasted future volumes to the capacity of these links to determine the V/C at the link level. Both base and high HST ridership forecasts were developed. Because the comparisons between No Project and project conditions were very similar for the two forecasts, this study presents results from the only the base forecast for the intercity highway links.

- Station Cordons— After V/C across each cordon for roadways (not intersections) was established for the weekday peak hour, the LOS for these roadways was determined using *2000 HCM* standards for capacity (Transportation Research Board 2000). Screenlines/cordons around stations are shown in Appendix 3.1-A.
- Transit Access—Existing and future No Project conditions were established through an inventory of available public transportation services at and adjacent to the station location options.
- Goods Movement—Existing and future No Project conditions for goods movement (truck freight) at weekday peak hour for locations in the area were identified as critical by regional goods movement studies.
- Parking Near Stations—Descriptions of parking conditions are based on 2002 parking supply and demand, local plans for major parking expansion, and adequacy of local parking codes for meeting the projected growth in demand in 2030 (without the HST).

Additional analysis was conducted for the No Project and project conditions at the HST station screenlines. Trip generation in the vicinity of HST station location options was calculated based on the forecast 2030 demand for high-speed rail. Results from the high ridership forecast were used in the analysis to give the worst-case traffic impacts around stations. The generated trips were added to the appropriate baseline volumes and distributed to the identified roadway screenlines. Next, the generated trips were distributed on selected segments/links on station routes and modes of access to station location options and similar facilities. Specific methods are detailed below.

- For each screenline or cordon, new ratios of demand-to-capacity were calculated. Demand is the baseline volume plus additional trips generated by the HST system.
- Future No Project link capacity conditions were established based on the available plans from local and regional agencies, and fiscally constrained elements of the relevant RTP.

- Link-level analysis of impacts was performed on roadways for generalized weekday peak-hour conditions. Capacity levels were based on the *2000 HCM* methods. Future roadway V/C on selected segments compared future volumes with/without the proposed project with future capacity determined. Future V/C with/without the HST Alignment Alternatives was analyzed. This assessment was performed at a cordon level, aggregating the V/C on all major facilities accessing the stations.
- Cordon-level analysis was also performed for public transportation serving the stations, based on generalized weekday peak-hour service headway and capacity conditions.
- Impacts were determined by comparing qualitative future No Project transit service levels (as specified in relevant RTPs) with existing transit service levels and by comparing qualitative future HST Alternative transit load factors with future No Project transit load factors.
- Impacts on parking were calculated by comparing parking demand for both base and high forecasts to parking capacity. In general, the project would provide enough parking to meet demand. The exception is in San Francisco, where commercial parking operators are expected to provide parking at market rates.
- Goods movement impacts were determined through an assessment of the net impact of project alternatives on the segments.

Table 3.1-2 identifies impacts on intercity highways/roadways for selected intercity links in the affected transportation corridors. Impacts in the vicinity of HST station location options on highways, public transportation services, and parking facilities are described in Table 3.1-3 according to the potential extent of change to traffic, transit, circulation, and parking. Impacts are described by the V/C ratios or the transit load factors. For traffic, impacts are further described in terms of LOS[1] (LOS A to LOS F) (Table 3.1-1).

The final analytic step was to consider the mitigation strategies identified in the statewide program EIR/EIS and related findings and decision documents to avoid potential impacts related to traffic, circulation, or parking. Further refinement of these mitigation strategies will involve subsequent analysis of traffic, circulation, or parking in project-level environmental analyses prepared for sections of the HST program.

C. CEQA SIGNIFICANCE CRITERIA

Under CEQA, a proposed project should be analyzed for the potential effects listed below (California Department of Transportation 2003).

- An increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in the number of vehicle trips, the V/C, or congestion at intersections).
- Either individually or cumulatively exceeding an LOS standard established by the county congestion management agency for designated roads or highways.
- A substantial increase in hazards attributable to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).
- Inadequate parking capacity.
- Inadequate emergency access.

[1] *Level of service* is a qualitative measure used to describe the condition of traffic flow, ranging from excellent conditions at level of service (LOS) A to overloaded conditions at LOS F. LOS D is typically recognized as an acceptable service level in urban areas. The definition for each level of service for signalized intersections is based on the V/C ratio.

- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks).
- Rail, waterborne, or air traffic impacts.

V/C ratios and LOS are defined quantitatively in Table 3.1-1.

Given the scale of the proposed high-speed rail system and the broad area considered in this document, virtually all of the criteria mentioned above potentially would be affected by the No Project Alternative and the HST Alternative Alignments at some location or locations in the system, and these criteria will be considered and applied in future project-level environmental reviews. For this analysis, this program-level document focuses on the criteria below.

- Traffic and LOS analysis of the following elements
  - Intercity highway links,
  - Screenlines of primary highways/roadways accessing HST station location options.

Under CEQA, the proposed project would have a significant impact related to transportation and traffic if the project would result in:

- Substantial increase in traffic on roadways that exceeds the V/C.
- Inadequate parking capacity.
- Substantial interference with goods movement.
- Substantial interference with or lack of connectivity with other transit systems.

Table 3.1-1
Level of Service and Volume-to-Capacity Ratio Definition

Level of Service	Volume-to-Capacity Ratio	Definition
A	0.000–0.600	EXCELLENT. No vehicle waits longer than one red light and no approach phase is fully used.
B	0.601–0.700	VERY GOOD. An occasional approach phase is fully used; many drivers begin to feel somewhat restricted within groups of vehicles.
C	0.701–0.800	GOOD. Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.
D	0.801–0.900	FAIR. Delays may be substantial during portions of rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.
E	0.901–1.000	POOR. Represents the maximum vehicles that intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.
F	>1.000	FAILURE. Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.

Source: Transportation Research Board 1980.

3.1.2 Affected Environment

There are six corridors and 26 station location options, including alternate locations, in the study region. This section discusses the parking and transit services available at the station location options and briefly discusses the major roadways serving the proposed locations. The results of LOS analysis of the local streets surrounding the station are also included. The current traffic, transit, and parking conditions or utilizations are rated by volume to capacity ratio.

The first subsection describes the intercity highway corridors and goods movement in the region. The second subsection describes the transit providers in the study region, and the final subsection discusses the existing traffic, transit, circulation, and parking conditions at station location options by corridor in the study region.

A. INTERCITY HIGHWAY CORRIDORS AND GOODS MOVEMENT

The primary north-south highways in the Bay Area are US 101 and I-280 on the Peninsula and I-880 and I-680 in the East Bay. I-380 and State Route (SR) 87 provide east-west access on the San Francisco Peninsula. I-80 links San Francisco and Oakland via the Bay Bridge and continues to Sacramento. I-580, I-205, and SR 152 provide access to I-5 in the Central Valley, while I-5 and SR 99 provide north-south access in the Central Valley. Eighteen intercity highway links listed below were selected for analysis of HST impacts on intercity highways. The location of these links is illustrated by Figures 3.1-1 and 3.1-2.

1. US 101: San Francisco—SF Airport
2. US 101: SF Airport —Redwood City
3. US 101: Redwood City—I-880
4. US 101: I-880—San José
5. US 101: San José—Gilroy
6. US 101: Gilroy—SR 152
7. SR 152: US 101—I-5
8. SR 152: I-5—SR 99
9. I-80: SF—I-880
10. I-80: I-880—I-5
11. I-880: I-80—I-580
12. I-880: I-580—Fremont/Newark
13. I-880: Fremont/Newark—US 101
14. I-580: I-880 via SR 238—Livermore
15. I-580: Livermore—I-5
16. I-680: I-580—US 101
17. I-5: I-580—SR 140
18. SR 99: Ripon—Merced

After a decade and half of rapid job growth in the Bay Area, analysis of 2005 peak-hour traffic volumes indicates that some freeway segments in the study corridors of I-80, US 101, I-880, I-580, and SR 152 are very congested, operating at LOS E or F in the generalized peak hour in the peak direction. Of the 18 highway links analyzed, four links operate at V/C approaching 1.0 and two links operate at V/C greater than 1.0, showing congested conditions (Table 3.1-2). Following a description of the transit providers in the study region, the existing conditions of the intercity highway links are explained in more detail under their respective study corridors in Subsection C, Study Corridors and

Potential High Speed Train Stations. Future conditions are discussed in Section 3.1.3, Environmental Consequences.

Vehicles for goods movements use two sets of roadways: the intercity freeway links and local roads to access their destinations. The only location where the HST Alignment Alternatives would affect the local roads would be in the vicinity of major goods movement destinations adjacent to the Port of Oakland. Goods movement is subjected to the same levels of congestion on the intercity highway network as other traffic.

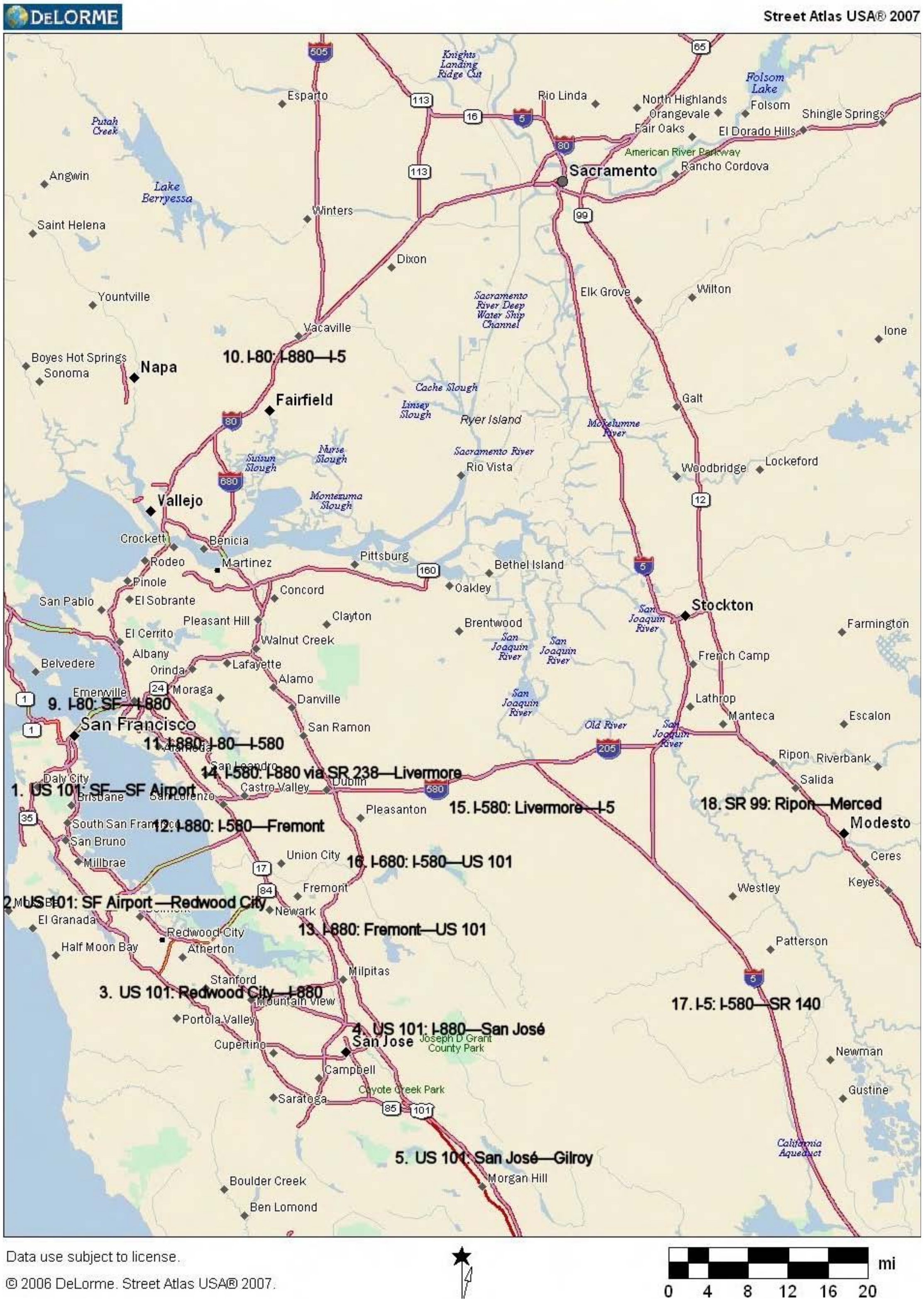

Figure 3.1-1
Bay Area Intercity Highway Links

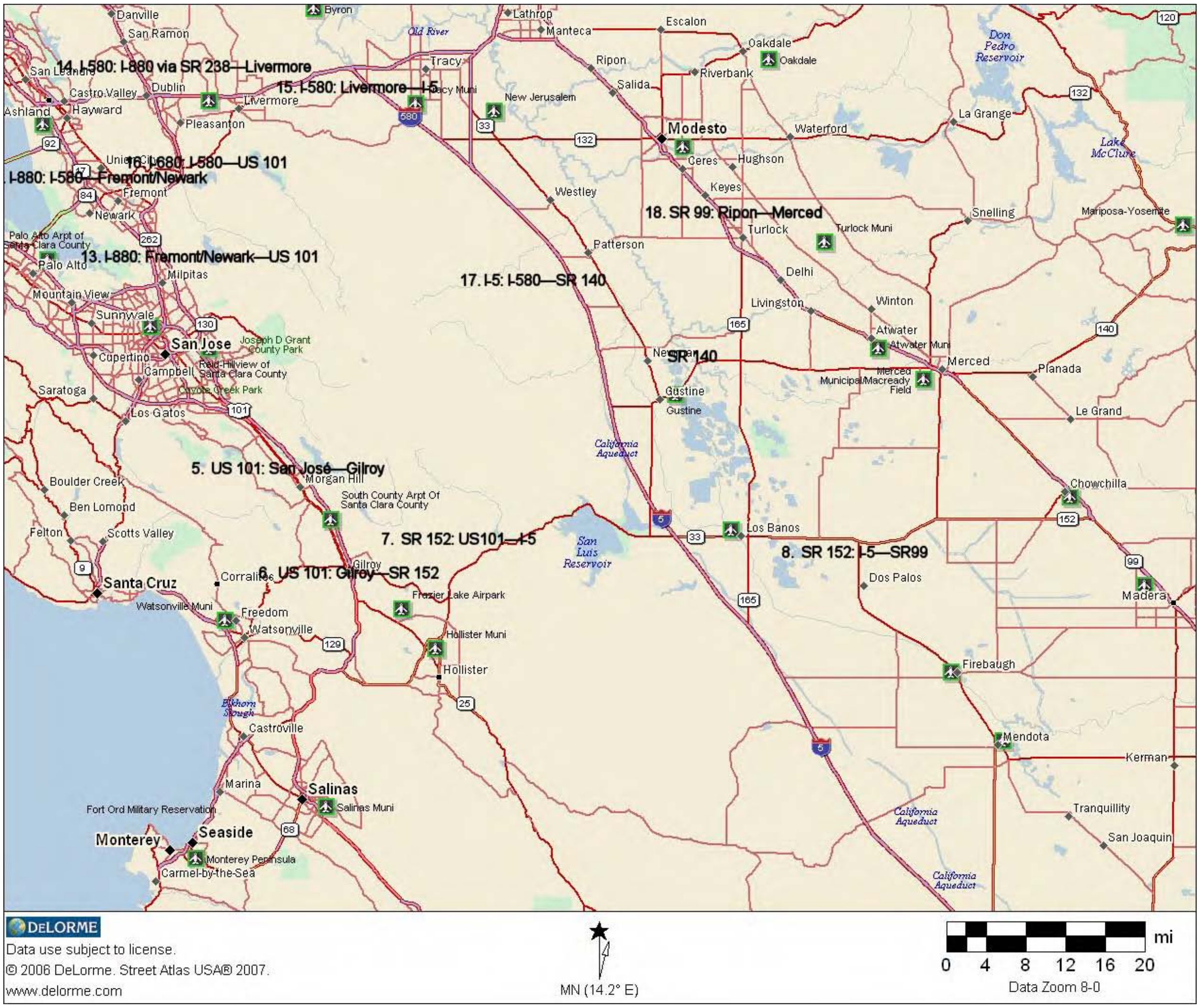

Figure 3.1-2
South Bay and Central Valley Intercity Highway Links

Table 3.1-2
Impacts to 2030 Peak-Hour Traffic on Intercity Freeways from Diversion to HST

				2030 ALIGNMENT ALTERNATIVES							
	2005	2030 NO-BUILD		PACHECO PASS ALTERNATIVES				ALTAMONT PASS ALTERNATIVES			
LOCATION	V/C, LOS[1]	V/C, LOS[1]	% CHANGE FROM EXISTING	PEAK-PERIOD TRIPS DIVERTED[2]	% CHANGE FROM NO-BUILD	V/C, LOS[1]	% CHANGE FROM NO-BUILD	PEAK-PERIOD TRIPS DIVERTED[2]	% CHANGE FROM NO-BUILD	V/C, LOS[1]	% CHANGE FROM NO-BUILD
US 101: San Francisco—SF Airport	0.81 D	0.95 E	17.2%	(596)	-0.6%	0.92 E	-2.7%	(599)	-0.6%	0.92 E	-2.7%
US 101: SF Airport —Redwood City	0.97 E	1.03 F	6.3%	(442)	-0.4%	1.03 F	-0.4%	(388)	-0.3%	1.03 F	-0.3%
US 101: Redwood City—I-880	0.75 C	1.47 F	96.5%	542	0.5%	1.48 F	0.5%	601	0.6%	1.48 F	0.6%
US 101: I-880—San José	0.73 C	0.79 C	8.3%	(5,392)	-4.6%	0.75 C	-4.6%	(4,989)	-4.2%	0.76 C	-4.2%
US 101: San José—Gilroy[3]	0.87 D	0.64 B	-26.7%	(4,948)	-4.0%	0.61 B	-4.0%	(2,015)	-1.6%	0.63 B	-1.6%
US 101: Gilroy—SR 152	0.72 C	1.17 F	64.0%	(2,986)	-3.7%	1.13 F	-3.7%	(1,524)	-1.9%	1.15 F	-1.9%
SR 152: US 101—I-5 [3]	0.78 C	0.51 A	-34.9%	(612)	-4.2%	0.49 A	-4.2%	81	0.6%	0.51 A	0.6%
SR 152: I-5—SR 99 [3]	0.59 A	0.46 A	-22.5%	(943)	-5.5%	0.43 A	-5.5%	(844)	-4.9%	0.43 A	-4.9%
I-80: SF—I-880	0.79 C	1.18 F	50.6%	(736)	-0.6%	1.18 F	-0.6%	(1,346)	-1.1%	1.17 F	-1.1%
I-80: I-880—I-5	0.81 D	0.98 E	19.9%	(2,545)	-3.7%	0.92 E	-5.6%	(3,007)	-4.4%	0.92 E	-6.2%
I-880: I-80—I-580	0.82 D	1.16 F	41.1%	(1,370)	-2.6%	1.13 F	-2.6%	(1,458)	-2.7%	1.13 F	-2.7%
I-880: I-580—Fremont/Newark	0.95 E	1.12 F	18.0%	(1,852)	-1.8%	1.10 F	-1.8%	(2,068)	-2.0%	1.10 F	-2.0%
I-880: Fremont/Newark—US 101	0.96 E	1.58 F	65.5%	(325)	-0.3%	1.58 F	-0.3%	(1,468)	-1.2%	1.57 F	-1.2%
I-580: I-880 via SR 238—Livermore	0.74 C	1.28 F	73.8%	(3,938)	-2.5%	1.25 F	-2.5%	(5,263)	-3.4%	1.24 F	-3.4%
I-580: Livermore—I-5	0.51 A	1.22 F	137.8%	(6,325)	-5.4%	1.15 F	-5.4%	(6,647)	-5.7%	1.15 F	-5.7%
I-680: I-580—US 101	1.06 F	1.34 F	25.8%	630	0.5%	1.34 F	0.5%	869	0.7%	1.35 F	0.7%
I-5: I-580—SR 140 [3]	0.99 E	0.81 D	-17.6%	(7,897)	-20.2%	0.65 B	-20.2%	(7,342)	-18.8%	0.66 B	-18.8%

LOCATION	2005	2030 NO-BUILD		2030 ALIGNMENT ALTERNATIVES							
				PACHECO PASS ALTERNATIVES				ALTAMONT PASS ALTERNATIVES			
	V/C, LOS[1]	V/C, LOS[1]	% CHANGE FROM EXISTING	PEAK-PERIOD TRIPS DIVERTED[2]	% CHANGE FROM NO-BUILD	V/C, LOS[1]	% CHANGE FROM NO-BUILD	PEAK-PERIOD TRIPS DIVERTED[2]	% CHANGE FROM NO-BUILD	V/C, LOS[1]	% CHANGE FROM NO-BUILD
SR 99: Ripon—Merced	1.04 F	1.36 F	30.9%	(1,847)	-2.8%	1.32 F	-2.8%	(1,943)	-3.0%	1.32 F	-3.0%

[1] Peak-hour V/C changes based on diversion to HST. LOS values are defined from V/C values as follows: up to 0.60=A, above 0.60 to 0.70=B, above 0.70 to 0.80=C, above 0.80 to 0.90=D, above 0.90 to 1.00=E, above 1.00=F

[2] The peak period is the sum of the AM and PM 3-hour peak periods. Where the percentage diversion is different than the V/C percentage change, it is because of unequal directional split of diversion.

[3] Future capacity increases result in improved LOS between 2005 and 2030.

Source: Caltrans 2005 AADT, Cambridge Systematics (base forecast), Parsons, June 2007.

Table 3.1-3
Impacts to Traffic, Transit, and Parking from HST Station Location Options

Corridor/Station Location Options	HIGHWAY/STATION CONDITIONS/IMPACTS (V/C)				TRANSIT CONDITIONS/IMPACTS (V/C)			PARKING CONDITIONS/IMPACTS [Demand V/C)]		
	2005 Conditions	2030 without HST Conditions	2030 HST Impacts		2005 Conditions	2030 without HST Conditions	2030 HST Impacts	2005 Conditions	2030 without HST Conditions	2030 HST Impacts
			Pacheco	Altamont						Pacheco/ Altamont
San Francisco to San Jose: Caltrain										
Transbay Transit Center	0.80; LOS D	0.90; LOS D	1.08 LOS F	1.03 LOS F	>1	>1	>1	<1	<1	2,000 - 3,000 (<1) 1,500 - 2,100 (<1)
4th and King (Caltrain)	0.33; LOS A	0.40; LOS A	0.69 LOS B	0.61 LOS B	<1	<1	<1	<1	<1	2,000 - 3,000 (<1) 1,500 - 2,100 (<1)
Millbrae/SFO	0.63; LOS B	0.91; LOS E	0.96; LOS E	0.96; LOS E	<1	<1	<1	<1	<1	2,400 - 2,500 (<1) 2,100 - 2,500 (<1)
Redwood City (Caltrain)	0.61; LOS B	0.68; LOS B	0.72; LOS C	0.71; LOS C	<1	<1	<1	<1	<1	3,000 - 3,900 (<1) 2,300 - 3,000 (<1)
Palo Alto (Caltrain)	0.85; LOS D	0.47; LOS A	0.50; LOS A	0.49; LOS A	<1	<1	<1	<1	<1	3,000 - 3,900 (<1) 2,300 - 3,000 (<1)
Oakland to San Jose: Niles/I-880										
West Oakland/7th Street[2]	0.15; LOS A	0.16; LOS A	0.32; LOS A	0.32; LOS A	<1	<1	<1	<1	<1	N/A[1]
12th Street/City Center[2]	0.40; LOS A	0.45; LOS A	0.53; LOS B	0.53; LOS B	<1	<1	<1	<1	<1	N/A[1]
Coliseum/Airport[2]	0.30; LOS A	0.45; LOS A	0.52; LOS A	0.52; LOS A	<1	<1	<1	<1	<1	N/A[1]
Union City (BART)[3]	0.50; LOS A	0.55; LOS A	0.67; LOS B	0.67; LOS B	<1	<1	<1	<1	<1	3,000 - 3,900 (<1) 1,300 - 1,800 (<1)
Fremont (Warm Springs)	0.48; LOS A	0.46; LOS A		0.47; LOS A	<1	<1	<1	<1	<1	1,300 - 1,800 (<1)
San Francisco Bay Crossings										
Union City (Shinn)	0.31; LOS A	0.46; LOS A		0.49; LOS B	<1	<1	<1	<1	<1	1,300 - 1,800 (<1)
San Jose to Central Valley: Pacheco Pass										
San Jose (Diridon)	0.25; LOS A	0.48; LOS A	0.59; LOS A	0.58; LOS A	<1	<1	<1	<1	<1	7,200 - 9,800 (<1) 6,500 - 8,800 (<1)
Morgan Hill (Caltrain)	0.42; LOS A	0.59; LOS A	0.65; LOS B		<1	<1	<1	<1	<1	1,400 - 1,500 (<1)
Gilroy (Caltrain)	0.44;	0.67;	0.74;		<1	<1	<1	<1	<1	2,800 - 3,800 (<1)

Corridor/Station Location Options	HIGHWAY/STATION CONDITIONS/IMPACTS (V/C)				TRANSIT CONDITIONS/IMPACTS (V/C)			PARKING CONDITIONS/IMPACTS [Demand V/C)]		
	2005 Conditions	2030 without HST Conditions	2030 HST Impacts		2005 Conditions	2030 without HST Conditions	2030 HST Impacts	2005 Conditions	2030 without HST Conditions	2030 HST Impacts
			Pacheco	Altamont						Pacheco/ Altamont
	LOS A	LOS B	LOS C							
East Bay to Central Valley: Altamont Pass										
Pleasanton (I-680/Bernal Rd)	0.47; LOS A	0.53; LOS A		0.70; LOS C	<1	<1	<1	<1	<1	6,900 - 9,100 (<1)
Pleasanton (BART)	0.21; LOS A	0.44; LOS A		0.46; LOS A	<1	<1	<1	>1	>1	6,900 - 9,100 (<1)
Livermore (Downtown)	0.46; LOS A	0.82; LOS D		1.10; LOS F	<1	<1	<1	NA	NA	6,900 - 9,100 (<1)
Livermore (I-580)	0.86; LOS D	1.07; LOS F		1.38; LOS F	<1	<1	<1	NA	NA	6,900 - 9,100 (<1)
Livermore (Greenville Road/UPRR)	0.21; LOS A	0.44; LOS A		0.71; LOS C	NA	NA	<1	NA	NA	6,900 - 9,100 (<1)
Livermore (Greenville Road/I-580)	0.44; LOS A	0.50; LOS A		0.80; LOS C	NA	NA	<1	NA	NA	6,900 - 9,100 (<1)
Tracy (Downtown)	0.34; LOS A	0.64; LOS B		0.74; LOS C	<1	<1	<1	<1	<1	1,200 - 1,700 (<1)
Tracy (ACE)	0.01; LOS A	0.02; LOS A		0.26; LOS A	NA	NA	<1	NA	NA	1,200 - 1,700 (<1)
Central Valley										
Modesto (Downtown)	0.53; LOS A	0.90; LOS D	0.92; LOS E	0.92; LOS E	<1	<1	<1	<1	<1	2,700 - 4,000 (<1) 2,800 - 4,100 (<1)
Briggsmore (Amtrak)	0.59; LOS A	0.88; LOS D	0.91; LOS E	0.91; LOS E	<1	<1	<1	NA	NA	2,700 - 4,000 (<1) 2,800 - 4,100 (<1)
Merced (Downtown)	0.95; LOS E	1.15; LOS F	1.16; LOS F	1.16; LOS F	<1	<1	<1	<1	<1	1,000 - 1,300 (<1) 1,200 - 1,600 (<1)
Castle AFB	0.45; LOS A	0.63; LOS B	0.65; LOS B	0.65; LOS B	<1	<1	<1	NA	NA	1,000 - 1,300 (<1) 1,200 - 1,600 (<1)

Note:
[1] Represents 'unavailable data'.
[2] Oakland Station conditions estimated from prior analyses because no current ridership forecasts are available.
[3] Demand for Warms Springs under Altamont is used to approximate the parking demand at Union City because no forecasts are currently available.
Parsons 2007

Transit Providers in the Study Region

There are a number of transit providers in the region; the primary agencies in the study region are as follows:

- Municipal Railway (Muni), providing bus and light rail transit in San Francisco and bus service to parts of Daly City in San Mateo County.
- Bay Area Rapid Transit District (BART), providing rapid rail transit throughout Contra Costa, Alameda, and northern San Mateo Counties.
- Golden Gate Transit and Bridge District, providing ferries on the Bay and bus transit among Sonoma, Marin, and San Francisco Counties.
- Alameda County (AC) Transit, providing bus transit in Alameda County with express service into San Francisco via the Bay Bridge and limited express service to San Mateo County (via the San Mateo and Dumbarton bridges) and Santa Clara County.
- Santa Clara Valley Transportation Authority (SCVTA), providing bus and light rail transit in Santa Clara County, with limited connections to San Mateo County.
- Merced County Transit's "The Bus," providing bus transit service locally and beyond, with connections out of the Merced Transportation Center to Turlock, Atwater, Livingston, Los Banos, and Dos Palos.
- San Benito County Transit, providing shuttle bus service among Hollister, San Juan Bautista, Salinas, and south Santa Clara County.
- Caltrain, providing commuter rail service from Gilroy to San Francisco.
- San Mateo County Transit District (SamTrans), providing bus transit throughout San Mateo County and into parts of San Francisco and Palo Alto.
- Altamont Commuter Express (ACE), providing limited commuter rail service between Stockton and San Jose.
- Monterey-Salinas Transit (MST), serving Monterey County and southern Santa Cruz County via its 33 routes.
- Amtrak Capitols, providing limited commuter rail service between the Sacramento area and San José.
- Greyhound, providing limited intercity service throughout California and other states.
- Other transit providers in the region, including Livermore Amador Valley Transit (WHEELS), Western Contra Costa County Transit (WestCAT), San Joaquin Regional Transit, Stanislaus Regional Transit (StaRT), Ceres Area Transit (CAT), Ceres Dial-A-Ride, Riverbank-Oakdale Transit Authority (ROTA), and Modesto Area Express (MAX).

Table 3.1-4 lists the connecting transit services at the HST station location options.

Table 3.1-4
Connecting Transit Service at HST Station Location Options

Potential HST Stations	Connecting Transit Service
Transbay Transit Center	Muni 5, 6, 10, 14, 14L, 14x, 38, 38L, 76, 108; AC Transit C, CB, E, F, FS, G, H, J, L, LA, N, NL, NX, NX1, NX2, NX3, NX4, O, OX, P, S, SA, SB, U, V, W, Z, 800 SamTrans DX, FX, KX, MX, NX, PX, RX, 391, 292; Golden Gate Transit Service 10, 20, 30, 50, 60, 70, 80, 2, 4, 8, 18, 24, 26, 28, 32, 34, 38, 44, 48, 54, 56, 72, 74, 76, 78, 90, 93; WestCAT; Greyhound; Caltrain; BART
4th & King	Muni 10, 15, 30, 45, 47, 80x, 81x, 82x, N-Judah and T-Third Light Rail, Caltrain
Millbrae	SamTrans MX, 242, 390, 391, Caltrain, BART
Redwood City	SamTrans KX, PX, RX, 270, 271, 390, 391, Caltrain
Palo Alto	SamTrans KX, PX, RX, 280, 281, 390, 391; SCVTA 22, 35, 88,522, Caltrain
San Jose	SCVTA 22, 63, 64, 65, 68, 180, 305, 522, Hwy. 17, Caltrain, ACE, Amtrak, DASH, LRT, MST 55 (Monterey to San Jose Express)
West Oakland	AC Transit 13, 14, 19, 62,; BART
Oakland City Center	AC Transit 1, 1R, 62, 72, 72R, 72M, 88; BART
Oakland Coliseum	AC Transit 45, 46, 56, 57C, 98; BART
Union City	AC Transit 97, 99, 211, 214, 216, 232, 332, 801 ; SCVTA DB, DB1, 1, 2, 3, 4; BART
Shinn	No existing facilities; closest transit connection available to this location is AC Transit route 216, which is about 0.6 miles away.
Warm Springs	No existing facilities; closest transit connection available to this location is AC Transit route 215 on Warm Springs Boulevard and route 218 on Grimmer Boulevard (both within 0.5 mile of the station location option.)
Morgan Hill	SCVTA 15, 121, Caltrain, MST 55
Gilroy	SCVTA 17, 19, 68, 121, Caltrain, Greyhound, San Benito Transit, MST 55.
Bernal/I-680	WHEELS 8, 53, 54.
Dublin/Pleasanton	County Connection, WHEELS 3, 8, 10, 12, 20, 51, 54, 70X, 604, San Joaquin Transit RTD 60, 71, BART
Livermore I-580	WHEELS 12, 12A, 12V, 15, 20
Livermore Downtown	WHEELS 10, 11, 12, 14, 18, 162, 163, Dart Livermore, Greyhound, Amtrak, ACE
Greenville I-580	No existing facilities; closest transit connections available to this location are SJRTD/SMART buses, WHEELS (Route 20X), MAX Commuter bus, Greyhound, Amtrak, Tri Delta transit and ACE, which is about 2 miles away.
Greenville UPRR	No existing facilities
Downtown Tracy	Tracer Route A, D/E and SJRTD Route 26
Tracy ACE	No existing facilities; closest transit connection available is Tracer's Route C and Route D/E, which are about 2 miles away.
Downtown Modesto	StaRT, CAT, Ceres Dial-A-Ride, ROTA, MAX Route 25.
Amtrak Briggsmore	MAX 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 39, 41, 42, AMTRAK, StaRT

Potential HST Stations	Connecting Transit Service
Castle AFB, Merced	Merced County Transit's "The Bus"
Downtown Merced	Merced County Transit's "The Bus"
Source: Muni, SamTrans, Santa Clara Valley Transportation Authority, AC Transit, Golden Gate Transit, Merced County Transit, Caltrain, BART, 2003.	

B. STUDY CORRIDORS AND POTENTIAL HIGH SPEED TRAIN STATIONS

San Francisco to San Jose Corridor

This corridor includes the areas on the west side of the San Francisco Bay along the Caltrain rail line, from the city of San Francisco to the city of San Jose HST station location options.

The major intercity highway links in the corridor are the US 101 freeway links. Some freeway links in this corridor are very congested, operating at LOS E in generalized peak hour in the peak direction. As illustrated in Table 3.1-2, the V/Cs of US 101 links in the study corridor vary from 0.72 (LOS C) to 0.97 (LOS E), showing a range travel conditions in the corridor.

Three HST stations are expected along this corridor. LOS of cordons around the station location options in the corridor varies from LOS A to LOS D (Table 3.1-3).

One station is being considered for downtown San Francisco, either at a new Transbay Transit Center or at the existing Caltrain terminus at 4th and King. Traffic, circulation, and parking conditions are slightly better at the 4th and King region than the Transbay Transit Center because the latter is situated at a comparatively busier urban location.

The second station is being considered at the existing Millbrae BART/Caltrain station close to the San Francisco International Airport. The third station option would be at the Redwood City or Palo Alto Caltrain stations. Traffic, circulation, and transit situations in these two areas are comparable. However, parking availability is better at the Redwood City station.

The existing conditions at these station locations are described in more detail below.

Transbay Transit Center, San Francisco

The Transbay Transit Center in San Francisco would be the northernmost HST station location option on the west side of San Francisco Bay and is located on Mission Street between First and Beale Streets. However, San Francisco Transbay Terminal is a transportation complex in San Francisco that currently serves as the San Francisco terminus for transbay buses from San Francisco north to Marin County, east to the East Bay, and south to San Mateo County and other long-distance buses. In addition to San Francisco's own Muni, its largest tenants are Golden Gate Transit, AC Transit, SamTrans, and Greyhound Bus Lines. The Transbay Transit Center is a separate future project that would include a bus terminal and a rail station for Caltrain service with or without the HST system. In addition to maintaining the current bus services, this proposed terminal would also include a tunnel that would extend the Caltrain commuter rail line from its current terminus at 4th and King Streets to the new Transbay Transit Center. The heavy rail portion of the terminal would be designed to accommodate the planned HST from Los Angeles via the Caltrain line, and thus the proposed HST would utilize the planned Caltrain station.

The major freeways serving the station area are US 101 and I-80. The one-way streets, Howard Street (westbound), First Street (southbound), and Fremont Street (northbound), are the major arterials serving the station area. Mission Street, another arterial serving the station area, also has a bus lane in each direction. The cordon around this station location option operates at LOS D (V/C = 0.80).

The Transbay Transit Center is the San Francisco terminus of AC Transit's transbay bus routes and would become the primary terminus station for Caltrain service. Transit services are also provided by Golden Gate Transit, SamTrans, and Muni. BART is accessible within walking distance, and the Caltrain is accessible through connecting Muni services. See Table 3.1-4 for a detailed listing of intermodal connections to this location. Most of the public transit links in the station area operate at or above capacity during peak hours, and hence transit load factor or V/C is greater than one.

The fact that parking supply exceeds demand is primarily a function of the marketplace, which is to say that parking is available for a price. In this area around the Transbay Transit Center in San Francisco, parking occupancy is currently about 85%, partly because prices can run as high as $30 per day, although nearby surface lots charge about half of that. In a situation like this, parking can provide enough revenue to ensure supply in the area, if not on the site. Hence currently, V/C is less than one indicating that parking supply exceeds demand.

4th and King, San Francisco

The station location option would be southwest of the Transbay Transit Center, 1.3 miles away. I-80 and I-280 are the major freeways serving this area. King Street is the major arterial, and Townsend and 4th Streets are the minor arterials serving the station area. The cordon around this station location option operates at LOS A (V/C = 0.33).

4th and King is also the current terminal station on the Caltrain line. It is served by MUNI bus transit and light rail transit. See Table 3.1-4 for a detailed listing of connections to this location. Most of the public transit links in the station area operate at or below capacity during peak hours, and hence transit load factor or V/C is less than one.

Caltrain does not own or have access to parking at this location. This area is in transition, and the parking situation may become like that in downtown in 20 years as the Mission Bay development builds out. Hence, in the future, high prices for parking would lead to less demand, which could ensure enough supply. Parking under baseline conditions is sufficient. Hence currently, V/C is less than one to indicate that parking supply exceeds demand.

Millbrae Station, San Francisco Airport

The Millbrae station location option is the existing BART/Caltrain station just north of Millbrae Avenue. The existing at-grade Millbrae BART/Caltrain station is located at 200 North Rollins Road. There are entrances to the station on both the east and west sides of the tracks. The station is wheelchair accessible and has bicycle lockers, ticket vending machines, and public telephones. This region is served primarily by US 101. SR 82 and Millbrae Avenue, a major arterial, provide access to the region. I-280 also provides freeway access to local arterials on the western edge of the city. East Millbrae Avenue is a major arterial east of SR 82 and a minor arterial west of SR 82. Trousdale Drive is a local street that serves the local traffic. California Drive is a minor arterial south of Trousdale Drive. The cordon around this station location option operates at LOS B (V/C = 0.63).

Transit access is by Caltrain, BART, and SamTrans routes MX, 242, 390, and 391. Most of the public transit links in the station area operate at or below capacity during peak hours, and hence transit load factor or V/C is less than one.

Approximately 3,000 parking spaces are available in a five-level parking structure and adjacent surface lot, both located on the east side of the station. Monthly reserved, daily (free), midday (free), and carpool (free) parking spaces are available in the parking structure and surface lots of the existing BART/Caltrain station. The BART parking garage (3,000-car capacity) is sufficient to meet existing demand. Hence, V/C is less than one.

Redwood City

The Redwood City HST station location option is the existing Caltrain station located at 1 James Avenue. The main entrance to the station is on the west side of the tracks. The station is wheelchair accessible and has bicycle lockers, ticket vending machines, and public telephones. US 101 is the major freeway serving Redwood City. I-280 also provides freeway access to local arterials on the western edge of the city. SR 82, El Camino Real, provides access to the station area. Several arterials can be used by local traffic to access the station area. Broadway, Jefferson Avenue, and Middlefield Road are the minor arterials serving the area. Major local streets that serve the area are James and Hopkins. The cordon around this station location option operates at LOS B (V/C = 0.61).

Caltrain and SamTrans are the major transit service providers. Seven SamTrans routes and Caltrain connect to this location. See Table 3.1-4 for a detailed listing of connections to this location. Most of the public transit links in the station area operate at or below capacity during peak hours, and hence transit load factor or V/C is less than one.

Currently, parking at this location is sufficient to meet the existing demand. Hence, V/C is less than one.

Palo Alto

The Palo Alto HST station location option is the existing Caltrain station site located at 95 University Avenue. The station has a historical depot building, is wheelchair accessible, and has bicycle lockers, ticket vending machines, and public telephones. The Palo Alto HST station, an alternative to the Redwood City station, falls between US 101 and I-280. SR 82 is also used by local traffic to access the station area. Local shuttles connect different parts of the city to the Caltrain station. University Avenue and Embarcadero Road are the major arterials providing access to the station area. Arboretum Road, Palm Drive, and Alma Street are the collector streets feeding the station area. The cordon around this station location option operates at LOS D (V/C = 0.85).

SamTrans, SCVTA, and Caltrain provide transit access to the station area. See Table 3.1-4 for a detailed listing of connections to this location. Most of the public transit links in the station area operate at or below capacity during peak hours, and hence transit load factor or V/C is less than one.

The Caltrain station has surface parking lots on both sides of the railroad tracks. Approximately 385 parking spaces are provided in multiple surface lots adjacent to the station. Currently, there is just enough parking at this location to meet the existing demand. Hence, V/C is less than one.

Oakland to San Jose Corridor

This corridor includes the areas on the east side of San Francisco Bay along I-880 from the City of Oakland to the City of San Jose.

I-880 is the primary highway in this corridor. As shown in Table 3.1-2, I-880 freeway links are operating at V/C from 0.82 (LOS D) to 0.96 (LOS E), showing steady-flow to congested travel conditions.

Three or four HST stations are projected for this corridor. Cordons of all station location options along the corridor operate at LOS A. The northernmost terminal station on the Oakland to San Jose corridor would be adjacent to a BART station, either at West Oakland or at 12th Street/City Center. Traffic, circulation, and parking conditions are slightly better at West Oakland location than the 12th Street location because the latter is located at a busy urban commercial area. The second station in this corridor is planned adjacent to the BART station at Oakland Coliseum, close to the Oakland International Airport. There would also be a station at either Union City or Warm Springs.

West Oakland

The West Oakland BART station is located at 1452 7th Street, is wheelchair accessible, and has eight bicycle lockers. The underground HST station location option is on 7th Street between Henry Street and Mandela Parkway, adjacent to the existing aboveground BART station. I-880 and I-980 are the major freeways feeding the region. Adeline Street, 7th Street, and 14th Street are the major arterials near the station area. Mandela Parkway is a minor arterial that serves the station area. Peralta and 8th Street are the local roads serving the area. To the west of Union Street, 8th Street is a one-way road (eastbound). To the east of Union Street, it is two-way. The cordon around this station location option operates at LOS A (V/C = 0.15).

Amtrak, AC Transit buses, and BART provide transit services to the station area. AC Transit routes 13, 14, 19, and 62 offer connections to this location. Most of the public transit links in the station area operate at or below capacity during peak hours, and hence transit load factor or V/C is less than one.

The existing West Oakland BART station is surrounded by fee and permit surface parking lots. Monthly reserved permit, daily fee, single day reserved permit, extended weekend, and midday parking is available in surface lots. Currently, parking at this location is sufficient to meet to the existing demand. Hence, V/C is less than one.

Oakland 12th Street/City Center

The existing underground BART station is located at 1245 Broadway. The underground HST station location option is along 12th Street between Broadway and Martin Luther King Junior Way adjacent to and on the west side of the 12th Street BART station. The station would be located in the City Center district, an urban commercial area. I-880 is six blocks south of the station location option. Broadway, San Pablo, Telegraph, and 14th Street are the major arterials serving the area. All four arterials are two-way streets. Webster (westbound) and Franklin (eastbound) provide local access and are one-way streets. The cordon around this station location option operates at LOS A (V/C = 0.40).

In addition to BART, the station would be served by AC Transit bus lines. See Table 3.1-4 for a detailed listing of connections to this location. Most of the public transit links in the station area operate at or below capacity during peak hours, and hence transit load factor or V/C is less than one.

Commercial parking lots, including a garage in the City Center complex, appear to provide sufficient parking. Hence, V/C is less than one.

Oakland Coliseum/Oakland Airport

The existing Oakland Coliseum BART/Amtrak station is located at 73rd Avenue and San Leandro Street. A pedestrian overpass links the BART and Amtrak Capitol Corridor platforms. The HST station location option is between 71st Avenue and 73rd Avenue, along the Amtrak railroad tracks. I-880 is the major freeway serving the Oakland Airport and Coliseum region. San Leandro Street and Hegenberger Road are the major arterials used for accessing the Oakland Airport and Coliseum region. 77th Avenue is a local street near the station area. The cordon around this station location option operates at LOS A (V/C = 0.30).

BART and AC Transit are the major transit service providers. Air-BART, a direct shuttle between the airport and the BART station, also aids transit. AC Transit Routes 45, 46, 56, 57C, and 98 provide connections to this location. Most of the public transit links in the station area operate at or below capacity during peak hours and hence transit load factor or V/C is less than one.

At the BART station there is a surface parking lot along Snell Avenue that is sufficient to handle the current demand. Hence, V/C is less than one.

Union City

The existing Union City BART station is located on a 14-acre site at Union Square and Decoto Road. The entrance to the station is on Union Square on the west side of the tracks. The station location option is on 11th Street just to the east of the existing BART station along the existing Niles Subdivision track. The major freeway serving the region is I-880. Other major roadways serving the region are Alvarado Niles, Decoto Road, and I-238. Decoto and Alvarado Niles are the major arterials leading to the station area. The cordon around this station location option operates at LOS A (V/C = 0.50).

Union City Transit, SCVTA, BART, and AC Transit serve the area. See Table 3.1-4 for a detailed listing of connections to this location. Most of the public transit links in the station area operate at or below capacity during peak hours, and hence transit load factor or V/C is less than one.

There are surface lots for monthly reserved, daily (free), extended weekend, midday (free), and long term parking. Currently parking at this location is sufficient to meet the existing demand. Hence, V/C is less than one.

Warm Springs

No station facilities exist at the Warm Springs station location, although a BART station is proposed for the location. The HST station location option is at the intersection of South Grimmer Road and Warm Springs Boulevard adjacent to the proposed BART station. The station location option falls within the Warm Springs Business District in the City of Fremont. I-680 and I-880 are the closest freeways, and Fremont Boulevard, Grimmer Boulevard, and Warm Springs Boulevard are the closest major arterials. The cordon around this station location option operates at LOS A (V/C = 0.48).

AC Transit Route 215 on Warm Springs Boulevard and Route 218 on Grimmer Boulevard are the closest transit connections available within half a mile of the station location option. These public transit links operate at or below capacity during peak hours, and hence transit load factor or V/C is less than one.

No public parking facilities exist at this location. However, demand for parking is low, and V/C is less than one.

San Francisco Bay Crossings Corridor – Shinn Station

These alignment alternatives include the San Francisco Bay crossings between the cities of San Francisco and Oakland near the San Francisco/Oakland Bay Bridge and between the cities of East Palo Alto and Newark south of the Dumbarton Bridge and into the City of Fremont. The latter comprises a station at Shinn, Union City. The V/C of the I-80 freeway link in this study corridor is 0.79 (LOS C).

There are no existing station facilities at the Shinn station location option. The station location option would be in the Centerville area of the City of Fremont. The station would be located along the existing UPRR and ACE/Capitol Corridor tracks at Shinn Street and Von Euw Com, just east of the BART track crossing. SR 84 is the closest freeway, and Shinn Street and Von Euw Com are the major arterials feeding this location. The cordon around this station location option operates at LOS A (V/C = 0.31).

The closest transit connection available to this location is through Route 216 of AC Transit, which is about 0.6 mile away. Because the demand for transit at this location is low, transit load factor or V/C is less than one.

No public parking facilities exist at this location. However, demand for parking is low, and V/C is less than one.

San Jose to Central Valley Corridor

This corridor includes the areas from the City of San Jose south to the City of Gilroy and east across the Diablo Range to the Central Valley. Three alignments are within this corridor: Pacheco, GEA North, and Henry Miller.

US 101 and SR 152 are the primary highways in this corridor. As shown in Table 3.1-2, the US 101 freeway links from San Jose to SR 152 operate at acceptable conditions (V/C varying from 0.72 to 0.87). SR 152 from US 101 to I-5 operates at LOS C conditions (V/C = 0.78)

Two station location options are considered in this corridor: the existing San Jose Diridon Caltrain terminal, and a station at either the existing Morgan Hill or Gilroy Caltrain stations. Cordons of all station location options along the corridor operate at LOS A.

San Jose

The station location option is the existing Diridon Station located at 65 Cahill Street, which serves as the central passenger rail depot for San Jose. The area is served by the I-880 and I-280 freeways and by the roadways San Carlos, Santa Clara, and SR 82. San Carlos, Park, and Santa Clara are the major arterials serving the area. Bird Avenue is a collector street feeding the area. The cordon around this station operates at LOS A (V/C = 0.25).

The Diridon Station provides service for the Capitol Corridor and Coast Starlight Amtrak routes, Altamont Commuter Express, Caltrain, and SCVTA light rail. A list of transit lines currently serving the location is provided in Table 3.1-4. Most of the public transit links in the station area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

At the existing station, approximately 595 spaces are available for all-day parking in surface lots adjacent to the station. Because parking is sufficient to meet the demand, V/C is less than one.

Morgan Hill

Caltrain has a Morgan Hill station at 17300 Depot Street between East Main and East Dunne Avenues. The station is wheelchair accessible and has ticket vending machines, bicycle lockers, and public telephones. The station location option is the existing Morgan Hill Caltrain station. US 101 is the major freeway in the area. Monterey Street, Hale, and Dunne are the major arterials in the station area. Main Street is a minor arterial. The cordon around this station location option operates at LOS A (V/C = 0.42).

The station area is served by Caltrain, SCVTA, and MST. See Table 3.1-4 for a detailed listing of intermodal connections to this location. Most of the public transit links in the station area operate below capacity during peak hours and hence the transit load factor or V/C is less than one.

At the existing Caltrain station, all day parking is available in a total of 486 parking spaces, including 346 standard spaces, 131 compact spaces, 8 handicap spaces, and 1 handicap van accessible space. As there is sufficient parking at this location to meet the existing demand, V/C is less than one.

Gilroy

The Gilroy HST station location option is the existing Gilroy Caltrain station located at 7150 Monterey Street. US 101 is the major freeway and SR 152 the other major highway for accessing the area. Monterey Highway is the major arterial feeding the Gilroy station area. Tenth Street is a local road that would also be used by local traffic. As described by the cordon analysis (Table 3.1-3), the cordon around this station location option operates at LOS A (V/C = 0.44).

SCVTA, Caltrain, MST, San Benito County Transit, and Greyhound are the major transit service providers. See Table 3.1-4 for a detailed listing of intermodal connections to this location. Most of the public transit links in the station area operate below capacity during peak hours and hence the transit load factor or V/C is less than one.

At the existing Caltrain station, all day parking is available in a total of 471 parking spaces, including 464 standard spaces, 2 handicap spaces, 1 handicap van accessible space, and 4 passenger pick-up/drop-off spaces. Because there is sufficient parking at this location to meet the existing demand, V/C is less than one.

East Bay to Central Valley Corridor

This corridor includes the areas from the City of Fremont east through Niles Canyon and into the cities of Pleasanton, Dublin, and Livermore. East of the City of Livermore, the alignment alternatives in this corridor continue through the Altamont Pass and into the Central Valley via the cities of Tracy and Manteca.

I-580 and I-680 are the primary highways in this corridor. As shown in Table 3.1-2, these intercity freeway segments are operating at freeflow to congested conditions, with V/C ratios varying between 0.51 (LOS A) and 1.06 (LOS F).

Two stations are being considered for this corridor: one station in Dublin (BART station), Pleasanton (Bernal/I-680), or Livermore (Livermore or Greenville), and a second station in Tracy. Within Tracy, the two locations being considered are downtown Tracy and Tracy Altamont Commuter Express (ACE) close to Banta Road. Currently, all station cordons operate at LOS A.

Bernal/I-680, Pleasanton

Currently, no station facilities exist at the Bernal HST station location option. The station location option is along the UPRR in the City of Pleasanton. I-680 is the closest freeway for accessing the station. The major arterials feeding the Bernal station location option are Bernal Avenue, Main Street, and Sunol Boulevard. The cordon around this station location option operates at LOS A (V/C = 0.47).

Service to this location is provided by Livermore Amador Valley Transit Authority (WHEELS). Routes 8, 8A, 53, 54, and 602/606 connect to this location because all of these routes stop at locations that are a walkable distance from the proposed station location option and are therefore easily accessible. Most of the public transit links in the station location option area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

There is no public parking available at or in the vicinity of this station location option. However, demand for parking is low, and hence V/C is less than one.

Dublin/Pleasanton

This station location option would be at the existing Dublin/Pleasanton BART station. Dublin/Pleasanton BART station is located at 5801 Owens Drive in Pleasanton between two interchanges at Dougherty Road and Hacienda Drive near I-580. Major arterials around this location are Owens Drive, Dublin Boulevard via Iron Horse Parkway, and Demarcus Boulevard. The cordon around this station location option operates at LOS A (V/C = 0.21).

The existing BART station is served by several bus connections, including County Connection, WHEELS, San Joaquin Regional Transit, and BART. Nine routes are served by WHEELS, all of which stop at the BART station. San Joaquin Regional Transit provides connection from the BART station to San Joaquin County. In addition, transit agencies such as County Connection and BART provide more connections to the surrounding regions. Therefore, as this location is served by more than one transit agency; it is well connected with the surrounding region. For a detailed listing of connections to this location, refer to Table 3.1-4. Most of the public transit links in the station area operate at or below capacity during peak hours, and hence the transit load factor or V/C is less than one.

Monthly reserved, daily (free), extended weekend, midday (free), carpool (free), and long-term parking are all available just south of the station along Owens Drive and in two surface lots north of the station. A pedestrian underpass connects the parking areas on both sides of the tracks and serves as an entrance point to the station. The parking demand at this station exceeds capacity during peak hours, and hence V/C is greater than one.

Livermore I-580

There are no station facilities at the station location option along I-580 just west of the intersection with North Livermore Avenue. The closest major arterial to this location is North Livermore Avenue. The cordon around this station location option operates at LOS D (V/C = 0.86).

This station location option is served by Tri-Valley buses. Currently, routes 12, 12A, 12V, 15, and 20 stop at distances that are walkable to and from the station location option. These connections are provided by WHEELS. Most of the public transit links in the station location area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

The station location option is in an area of undeveloped open space. North of I-580, the land is designated open space. There is currently no parking at this location. However, there is a park-and-ride lot nearby.

Downtown Livermore

The station location option is along the south side of the UPRR tracks between Murietta Boulevard and P Street. I-580 is the closest freeway for accessing the station. An ACE train station and Livermore Amador Valley Transit Authority (LAVTA) Transit Center are located less than 0.5 mile to the east of this Livermore station location option. The major arterials feeding this station location option are Stanley Boulevard and Murietta Boulevard. The cordon around this station location option operates at LOS A (V/C = 0.46).

Currently, this station location is served by Tri-Valley buses with additional ACE, Amtrak, and Greyhound connections available at the Livermore Transit Center, Dart Livermore, and ACE station. Seven routes are operated by WHEELS, all of which stop at the location. All of these buses stop at locations that are walkable from this location option and thus easily accessible. For a detailed listing of connections to this location, refer to Table 3.1-4. Most public transit links in the station location option area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

The parking supply in downtown Livermore consists of on-street public parking and public parking garages.

Greenville I-580, Livermore

No station facilities exist at the Greenville I-580 HST station location option. Currently there are two ACE stations in Livermore, one on Vasco Road near Brisa Street, and another on Railroad Avenue adjacent to the transit center in downtown Livermore. The station location option would be adjacent to the southern edge of I-580 just east of the Greenville Road interchange. This is a greenfield site with no existing transit facilities or railroad right-of-way. Land use in the immediate vicinity of the station location option is primarily open space. I-580 is the closest freeway for accessing the station. The closest major arterial to this location is Greenville Road. The cordon around this station location option operates at LOS A (V/C = 0.44).

The station location option is not served by transit facilities. San Joaquin Regional Transit District (SJRTD)/SMART buses, WHEELS (Route 20X), MAX Commuter bus, Greyhound, Amtrak, Tri Delta Transit, and ACE offer service to locations that are about 2 miles away.

No public parking is available close to this location.

Greenville UPRR, Livermore

No station facilities exist at the Greenville UPRR HST station location option. Currently there are two ACE stations in Livermore, one on Vasco Road near Brisa Street and another on Railroad Avenue adjacent to the transit center in downtown Livermore. The station location option would be adjacent to Greenville Road just south of Patterson Pass Road. This is a greenfield site with no existing transit facilities or railroad right-of-way. Development of this site would require the placement of a new track and station facilities. I-580 is the closest freeway for accessing the station, and Greenville Road is the major arterial that would feed this location. The cordon around this station location option operates at LOS A (V/C = 0.21).

There are no transit services within half a mile of the station location option.

No public parking is available at or in the vicinity of this location option.

Tracy Downtown

The downtown Tracy HST station location option is along the UPRR right-of-way at East 6th Street just west of the intersection with North McArthur Drive. The station location option is at the southern end of the downtown area. I-205 is the closest freeway for accessing the station. The closest major arterial is Mc Arthur Road. The cordon around this station location option operates at LOS A (V/C = 0.34).

"Tracer," the City of Tracy's fixed bus route service, and SJRTD provide transit service to the station location option. Currently, Tracer's Route A and Route D/E (commuter) along with Route 26, an intercity route operated by SJRTD, serve the area. Bus stops for these routes are located within a brief walk of the station location option. Route 26 connects with Tracer in downtown Tracy and future Manteca transit buses in downtown Manteca. Most of the public transit links in the station area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

Public parking lots are located on the east and west sides of Central Avenue at 6th Street, close to the station location option. Parking lots also are located behind the businesses on the north and south sides of 10th Street between B Street and Central Avenue. Currently, parking spaces seem adequate to serve the existing demand, and hence V/C is less than one.

Tracy ACE

The other Tracy station location option is along the ACE railroad right-of-way, west of South Banta Road and about 1.5 miles south of I-205. This station location option is approximately 3 miles east of the existing Tracy ACE station and is outside the city limits but within the City of Tracy sphere of influence. I-205 is the closest freeway for accessing the station. The closest major arterial is South Banta Road. The cordon around this station location option operates at LOS A (V/C = 0.01).

Tracer and ACE provide transit service in the general area. The closest transit connection available is the ACE train service and Route C and Route D/E, which are about 2 miles away.

The station site is in a designated industrial area and is surrounded by undeveloped land/farmland, with limited off-street parking. Because the area is undeveloped, there is very little parking demand at this location.

Central Valley Corridor

The Central Valley corridor includes the areas of the Central Valley from the City of Stockton south to the northern areas of Madera County. There are six alignment alternatives in the Central Valley corridor that follow the existing UPRR and BNSF rail lines.

I-5 and SR 99 are the primary highways in this corridor. As shown in Table 3.1-2, these intercity freeway segments operate at congested LOS with V/C varying from 0.99 (LOS E) to 1.04 (LOS F).

Four station location options are being considered in this corridor. The two locations being considered for the Modesto station are downtown Modesto or close to East Briggsmore Road. The second station in this corridor would be at Merced. The two locations being considered are downtown Merced and Castle AFB. All station cordons except downtown Merced operate at LOS A. The cordon surrounding the downtown Merced station location option operates at LOS E, showing congested travel conditions.

Modesto Downtown

No station facilities exist at the downtown Modesto HST station location option. The existing Amtrak station is located on the northeastern edge of the city off of E. Briggsmore Avenue/Parker Road. The downtown Modesto HST station location option is along the Southern Pacific rail line between Low Street and Olive Street and parallel to 8th Street in downtown Modesto.

Regional access to downtown Modesto is provided by SR 99, SR 132, and SR 108. These routes are located close to the station area. The roadway network in the downtown area is made up of a grid system with one-way roadway segments. Major east-west arterials in the downtown area are L Street (SR 132 and SR 108) and K Street (SR 108). These two streets form a one-way couplet with three lanes provided on each facility. The major north-south arterial is 9th Street (SR 132). Other roadway facilities that provide access to the station area include north-south 7th, 10th, 11th, and 12th Streets, and east-west oriented J Street. The cordon around this station location option operates at LOS A (V/C = 0.53).

The Downtown Transportation Center is located 1 block away at 9th and J Streets. With convenient access to the Downtown Transportation Center, connections can be made to StaRT, CAT, Ceres Dial-A-Ride, and ROTA. The downtown station site is located 2 blocks northwest of the MAX Center, the transfer point for 16 bus routes providing 26 buses in the AM peak hour. Most of the public transit links in the station area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

Parking lots bound the downtown Modesto station area, with lots on 8th, 9th, K, and I Streets. A 700-space garage is on 10th Street. A small parking structure is on 11th street between J and I streets. In addition, the city-county building offers public parking and is located at the corner of 11th and K streets. There is also a 700-space parking garage at the corner of 12th and I Streets. With all of this parking available, V/C is less than one.

Amtrak Briggsmore (Modesto)

There is an existing Amtrak station located at E. Briggsmore Avenue/Parker Road. The suburban Modesto HST station location option is adjacent to the existing Amtrak station at the intersection of East Briggsmore Avenue and Santa Fe Avenue, approximately 5 miles northeast of downtown Modesto. The closest freeways to this location are SR 99, SR 132, and SR 108. East Briggsmore Avenue and Santa Fe Avenue are the two major arterials closest to this location. The cordon around this station location option operates at LOS A (V/C = 0.59).

MAX route 25 connects the Amtrak station with the Downtown Transportation Center. Currently, this location is served by 19 MAX routes and StaRT. Most of the public transit links in the station area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

The area surrounding the East Briggsmore Avenue site is generally undeveloped, and public parking supplies are those provided at the Amtrak station (approximately 150 parking spaces).

Castle AFB, Merced

No station facilities exist at the Castle AFB HST station location option, which is in an area just west of the defunct Castle AFB airfield.

The AFB is located approximately 8 miles from downtown Merced, and approximately 10 miles from the new UC Merced Campus. The major access roads around this location are Headwind Drive, Shaffer Road, and Santa Fe Drive. The cordon around this station location option operates at LOS A (V/C = 0.45).

Merced County Transit's "The Bus" system operates locally and beyond, with connections out of the Merced Transpo Center to Turlock, Atwater, Livingston, Los Banos, and Dos Palos. Most of the public transit links in the station area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

The areas surrounding the Castle AFB station and MCE area are currently undeveloped, with limited off-street parking supplies.

Merced Downtown

The downtown Merced HST station location option is on 16th Street between M and O Streets. The station area is currently occupied by a Southern Pacific Depot and is used for non-rail purposes and a regional bus transportation center. There is a historical Southern Pacific Company station in Merced at 15th Street between M and O Streets. SR 99 lies a block to the south. The closest major arterials are O Street, M Street, Main Street, and 16th Street. The cordon around this station location option operates at LOS E (V/C = 0.95).

Merced County Transit's "The Bus" system operates locally and beyond, with connections out of the Merced Transpo Center to Turlock, Atwater, Livingston, Los Banos, and Dos Palos. Most of the public transit links in the station area operate below capacity during peak hours, and hence the transit load factor or V/C is less than one.

Merced's downtown parking district provides approximately 1,400 public parking spaces. Currently the parking supply exceeds demand, and hence the V/C is less than one.

3.1.3 Environmental Consequences

This section describes the traffic, transit, circulation, and parking conditions under the No Project and the HST Alignment Alternatives. Subsections A and B below summarize the impacts (Tables 3.1-2 and 3.1-3) while Subsection C discusses impacts in detail by study corridor.

A. NO PROJECT ALTERNATIVE

The No Project Alternative would include programmed and funded transportation improvements to the existing transportation system that will be implemented and operational by 2030.

The primary differences between existing conditions and the No Project Alternative are the increased level of travel demand on local roads that lead to the stations and the implementation of new infrastructure. Improvements (programmed and funded) focus on existing modes of transportation;

therefore, the same modes of intercity transport will continue to be available. The programmed or funded transportation improvements assumed to be in operation by 2030 include some capacity improvements but generally no systemwide capacity improvements (e.g., major new highway construction) and will not result in a general improvement or stabilization of existing highways across the study area.

As discussed in Section 3.1.2, Affected Environment, six freeway links in the study area are very congested in 2005, operating at LOS E or F in the peak hour in the peak direction. V/Cs are expected to worsen on most links under the No Project Alternative. Despite planned highway capacity increases on most links, conditions are expected to improve only on four of the 18 links. Overall, traffic congestion is projected to worsen because travel rates (or the number of trips taken) are increasing by 2% per year at the gateways to the Bay Area. Traffic projections for the HST analysis show that commute trips into the Bay Area are expected to increase by 69% between 2005 and 2030. As a result, 13 of the 18 links are projected to operate at LOS E or F in 2030 (Table 3.1-2).

As described in Section 3.1.2, Affected Environment, some roadways leading to the station location options currently are congested. It should be noted that for some stations, even though the cordon surrounding station might operate at acceptable LOS, one or more roadways leading to the station location option could be operating at LOS E or LOS F (V/C greater than 0.9 or 1.0). These conditions are expected to deteriorate further under the No Project Alternative. Capacity under No Project conditions would be insufficient to accommodate the projected growth in traffic. V/Cs of cordons for all station location options in the study region would deteriorate under No Project conditions and are projected to experience an impact at the cordon level (Table 3.1-3).

Currently, parking lots in several of the BART and Caltrain stations are either at capacity or approaching capacity, with riders finding it hard to find parking spaces during peak hours. BART's strategic plan calls for improvements to station access by all modes through the promotion of alternatives to driving alone. This includes increasing the use of alternative modes of access including taxis, carpools, drop-off, shuttles, buses, walking, and bicycles to and from BART. As part of this, BART proposes to add additional parking spaces at selected existing stations to accommodate parking demand from the proposed BART to Silicon Valley extension. New parking facilities are planned as part of the new West Dublin/Pleasanton Station to add another 1,200 parking spaces. BART also plans to add another 500 parking spaces at the existing Dublin/Pleasanton Station in the future. Additional facilities may be constructed if infill BART stations are developed in the future. However, at this time there are no plans to significantly increase parking at existing BART stations.[2]

According to the Caltrain Capitol Improvements Plan, Caltrain proposes to add approximately as much parking as the increased demand in year 2020. Although this addition might improve the overall parking situation in the system, station-specific situations might not necessarily improve.

As a result, the parking situation at all the existing stations comprised within the above two systems would either remain the same or would deteriorate.

B. HIGH SPEED RAIL

Based on travel forecasts with and without HST alternatives, overall intercity highway conditions would improve with the HST. Table 3.1-2 illustrates the peak-period trips diverted on each link and the resulting changes in V/C. Of the 18 links analyzed, 15 or 16 links, depending on the alignment alternative, show V/C improvements compared with 2030 No Build conditions ranging from less than 1% to greater than 20%. The Pacheco Pass alternatives show improvement on 16 links, while the Altamont Pass alternatives show improvement on 15 links. The links that degrade in performance in

[2] Malcolm Quint, Principal Planner, San Francisco Bay Area Rapid Transit District, May 2007.

either case do so only slightly. The general intercity highway conditions would remain at poor LOS, however, with 12 or 13 links projected to experience LOS E or F in 2030 under the Pacheco Pass alternatives and Altamont Pass alternatives, respectively. The intercity highway links are explained in more detail under the pertinent corridor in Subsection C, Study Corridors and Potential High Speed Train Stations.

HST station trip generation was calculated based on the 2030 high demand forecast for HST service. The HST trips were then distributed to and from HST station location options. These trips are additions to the background traffic forecast (by the MTC travel model, or other travel models) for the arterial streets around each station.

The HST stations would have adverse impacts in some areas as a result of adding traffic to streets already congested with other traffic under the No Project Alternative in 2030. Note that the capacity of these arterial streets would be the same under both the No Project Alternative and the HST. A cordon analysis was conducted to see how the traffic operations on the streets vary under the two alternatives. This analysis looked at the traffic operations of the cordon surrounding the station area, as well as the individual streets in the cordon. Traffic operations in the cordon surrounding the station area would deteriorate slightly in all 26 locations, but would deteriorate from LOS D to LOS E or F in four cases or from LOS E or F to a worse LOS E or F in three cases. Subsection C below describes in more detail the differences in arterial operations at each station location option.

C. STUDY CORRIDORS AND POTENTIAL HIGH SPEED TRAIN STATIONS

By 2030, traffic conditions throughout the traffic study area are expected to worsen, and only limited improvements to transportation facilities are funded and programmed for implementation by 2030. Steadily increasing regional and urban traffic affects intercity commutes by delaying travelers where capacity is constrained. The HST would reduce long-term impacts on freeways and airports by diverting intercity automobile and airplane trips to the HST system. Table 3.1-2 lists the V/Cs and LOS of different highway links in the region under the No Project Alternative and two HST scenarios: the Pacheco Pass alternatives and the Altamont Pass alternatives.

Generally, public transit and goods movement are operating under the traffic conditions as other traffic. Compared to conditions under the No Project Alternative in 2030, V/C would improve on most intercity links under the HST alternatives. Goods movement would be generally improved by the HST, with the impacts following the freeway condition improvements resulting from diverted traffic.

The remainder of this section describes the conditions for the HST Alignment Alternatives and station location options and compares in more detail the relative differences between the No Project Alternative and the HST Alternatives. This section is organized by corridors and then by station. Tables 3.1-2 and 3.1-3 summarize the findings of this evaluation.

San Francisco to San Jose Corridor

This corridor includes the areas on the west side of San Francisco Bay along the Caltrain rail line from the city of San Francisco to the city of San Jose.

The intercity highway links in the corridor are the US 101 freeway links. Under the 2030 No Project Alternative, these links would operate at LOS C to F with volume to capacity ratio ranging from 0.79 to 1.47. The HST would alleviate some congestion on these freeway links by diverting some of the intercity automobile trips to the HST system, but it would increase the upper end of the V/C ratio to 1.48 from 1.47 in the No Project alternative. However, the lower end of the V/C ratio would decrease to 0.75 from 0.79 in the case of No Project. In the case of the Altamont Pass alternatives, the V/C for the US 101 link between San Francisco to San Francisco Airport would decrease by about 3% as compared to the No Project alternative.

Overall, there is a very slight difference in the effects of the two HST alternatives on V/C, and there is no difference in the LOS that ranges from C to F.

This corridor includes HST station location options in San Francisco (at the Transbay Transit Center or at 4th and King), Millbrae, and Redwood City or Palo Alto. With additional vehicles using the roadways to reach HST stations, LOS of these roadways would deteriorate compared to the No Project Alternative. The traffic impact on the cordon around the Transbay Transit Center would deteriorate from LOS D to LOS F. The impact on all other station cordons would be similar to or slightly worse as compared to the cordon traffic conditions under the No Project Alternative.

While at the comparatively busier urban location of the Transbay Transit Center the overall levels of operation would deteriorate from LOS D to LOS F under the No Project Alternative, at the 4th and King location the LOS would only deteriorate from LOS A to LOS B. Although there is no parking proposed at both these locations, as discussed in detail below, due to the high price of parking at these locations, sufficient parking would be available to accommodate the demand.

Traffic, circulation, and transit situations in Redwood City or Palo Alto Caltrain station location option areas are comparable, with slightly more base traffic on the streets feeding Redwood City station. Compared to the Palo Alto station location option, parking availability would be better at the Redwood City station and would remain so during No Project conditions. However, with the addition of HST traffic, neither station would be able to accommodate the parking demand even with the additional parking spaces proposed for the HST system.

Transbay Transit Center, San Francisco

By 2030 even without the HST, most of the roadways surrounding the station location option would operate near capacity. The cordon surrounding the station area would operate at LOS D (V/C = 0.90). With the addition of HST traffic, the Pacheco Pass alternatives would have a V/C of 1.08 (LOS F), and in the case of the Altamont Pass alternatives, the V/C would be 1.03 (LOS F).

The proposed Transbay Transit Center would be a major transportation hub in downtown San Francisco. SamTrans, AC Transit, Muni, Golden Gate Transit, Greyhound, and Amtrak buses would serve the Transbay Transit Center. A potential below-grade pedestrian route could connect the Transbay Transit Center to BART and the Market Street Muni subway lines. The Metropolitan Transportation Commission's Transbay Transit Center Improvement Plan details a new 1 million square foot bus and rail transit facility as well as new transit-oriented development surrounding the terminal. The terminal would include 30 bus bays on a single elevated bus level and 10 bus bays on a below grade mezzanine level plus an underground train station for future high-speed and conventional intercity and corridor rail service. Being in an urban hub, much of the HST station traffic would use transit services to access the station. Because the transit system in the region already would be operating at or above capacity during peak hours, this additional traffic would burden the transit lines further. Hence, the transit load factor or V/C would be greater than one.

With the addition of HST service to the Transbay Transit Center, the increase in parking demand would range from 2,000 to 3,000 spaces in the case of the Pacheco Pass alternatives and from 1,500 to 2,100 spaces in the case of the Altamont Pass alternatives. Because it is assumed that the private sector would respond to the demand at market rates and provide sufficient parking at or close to this location to accommodate the demand at this location, the V/C would be less than one. Basically, the assumption is that the HST riders have adequate parking if they pay $25 per day, the current market rate for the area.

4th Street and King Street, San Francisco

In 2030 without an HST station, the cordon surrounding the area would operate at LOS A (V/C = 0.40). With the addition of HST traffic, in the case of the Pacheco Pass alternatives, the V/C be 0.69 (LOS B) and in the case of the Altamont Pass alternatives, the V/C would be 0.61 (LOS B).

4th and King is also a station on the Caltrain line. Passengers at the existing Caltrain station can transfer to various MUNI buses and the N-Judah or T-Line light rail. With these transit services in operation at this location, transit load factor or V/C would be less than one.

With the addition of an HST station, increase in parking demand would range from 2,000 to 3,000 spaces in the case of the Pacheco Pass alternatives and from 1,500 to 2,100 spaces in the case of the Altamont Pass alternatives. Because it is assumed that the private sector would respond to the demand at market rates and provide sufficient parking at or close to this location to accommodate the demand at this location, the V/C would be less than one. Basically, the assumption is that the HST riders have adequate parking if they pay $25 per day, the current market rate for the area.

Millbrae Station, San Francisco Airport

By 2030 even without an HST station, most of the roadways surrounding the station location option would operate near capacity. The cordon surrounding the station would operate at LOS E (V/C = 0.91). With the addition of HST-related traffic, in the case of the Pacheco Pass or Altamont Pass alternatives, the V/C would be 0.96 (LOS E).

At this station location option, connections are available with BART, Caltrain, and SamTrans buses. Transit lines at this location operate at or below capacity, and therefore the transit load factor or V/C is less than one.

Parking is currently available in the parking structure and surface lots of the existing BART/Caltrain station. With the addition of an HST station, increase in parking demand would range from 2,400 to 2,500 spaces in the case of the Pacheco Pass alternatives and from 2,100 to 2,500 spaces in the case of the Altamont Pass alternatives. As part of this station location option, the parking area would be expanded by adding a new two-level parking garage on Sierra Avenue and Isabel Alley, although current extra capacity in the BART/Caltrain garage may make this addition unnecessary. There would be sufficient parking to accommodate the demand at this location and hence ensure that the parking V/C would be less than one.

Redwood City

By 2030 even without an HST station, most of the roadways surrounding this station location option would operate near capacity. The cordon surrounding the station area would operate at LOS B (V/C = 0.68). With the addition of HST-related traffic, in the case of the Pacheco Pass alternatives, the V/C would be 0.72 (LOS C), and in the case of the Altamont Pass alternatives, the V/C would be 0.71 (LOS C).

Connections available at this station include Caltrain and SamTrans. Transit lines would operate at or below capacity and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 3,000 to 3,900 spaces in the case of the Pacheco Pass alternatives and from 2,300 to 3,000 spaces in the case of the Altamont Pass alternatives. If this HST rail station location option is selected, the existing surface parking area adjacent to the south side of the tracks off Brewster Avenue would be expanded to ensure sufficient number of spaces to meet the demand at this location. Therefore, the V/C would be less than one.

Palo Alto

By 2030 without an HST station, most of the roadways surrounding the station location option would operate below capacity. The cordon surrounding the HST station area would operate at LOS A (V/C = 0.47). Even with the addition of HST traffic, in the case of the Pacheco Pass alternatives, the V/C would be 0.50 (LOS A) and in the case of the Altamont Pass alternatives, the V/C would continue to be 0.49 (LOS A).

Intermodal connections available at this station include Caltrain, SamTrans, Dumbarton Express, SCVTA, Palo/Alto Crosstown/Embarcadero Shuttle, East Palo Alto Shuttle, and Stanford Marguerite Shuttle. These transit lines would operate at or below capacity, and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 3,000 to 3,900 spaces in the case of the Pacheco Pass alternatives and from 2,300 to 3,000 spaces in the case of the Altamont Pass alternatives. The Caltrain station has surface parking lots on both sides of the railroad tracks. The HST station location option would include a 4-story parking facility on the western side of the tracks, in the southern portion of El Camino Park. This additional parking would be sufficient to accommodate the demand, and hence the V/C would be less than one.

Oakland to San Jose Corridor

This corridor includes the areas on the east side of San Francisco Bay along I-880 from the City of Oakland to the City of San Jose.

The intercity highway links in this corridor are the I-880 freeway links. With rising congestion, under the 2030 No Project Alternative, the I-880 freeway links in this segment would all operate at LOS F with volume to capacity ratio ranging from 1.12 to 1.58. The HST would alleviate some congestion on these freeway links by diverting some of the intercity automobile trips to the HST system. Although the freeway links would still operate at LOS F, for the Pacheco Pass alternatives, the V/C would range from 1.10 to 1.58 and for the Altamont Pass alternatives, the V/C would range from 1.10 to 1.57. In the case of the Altamont high alternative, the V/Cs for the Interstate 880 links between I-80 and I-580 and between I-580 and Fremont/Newark would decrease by 3 and 2%, respectively.

Three HST stations are projected in this corridor: Oakland (West Oakland or 12th Street), Oakland Coliseum, and either Union City or Warm Springs.

The Oakland HST station location option would be adjacent to the BART station either at West Oakland or at 12th Street/City Center. Traffic, circulation, and parking conditions are slightly better at the West Oakland location than the 12th Street location because the latter is a busy urban commercial area. In the 12th Street station location option, a few roadway segments would operate at LOS F both with the No Project and with an HST station. The proposed HST system would provide parking at the Oakland City Center station sufficient to serve demand, and the V/C would be less than one. Even though the BART station at West Oakland has parking spaces, on weekdays these spaces would likely be used by the BART patrons. However, enough parking would be provided for HST users, and thus the V/C at this location would be less than one.

There is also a potential station location option at either Union City or Warm Springs. One or more streets in Warm Springs or Union City would operate at LOS E or LOS F. Sufficient parking would be provided to accommodate the demand at these stations.

West Oakland

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.16). Even with the addition of the HST, under both the Pacheco Pass and Altamont Pass alternatives, V/Cs would be 0.32 (LOS A).

Passengers at the West Oakland station location option could connect to BART and AC Transit buses. Currently, AC Transit buses (Routes 13, 19, and 62) stop at the station site. BART is located adjacent to this site. Transit lines would operate at or below capacity, and hence the transit load factor or V/C is less than one.

The existing West Oakland BART station is surrounded by fee and permit surface parking lots. With the addition of an HST station in the area, parking demand would increase. The existing parking can only accommodate BART users and would not be adequate to serve the additional HST. However, enough parking would be provided for HST users, and thus the V/C at this location would be less than one.

Oakland 12th Street/City Center

In 2030 in the absence of an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.45). Even with the addition of the HST, under both the Pacheco Pass and Altamont Pass alternatives, V/Cs would be 0.53 (LOS A). Even though the cordon as a whole operates at acceptable LOS, the operations on southbound Franklin Avenue, south of 8th Street, would deteriorate from LOS C (V/C = 0.79) to LOS F (V/C = 1.06). Southbound Telegraph Avenue, south of Grand Avenue, would operate at LOS F both under the No Project Alternative and HST (V/C = 1.34 and 1.37, respectively). Similarly, northbound Webster Avenue, south of 8th Street, would operate at LOS F both under the No Project and HST (V/C = 1.18 and 1.45, respectively.)

Even with the addition of HST, the transit links are anticipated to operate at acceptable levels of service. Hence, the transit load factor or V/C is less than one.

The addition of an HST station in the area would increase parking demand as compared to the No Project Alternative. Development of this station location option includes four levels of underground parking. Assuming that these additional parking spaces would accommodate the increased demand, the V/C at this location would be less than one.

Oakland Coliseum/Oakland Airport

In 2030 in the absence of an HST station, the cordon surrounding the location would operate at LOS A (V/C = 0.45). Even with the addition of the HST, under both the Pacheco Pass and Altamont Pass alternatives, V/Cs would be 0.52 (LOS A).

Passengers at the Oakland Coliseum station can transfer to BART, Amtrak, AC Transit, and the AirBART shuttle to Oakland Airport. Even with the addition of HST, the transit links are anticipated to operate at acceptable levels of service. Hence, the transit load factor or V/C is less than one.

The addition of an HST station in the area would increase parking demand as compared to the No Project Alternative. In addition to the existing BART station parking along Snell Avenue, two new surface parking lots on either side of 73rd Avenue would be provided. Based on the assumption that these additional parking spaces would accommodate the increased demand, the V/C at this location would be less than one.

Union City

In 2030 in the absence of an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.55). With the addition of HST-related traffic, in the case of the Pacheco Pass alternatives, the V/C would be 0.67 (LOS B) and in the case of the Altamont Pass alternatives, the V/C would be 0.67 (LOS B). Even though the cordon as a whole operates at acceptable LOS, the operations on southbound Decoto Road, south of Alvarado Niles Road, would worsen from LOS C (V/C = 0.79) to LOS E (V/C = 0.95).

Passengers at the Union City BART station would be able to connect to AC Transit, SamTrans, Union City Transit, Amtrak, and future Dumbarton service. Even with the addition of the HST, the transit links are anticipated to operate at acceptable levels of service. Hence, the transit load factor or V/C is less than one.

With the addition of an HST station, the increase in parking demand would range from 3,000 to 3,900[3] spaces in the case of the Pacheco Pass alternatives and from 1,300 to 1,800 spaces in the case of the Altamont Pass alternatives. The HST station location option would include new parking spaces along the eastern side of the right-of-way in addition to the existing BART parking lot on the western side. Because of the provision of these additional parking spaces, the V/C at this station location option would be less than one.

Warm Springs

In 2030 in the absence of an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.46). Even with the addition of the HST, under both the Pacheco Pass and Altamont Pass alternatives, V/Cs would be 0.47 (LOS A). Even though the cordon as a whole operates at an acceptable LOS, the operations at southbound Warm Springs Boulevard, south of Grimmer Boulevard, would deteriorate from LOS C (V/C = 0.79) to LOS F (V/C = 1.10). Further, operations at southbound Fremont Boulevard, south of Grimmer Boulevard, would worsen from LOS B (V/C = 0.69) to LOS E (V/C = 0.91).

Plans for the new BART station at Warm Springs include access to SCVTA and Alameda–Contra Costa (AC) Transit buses. Buses would access the station via the surface parking lot from Grimmer Road. Adjacent to the parking lot for the HST station location option would be a bus transfer lot. Even with the addition of HST, the transit links are expected to operate at acceptable LOS. Hence, the transit load factor or V/C is less than one.

The new BART station is anticipated to provide approximately 2,040 parking spaces. A new HST station would include a surface parking lot that would be sufficient to meet the projected demand. The addition of an HST station in the area would increase parking demand by about 1,300 to 1,800 spaces in the Altamont Pass alternatives. BART environmental documents indicate that by 2025, BART parking would be fully utilized by BART patrons. However, since additional parking would be constructed so as to meet the HST parking demand, V/C would be less than one.

San Francisco Bay Crossings Corridor – Shinn Station

These crossing alignment alternatives include the San Francisco Bay crossings between the cities of San Francisco and Oakland near the San Francisco/Oakland Bay Bridge and between the cities of East Palo Alto and Newark south of the Dumbarton Bridge and into the City of Fremont. In the latter case, there is one proposed station at Shinn, Union City.

The intercity freeway link in this corridor is the Interstate 80 link that runs between San Francisco and I-880. Under the No Project alternative, this link operates at a V/C ratio of 1.18 (LOS F). All the other HST alternatives would operate at LOS F (V/C ranging from 1.17 to 1.18).

In 2030 in the absence of an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.46). Even with the addition of HST-related traffic, under both the

[3] Demand for Warms Springs under Altamont is used to approximate the parking demand at Union City because no forecasts are currently available.

Pacheco as well as the Altamont Pass alternatives, the cordon surrounding the station area would operate at LOS A (V/C = 0.49).

Currently, the closest transit connection available near the station location option is 0.6 mile away and is provided by AC Transit bus route 216 along Peralta Boulevard (off Shinn Street). Connections with Amtrak Capitol Corridor and ACE would be established. Even with the addition of the HST, the transit links are anticipated to operate at acceptable levels of service. Hence, the transit load factor or V/C is less than one.

The addition of an HST station in the area would increase parking demand by about 1,300 to 1,800 spaces in the Altamont Pass alternatives. However, the Shinn station location option includes a surface parking lot at the intersection of Von Euw Com and Shinn Avenue. Based on the assumption that the additional parking spaces would accommodate the increased demand, V/C would be less than one.

San Jose to Central Valley Corridor

This corridor includes the areas from the City of San Jose south to the City of Gilroy and east across the Diablo Range to the Central Valley.

The intercity highway links in this corridor are the US 101 freeway and SR 152. Under the 2030 No Project Alternative, the US 101 freeway links between San Jose and Gilroy would operate at LOS B or F with V/C varying from 0.64 to 1.17. Under the same alternative, the SR 152 freeway links would operate at LOS A with V/C varying from 0.46 to 0.51.

With some automobile traffic diverted to the HST system, both links would operate at lower V/Cs, as shown in Table 3.1-2. For the Pacheco Pass alternatives, the V/C for this corridor would range from 0.61 to 1.13 (LOS B to F) and for the Altamont Pass alternatives, the V/C for the corridor would range from 0.63 to 1.15 (LOS B to F). While the V/Cs of the US 101 links from San Jose to Gilroy and Gilroy to SR 152 would decrease by 4% in the Pacheco Pass alternatives, the decrease would be about 2% under the Altamont Pass alternatives. V/C ratios of the SR 152 link between US 101 and I-5 decrease by 4% in the Pacheco Pass alternatives and increase by 0.6% in the Altamont Pass alternatives, as compared to the No Project alternative. The V/C ratios of the SR 152 link between I-5 and SR 99 decrease by 6% in the Pacheco Pass alternatives and by 5% in the Altamont Pass alternatives.

The station location options being considered in this segment are the existing San Jose Diridon Caltrain terminal and either the existing Morgan Hill or Gilroy Caltrain station. Traffic, transit, circulation, and parking conditions are similar for both Morgan Hill and Gilroy station options.

San Jose

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.48). Even with the addition of HST-related traffic, the cordon surrounding the station area still would operate at LOS A (V/C ranging from 0.59 to 0.58 in the Pacheco and Altamont Pass alternatives, respectively). Even though the cordon as a whole operates at LOS A, a few roadways would operate at LOS E and F both under the No Project Alternative and with the HST system.

Diridon Station provides service for the Capitol Corridor and Coast Starlight Amtrak routes, ACE, Caltrain, and SCVTA light rail. Transit lines would continue to operate at acceptable levels, and therefore the transit load factor or V/C is less than one.

At the existing station, approximately 595 spaces are available for all day parking in surface lots adjacent to the station. With the addition of an HST station, increase in parking demand would range from 7,200 to 9,800 spaces in the case of the Pacheco Pass alternatives and from 6,500 to

8,800 spaces in the case of the Altamont Pass alternatives. However, this demand would be offset by the provision of additional parking, and hence the V/C would be less than one.

Morgan Hill

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.59). With the addition of HST, in the case of the Pacheco Pass alternatives, the V/C would be 0.65 (LOS B).

Even though the cordon as a whole operates at acceptable LOS, westbound East Dunne Street would operate at LOS F both under the No Project Alternative and with the HST.

The Morgan Hill station location option is the existing Morgan Hill Caltrain station. The passengers at the Caltrain station can transfer to SCVTA buses. Transit lines would continue to operate at acceptable levels, and therefore the transit load factor or V/C is less than one.

At the Caltrain station, 486 parking spaces are currently available. With the addition of an HST station, increase in parking demand would range from 1,400 to 1,500 spaces in the case of the Pacheco Pass alternatives. This increased demand would be offset by additional parking that would be provided. Hence, V/C would be less than one.

Gilroy

In 2030 without an HST station, the cordon surrounding the potential station area would operate at LOS B (V/C = 0.67). With the addition of HST-related traffic, in the case of the Pacheco Pass alternatives, the V/C would be 0.74 (LOS C). Even though the cordon as a whole operates at acceptable LOS, segments of 10th Street would operate at LOS E or F both under the No Project Alternative and with the HST system.

The Gilroy station location option is the existing Gilroy Caltrain station. Passengers at the existing Caltrain station can transfer to SCVTA buses, the San Benito County Transit Shuttle, Monterey-Salinas Transit buses, and Amtrak motor coaches connecting to the Capitol Corridor trains in San Jose or Oakland. Transit lines would continue to operate at acceptable levels, and therefore the transit load factor or V/C is less than one.

At the Caltrain station, currently about 471 parking spaces are available. With the addition of an HST station, increase in parking demand would range from 2,800 to 3,800 spaces in the case of the Pacheco Pass alternatives. This increased demand would be offset by additional parking that would be provided. Hence, V/C would be less than one.

East Bay to Central Valley Corridor

This corridor includes the areas from the City of Fremont east through Niles Canyon and into the cities of Pleasanton, Dublin, and Livermore. East of the City of Livermore, the HST Alignment Alternatives in this corridor continue through the Altamont Pass and into the Central Valley through the cities of Tracy and Manteca.

The intercity highway links in this corridor are the I-580 and I-680 freeway links. Under the 2030 No Project Alternative, I-580 and I-680 freeway links would operate at LOS F with V/C varying from 1.22 to 1.34. With some automobile traffic diverted to the HST system, the links would operate at slightly lower V/Cs, as shown in Table 3.1-2, The V/C would range from 1.15 to 1.34 (LOS F) under the Pacheco Pass alternatives and from 1.15 to 1.35 (LOS F) under the Altamont Pass alternatives.

Under the Pacheco Pass alternatives, the V/Cs of the I-80 link between I-880 and I-5 decrease by 6 to 8% while those under the Altamont Pass alternatives decrease by 6 to 10%. The V/Cs of the freeway link, I-580 between I-880 to Livermore, would decrease by about 3% in the Pacheco and

Altamont Pass alternatives. While under the Pacheco Pass alternatives, the V/C of I-580 between Livermore and I-5 would decrease by 5%, the V/C under the Altamont Pass alternatives would decrease by 6%. Both sets of alternatives would cause a slight increase in traffic on I-680 between I-580 and US 101 due to traffic accessing East Bay HST stations.

This corridor includes a station location option in Dublin (BART station), Pleasanton (Bernal/I-680), or Livermore (Livermore or Greenville). Transit and parking conditions are similar for all station location options. However, arterial traffic conditions would be worse at the Livermore station location options. The cordon surrounding the Livermore I-580 station location option would operate at LOS F both under the No Project Alternative and with the HST.

The second HST station in this corridor would be at Tracy. The two station location options being considered are downtown Tracy and Tracy ACE close to Banta Road. Transit and parking conditions are similar for both locations. Traffic operations would be slightly worse under the downtown option because it is an urban area.

Bernal/I-680, Pleasanton

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.53). With the addition of HST-related traffic, in the case of the Altamont Pass alternatives, the V/C would be 0.70 (LOS C).

Currently, the transit routes serving the station area are Tracer's Route A and Route D/E (commuter) along with Route 26, operated by SJRTD. Potential connections other than Tracer and SJRTD include ACE passenger rail service and proposed e-BART. Transit lines would continue to operate at acceptable levels, and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 6,900 to 9,100 spaces in the case of the Altamont Pass alternatives. With the HST, these spaces would be provided in a parking garage located on the south side of the tracks, resulting in a V/C of less than one.

Dublin/Pleasanton

In 2030 in the absence of an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.44). Even with the addition of HST-related traffic, under the Altamont Pass alternatives, the cordon surrounding the station area would operate at LOS A (V/C = 0.46). Although the cordon as a whole operates at acceptable LOS, the operations on southbound Dougherty Road, north of I-580, and southbound Hacienda Drive, south of Dublin, would deteriorate from LOS D (V/C = 0.82) to LOS F (V/C = 1.08) and from LOS D (V/C = 0.89) to LOS F (V/C = 1.17), respectively.

Even with the addition of the HST, the transit links are anticipated to operate at acceptable levels of service. Hence, transit lines would continue to operate at acceptable levels, and the transit load factor or V/C is less than one.

The parking for BART would be consolidated on the north side of the station in a structure. With the addition of an HST station, increase in parking demand would range from 6,900 to 9,100 spaces in the case of the Altamont Pass alternatives. As part of the proposed project, additional spaces would be located on the south side of the HST station in a parking garage. The provision of these additional parking spaces would ensure that the V/C would be less than one.

Livermore I-580

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS F (V/C = 1.07). With the addition of HST-related traffic, the cordon surrounding the station area would operate at LOS F with a V/C of 1.38. Thus, the station cordon operates over capacity both under the No Project Alternative and with the HST system.

Even with the addition of the HST, the transit links are anticipated to operate at acceptable levels of service. Hence, transit lines would continue to operate at acceptable levels, and the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 6,900 to 9,100 spaces in the case of the Altamont Pass alternatives. As part of the proposed project, additional spaces would be provided in a parking garage. The provision of these additional parking spaces would ensure sufficient parking, and hence V/C would be less than one.

Downtown Livermore

In 2030 in the absence of an HST station, the cordon surrounding the station location option would operate at LOS D (V/C = 0.82). With the addition of HST-related traffic, the cordon surrounding the station area would operate at LOS F with V/C equal 1.10.

Even with the addition of HST, the transit links are anticipated to operate at acceptable levels of service. Hence, transit lines would continue to operate at acceptable levels, and the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 6,900 to 9,100 spaces in the case of the Altamont Pass alternatives. As part of the proposed project, additional spaces would be provided in a parking garage. The provision of these additional parking spaces would ensure sufficient parking, and hence V/C would be less than one.

Greenville I-580, Livermore

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.50). With the addition of HST-related traffic, the cordon surrounding the station area would operate at LOS C with V/C just less than 0.80.

This HST station location option would be served by Tri-Valley buses. Connections with local and regional bus service would be available in the station parking area. Future transit services in the vicinity of the station location option could include BART with the proposed BART extension to Livermore. The City of Livermore General Plan advocates the extension of BART along the I-580 median to Greenville Road (Objective CIR-3.1, Action A3) (City of Livermore General Plan: 2003–2025, adopted February 9, 2004). BART has purchased land near the Greenville Road/I-580 interchange for a possible terminal yard and/or station. Hence, transit lines would continue to operate at acceptable levels, and the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 6,900 to 9,100 spaces in the case of the Altamont Pass alternatives. As part of the proposed project, additional spaces would be provided in a parking garage. The provision of these additional parking spaces would ensure sufficient parking, and hence V/C would be less than one.

Greenville UPRR, Livermore

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS A (V/C = 0.44). With the addition of HST-related traffic, the cordon surrounding the station area would operate at LOS C (V/C = 0.71). Even though the cordon as a whole operates at acceptable LOS, the operations on southbound Greenville Road would deteriorate from LOS C (V/C = 0.79) to LOS F (V/C = 1.11).

The station location option would be served by Tri-Valley buses. Connections with local and regional bus service would be available in the station parking area. Future transit services in the vicinity of this HST station location option could include BART with the proposed BART extension to Livermore. The City of Livermore General Plan advocates the extension of BART along the I-580 median to Greenville Road (Objective CIR-3.1, Action A3) (City of Livermore General Plan). BART has purchased land near the Greenville Road/I-580 interchange for a possible terminal yard and/or station. Hence, transit lines would continue to operate at acceptable levels, and the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 6,900 to 9,100 spaces in the case of the Altamont Pass alternatives. As part of the proposed project, additional spaces would be provided in a parking garage. The provision of these additional parking spaces would ensure sufficient parking, and hence V/C would be less than one.

Tracy Downtown

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS B (V/C = 0.64). With the addition of HST-related traffic, the cordon surrounding the station area would operate at LOS C (V/C 0.74). Although the cordon as a whole would operate at acceptable LOS, traffic operations on McArthur Road would deteriorate from LOS C to LOS E and F (V/C 0.97 to 1.15).

Currently, the transit routes serving the station location option include Tracer's Route A and Route D/E (commuter) along with Route 26, operated by SJRTD. Potential connections other than Tracer and SJRTD include ACE passenger rail service and proposed e-BART. These transit lines would continue to operate at acceptable levels, and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 1,200 to 1,700 spaces in the case of the Altamont Pass alternatives. As part of the proposed project, additional spaces would be provided in a parking garage on the south side of the tracks. The provision of these additional parking spaces would ensure sufficient parking, and hence V/C would be less than one.

Tracy ACE

In 2030 without an HST station, the cordon surrounding the area would operate at LOS A (V/C = 0.02). Even with the addition of HST-related traffic, the cordon surrounding the station area would operate at LOS A (V/C 0.26).

Currently, the closest transit connection available near the station location option is 2 miles away and is provided by local fixed-route bus service (Tracer). In the future, bus transfers to Tracer and intercity bus service operated by SJRTD would be available in addition to connections with ACE passenger rail service and proposed e-BART. These transit lines would continue to operate at acceptable levels, and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 1,200 to 1,700 spaces in the case of the Altamont Pass alternatives. As part of the proposed project, additional spaces would be provided in a parking garage on the south side of the tracks. The provision of these additional parking spaces would ensure sufficient parking, and hence V/C would be less than one.

Central Valley Corridor

The Central Valley corridor includes the areas of the Central Valley from the City of Stockton south to the northern areas of Madera County.

The intercity highway links in this corridor are the I-5 and SR 99 freeway links. Under the 2030 No Project Alternative, the I-5 and SR 99 freeway links would operate at LOS D and F with V/C varying from 0.81 to 1.36. With some automobile traffic diverted to HST system, the freeway link SR 99 from Ripon to Merced would still operate at LOS F but that of I-5 from I-580 to SR 140 would operate at less congested levels (LOS B). For both the Pacheco and Altamont Pass alternatives, the V/C would range from 0.62 (LOS B) to 1.32 (LOS F). The V/C of the freeway link, I-5 from I-580 to SR 140, would decrease by about 20%. However the percentage decrease for SR 99 from Ripon to Merced would be about 3%.

Two HST stations are being considered in this corridor—one at Modesto and another at Merced. The two locations being considered for the Modesto HST station are downtown Modesto or close to the East Briggsmore Road. Transit and parking conditions at the two station locations would be similar. Traffic conditions at downtown Modesto would be slightly worse because it is an urban location.

The second HST station in this corridor would be at Merced. The two locations being considered are downtown Merced and Castle AFB. Merced downtown station cordon would operate at LOS F under both alternatives, showing congested travel conditions. In comparison, the cordon for the AFB station location would be operating at LOS B. Transit and parking impacts are similar for the options.

Modesto Downtown

In 2030 without an HST station, the cordon surrounding the area would operate at LOS D (V/C = 0.90). With the addition of HST-related traffic, in both the Pacheco and Altamont Pass alternatives, the V/C would be 0.92 (LOS E).

Currently, the station location option is well served by transit lines. With convenient access to the Downtown Transportation Center, connections can be made to StaRT, CAT, Ceres Dial-A-Ride, and ROTA. These transit lines would continue to operate at acceptable levels, and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 2,700 to 4,000 spaces in the case of the Pacheco Pass alternatives and from 2,800 to 4,100 spaces in the case of the Altamont Pass alternatives. As part of the proposed project additional parking spaces would be provided in a structure. The parking structure would be located between M and L Streets, adjacent to the north side of the tracks. This additional parking would be sufficient to accommodate the increased demand, and therefore V/C would be less than one.

Amtrak Briggsmore, Modesto

In 2030 without an HST station, the cordon surrounding the station location option would operate at LOS D (V/C = 0.88). With the addition of HST-related traffic, under both the Pacheco Pass and Altamont Pass alternatives, the cordon surrounding the station area would operate at LOS D (V/C 0.91).

Currently, the location option is well served by transit lines. MAX Route 25 connects the Amtrak station with the Downtown Transportation Center. These transit lines would continue to operate at acceptable levels, and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 2,700 to 4,000 spaces in the case of the Pacheco Pass alternatives and from 2,800 to 4,100 spaces in the case of the Altamont Pass alternatives. As part of the proposed project, additional parking spaces would be provided in a structure. This additional parking would be sufficient to accommodate the increased demand, and hence V/C would be less than one.

Merced Downtown

By 2030 even without an HST station, most of the roadways surrounding the station area would be over-taxed and operate above capacity. The cordon surrounding the station location option would operate at LOS F (V/C = 1.15). With the addition of HST-related traffic, under both the Pacheco Pass and Altamont Pass alternatives, the cordon surrounding the station area would operate at LOS F (V/C = 1.16).

The station location option would be served by Merced County Transit buses. These would continue to operate at acceptable levels, and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 1,000 to 1,300 spaces in the case of the Pacheco Pass alternatives and from 1,200 to 1,600 spaces in the case of the Altamont Pass alternatives. The proposed station would include additional parking spaces surrounding the station building and in a surface lot located on the north side of 15th Street between Canal and M Streets. This additional parking would be sufficient to accommodate the increased demand, and hence V/C would be less than one.

Castle AFB, Merced

By 2030, in the absence of the proposed project, the cordon surrounding the station location option would operate at LOS B (V/C = 0.63). With the addition of HST-related traffic, under both the Pacheco Pass and Altamont Pass alternatives, the cordon surrounding the station area would operate at LOS B (V/C 0.65).

The proposed station would be served by Merced Area Regional Transit System buses. These would continue to operate at acceptable levels, and hence the transit load factor or V/C is less than one.

With the addition of an HST station, increase in parking demand would range from 1,000 to 1,300 spaces in the case of the Pacheco Pass alternatives and from 1,200 to 1,600 spaces in the case of the Altamont Pass alternatives. The proposed station would include additional parking spaces to meet this demand in a surface lot. This additional parking would be sufficient to accommodate the increased demand, and hence V/C would be less than one.

3.1.4 Role of Design Practices in Avoiding and Minimizing Effects

Currently, regional planning agencies and the counties and cities in the regions have considerable flexibility to deal with identified traffic, transit, and parking impacts. The Authority would expect to participate in developing potential construction and operational mitigation measures in consultation with state, federal, regional, and local governments and affected transit agencies during project-level reviews.

Potential mitigation measures could be developed to improve access to the proposed stations. These improvements would be based on the forecast capacity deficiencies identified for the No Project Alternative and HST station options and possibly could employ some of the following approaches.

- Transportation System Management (TSM)/Signal Optimization (including retiming, rephrasing, and signal optimization); other measures may include turn prohibitions, use of one-way streets, and traffic diversion to alternate routes.
- Local spot widening of curves that allows for geometric improvements without significant right-of-way acquisition.
- Major intersection improvements (full lane widening), which require significant right-of-way.
- Acquisition to accommodate additional left-turn and/or through lanes.
- Consultation and coordination with public transit services to encourage the provision of adequate bus feeder routes to serve proposed station areas in order to mitigate potential transit impacts.
- Provision of additional parking facilities at HST stations with excess parking demand.

3.1.5 Mitigation Strategies and CEQA Significance Effects

Based on the analysis above, and considering the design practices described in Section 3.1.4, each of the HST Alignment Alternatives would have significant impacts related to traffic and transportation.

The CEQA significance criteria for traffic are explained in Section 3.1.1C, CEQA Significance Criteria. Around station location option areas, an increase in traffic and congestion is expected with the proposed HST. As explained in Section 3.1.3, Environmental Consequences, with the HST, cordon traffic operations at the following stations may constitute an impact: Transbay Transit Center, Millbrae, Livermore Downtown and I-580, Modesto Downtown, Briggsmore, and Merced Downtown. In these cases, traffic cordon conditions would deteriorate from LOS D to LOS E or F in four cases or from LOS E or F to a worse LOS E or F in three cases. Traffic effects of all other station location options would not constitute an impact. In some cases, however, even though the cordon itself would be operating at acceptable LOS, individual roadway segments would operate at congested conditions under the No Project Alternative and/or with the HST.

Except at the downtown San Francisco Transbay Transit Center station location option, transit services serving the proposed station areas would have enough capacity to meet the transit demand, and hence the impact attributable to additional HST traffic would be low. At the San Francisco station, transit lines would be operating above capacity during peak hours under the No Project Alternative. The additional HST traffic would deteriorate the conditions further. Hence, under both scenarios there would be impacts on transit. Mitigation strategies mentioned above (such as improving bus service near the location) could be applied to reduce this impact.

With the additional traffic accessing the stations with the HST system, it is anticipated that parking will be added at the stations that is sufficient to meet demand, and the impacts on parking at all stations would remain at V/C less than 1, except in downtown San Francisco, where private parking operators are expected to provide sufficient parking, albeit at $25 per day. Thus, parking impacts would be less than significant at the HST stations.

No substantial interference with goods movement is anticipated, and connectivity with transit systems will be enhanced rather than suffer interference.

Program-level mitigation strategies would be further refined, and specific measures would be considered during project-level environmental reviews where impacts are found to be significant at the project level. Potential mitigation strategies to be considered during project-level environmental reviews would include the following, listed below by regional and local applications.

A. REGIONAL STRATEGIES:

- Coordination with regional transportation (highway and transit) planning (e.g., regional transportation plans, congestion management plans, freeway deficiency plans, etc.).
- Intelligent Transportation Systems Strategies (ITS).

B. LOCAL STRATEGIES:

- Provide additional parking.
- Consider offsite parking with shuttles.
- Share parking strategies.
- Implement parking permit plans for neighborhoods.
- Employ parking and curbside use restrictions.
- Develop and implement a construction phasing and traffic management plan.
- Widen roadways.
- Install new traffic signals.

- Improve capacity of local streets with upgrades in geometrics, such as providing standard roadway lane widths, traffic controls, bicycle lanes, shoulders, and sidewalks
- Install modifications at intersections, such as signalization and/or capacity improvements (widening for additional left-turn and/or through lanes)
- Coordinate and optimize signals (including retiming and rephrasing)
- Designate one-way street patterns near some station locations
- Implement turn prohibitions
- Use one-way streets and traffic diversion to alternate routes
- Work with public transportation providers to coordinate services and to increase service and/or add routes, as necessary, to serve the HST station areas.
- Minimize closure of any proximate freight or passenger rail line or highway facility during construction.

The above mitigation strategies would be refined and applied at the project level and are expected to substantially avoid or lessen impacts around station areas to a less-than-significant level in most circumstances. Planning multi-modal stations, coordinating with transit services, providing accessible locations and street improvements, and encouraging transit-oriented development in station areas would help to ease traffic constraints in station areas. At the project level, it is expected that for various HST station projects, impacts would be mitigated to a less-than-significant level, but it is possible that for some stations impacts would not be mitigated to the less-than-significant level. Sufficient information is not available at this programmatic level to conclude with certainty that the above mitigation strategies would reduce impacts around stations to a less-than-significant level in all circumstances. This document therefore concludes that traffic impacts around station areas may be significant, even with the application of mitigation strategies. Additional environmental assessment will allow a more precise evaluation in the second-tier, project-level environmental analyses. The co-lead agencies will work closely with local government agencies at the project level to implement mitigation strategies.

3.1.6 Subsequent Analysis

Subsequent multimodal access and circulation studies could be conducted at proposed station location options along proposed alignments as plans for alignments, stations, and operations are refined. Additional environmental analysis would be required in conjunction with these studies to ascertain the exact locations of potential project-generated traffic impacts and potential parking demand impacts and the potential effects on existing bus and rail transit ridership. Station area circulation studies would be expected as part of project-level environmental documentation.

3.2 Travel Conditions

This section addresses the existing and future potential for travel conditions to change related to the No Project and HST alternatives.[1] Automobile transportation and air transportation currently carry more than 99% of intercity trips and are therefore the focus of this analysis, together with the HST mode. For this analysis, *travel conditions* are defined as the experience, quality, sustainability, safety, reliability, and cost of intercity travel in the study region and state. Travel factors were developed based on the purpose and need (Chapter 1) for the proposed HST system and are used to evaluate the general impact of the No Project Alternative and the HST alternatives on the transportation system.

In contrast to other sections in this chapter, this section broadly compares the HST system to other modes of travel, rather than focusing on comparison of alignment alternatives. HST Alignment Alternatives and Network Alternatives are referred to collectively as *HST alternatives*.[2]

3.2.1 Methods of Evaluation

The overall method used to evaluate travel conditions is described below. To evaluate the relative differences in travel conditions that would result from the No Project or HST alternatives, five travel factors were considered that relate directly to the purpose and need and the goals and objectives defined in Chapter 1. These factors are described below.

- Travel Time: Travel time is the total time required to complete a journey. With the exception of the automobile, intercity transportation options require multiple modes to complete a trip. For example, an air trip is not just the time spent in the air (the line-haul portion of the trip) but also includes the time required to travel to the airport, check in, pass through security, board the plane, and travel to the final destination. The total travel time of a mode also depends on its reliability. If a mode is unreliable, a traveler must allow more time to complete a trip, effectively lengthening the total travel time.
- Reliability: Reliability is the delivery of predictable and consistent travel times and is a key factor in attracting passengers to use a particular mode of travel. Travel time and reliability directly affect productivity because they determine the ease and speed with which workers and products arrive at their destinations. Greater travel demand on capacity-constrained facilities results in further congestion and is one of the primary reasons for longer travel times. Reliability is primarily a function of unexpected delays, which can be caused by many factors, including traffic congestion, accidents, mechanical breakdowns, roadwork, and inclement weather.
- Safety: Projected growth in the movement of people and goods in California by road and air underscores the need for improved travel safety. National and statewide statistics indicate that the rate of fatality or serious injury by private motor vehicle is increasing, primarily because more people are traveling by this mode. Nationally, over the last 10 years, accident and injury rates have remained fairly constant for commercial airline travel, which remains a safe mode compared to the private automobile.
- Connectivity (Modal): Connections between modes of transportation are an element in the development and operation of a successful total transportation system. The ability to transfer easily between modes and the frequency of service are additional key factors that can determine a traveler's modal choice. Statewide, connections between airports and the extensive regional

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[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

[2] Representative Pacheco Pass and Altamont Pass network alternatives are used for evaluation in this section. See Chapter 2 for a description of network alternatives.

urban and commuter transit systems are limited. Under existing conditions and the No Project Alternative, modal connections at airports are limited, and connections and services are fragmented and not provided as an integrated system with coordinated fares, schedules, and amenities. With the exception of the new BART extension to SFO and the Metrolink connection to Burbank Airport, other airports do not have direct rail connections to city centers, other transit systems, or the region. Airport transit connections can be cumbersome, often requiring multiple transfers and long waiting times; are not well advertised to potential passengers; and lack coordinated fares and schedules.

- Connectivity (Geographic):Connecting the San Francisco Bay Area to other parts of northern California, the Central Valley, and southern urban areas of the state with an additional transportation system could significantly improve statewide mobility. In addition, connecting the San Francisco Bay Area with the cities and communities of the Central Valley could yield other potential benefits. Due to poor connectivity, limited services, and weather impacts, travel options to and from Central Valley cities are limited, travel times are long, and the potential for delay is high.
- Cost: Direct, passenger-borne costs are another key factor in passenger travel choice. Most travel demand studies have found that travel costs are highly variable, depending on the type of traveler and the purpose of travel. Business travelers may be willing to pay high fares for urgent needs, but leisure travelers may constrain themselves to the lowest fare possible. In some cases, travelers are also willing to pay a premium for a reliable, comfortable, and safe journey.

The five travel factors are summarized in Table 3.2-1. These travel factors are used to evaluate the relative difference between alternatives both qualitatively and quantitatively. The method by which the travel factors have been applied to the alternatives is summarized in Table 3.2-2. Each of the travel factors is described in greater detail as they are applied in the potential environmental consequences of travel conditions discussion.

In general, the No Project Alternative would include the same intercity travel modes that are available under existing conditions, which are the automobile, airplane, intercity bus, and conventional rail. This Program EIR/EIS is to broadly assess the highest reasonably foreseeable potential level of impact. Therefore, the high ridership forecasts for the HST (117 million trips) are used to describe the operations and required facilities for the proposed alternatives. However, in a few areas where the high ridership forecast produced the lowest impacts or highest benefit, analysis of conditions based on the base case HST forecast (88 million trips) is also included. The high ridership forecast and the base case include 31 and 22 million long-distance commute trips, respectively.

Table 3.2-1
Relation of Travel Factors and Purpose and Need/Objectives

	Travel Factors				
	Connectivity	Travel Time	Reliability	Safety	Passenger Cost
Project Purpose					
Improve intercity travel experience	X	X	X	X	
Maximize intermodal transportation opportunities	X	X			
Meet future intercity travel demand	X	X			
Increase efficiency of intercity transportation system	X		X		
Maximize use of existing transportation corridors	X		X		
Develop a practical and feasible transportation system by 2020 and in phases	X				X
Provide a sustainable reduction in travel time		X			
Project Need					
Limited modal connections	X	X			
Future growth in travel demand					
Capacity constraints			X		
Unreliability of travel			X	X	
Project Goals and Objectives					
Maximize mobility	X				X
Minimize travel times		X			
Minimize environmental impacts					
Maximize system safety			X	X	
Maximize reliability			X		

X = Directly applies.
Source: Parsons Brinckerhoff 2003.

Table 3.2-2
Application of Transportation Factors to Alternatives

Typology	Description	Measurement
Travel Time	Total door-to-door travel time	Total travel time including access and in-vehicle times
Reliability	Ability and perception to arrive at the destination on-time	Accidents Inclement weather Transportation-related construction Volume variation Special events Traffic control devices and procedures Base capacity Vehicle availability
Safety	Loss of life or injury	Comparison of safety performance characteristics by mode (operator, vehicle, and environment)
Connectivity	Transportation options that connect to other systems and destinations	Modal: Number of intermodal connections and options, and frequency of service provided by each alternative Geographic: Connectivity between regions by mode
Passenger cost	One-way travel costs	Total costs, including fares and other costs, for intercity travel by mode
Source: Parsons Brinckerhoff 2003.		

3.2.2 Affected Environment

A. STUDY AREA DEFINED

This program-level analysis of travel conditions and potential impacts does not measure the specific potential impact on individual transportation facilities (e.g., a transit line, highway, or airport). Rather, travel conditions have been evaluated for the state, with a focus on the study region. Specific examples of representative travel conditions in a corridor or for a specific highway, airport, or rail facility are identified where possible.

B. GENERAL DISCUSSION OF TRAVEL CONDITIONS

For travel conditions, the affected environment is California's intercity travel network, which consists of three main components: highways, airports, and rail. Of these, automobiles and air transportation carry more than 99% of intercity trips and are therefore the focus of this section. Congestion in the affected environment is a serious concern, as shown in Figure 3.2-1. According to the Texas Transportation Institute, the urban areas of San Francisco and Los Angeles experience some of the most severe highway congestion and travel delays in the country (Shrank and Lomax 2002). Recent research by the Institute of Transportation Studies at the University of California, Berkeley, indicates that California airports generally experience the highest average air travel delays in the nation (Hansen et al. 2002). Although the main contributors to this congestion are local and commuter highway trips and transcontinental and international flights (at least at major airports such as SFO and LAX), intercity trips compete for the limited capacity on these overburdened facilities.

The highway system is congested near and around urban centers (e.g., San Francisco, Oakland, San Jose) and in rural and suburban communities (e.g., Central Valley) during both the morning and evening peak hours. According to the MTC, seven out of ten of the most congested highway corridors in the Bay Area (including segments of I-880, I-580, and US-101) are key intercity routes in the Bay

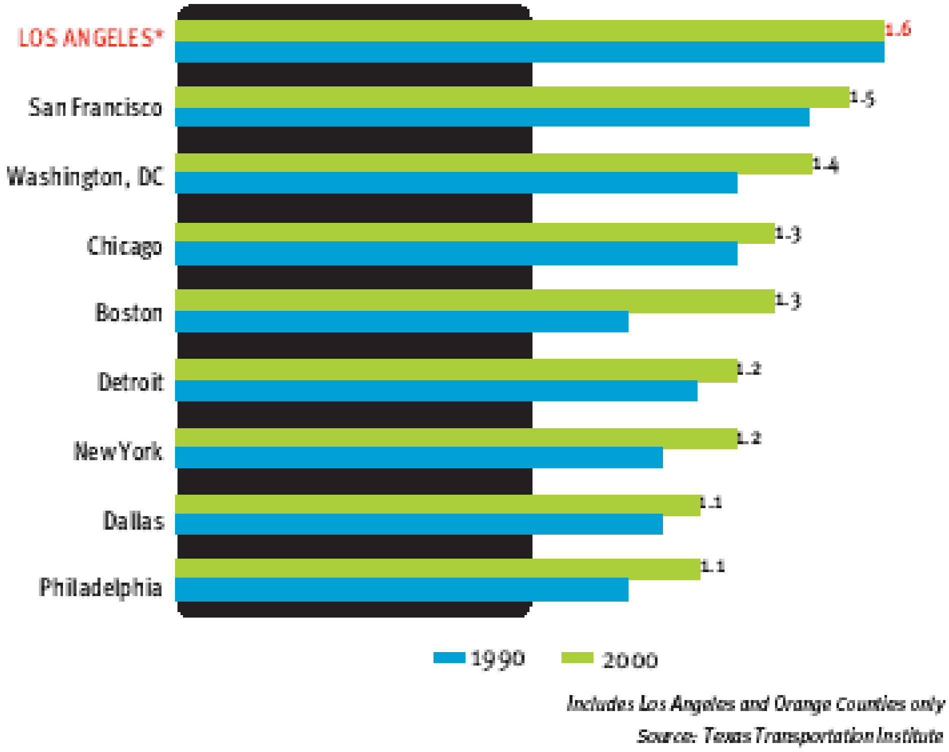


Figure 3.2-1
Nationwide Highway Congestion

Area to Merced region (Figure 3.2-2). Similarly, according to the San Joaquin Council of Governments, several major routes that traverse the Central Valley (I-5, I-205, I-580, SR 120, SR 99) are critical intercity links for passengers and goods traveling between northern and southern California. Section 3.1, Traffic, Transit, Circulation, and Parking, notes that several of these routes are operating during the peak periods at or near congested levels of operations. In fact, I-5 and SR 99 (key intercity routes assessed in this analysis) are designated by Caltrans as "high emphasis focus routes" of critical importance to the movement of goods in California.

California's aviation system provides for intercity, domestic, and international travel. The aviation system is also a significant economic generator that fuels the state's economy. According to the FHWA, in 2002 California's airports contributed to about 9% of the state's employment and total economic output (Federal Highway Administration 2003). According to Caltrans, in 2002 about 159 million passengers in California traveled by air, or about 12% of the national total. Seven California airports are ranked in the top 50 U.S. primary/commercial service airports. As shown in Table 3.2-3, three of these airports are located in the study region.

Table 3.2-3
California Airport National Rankings (2002)

Airport	U.S. Ranking	Region
Los Angeles (LAX)	3	Bakersfield to Los Angeles and Los Angeles to San Diego (via Inland Empire and Orange County)
San Francisco (SFO)	8	Bay Area to Central Valley
San Diego (SAN)	30	Los Angeles to San Diego (via Inland Empire and Orange County)
San Jose (SJC)	34	Bay Area to Central Valley
Oakland (OAK)	37	Bay Area to Central Valley
Sacramento (SMF)	44	Sacramento to Bakersfield
John Wayne/Orange County (SNA)	45	Los Angeles to San Diego via Orange County
Source: Aviation in California Fact Sheet, California Department of Transportation, Division of Aeronautics, 2002.		

The National Center of Excellence for Aviation Operations and Research predicted that demand at California airports, which dropped by as much as 33% after the September 11, 2001, terrorist attacks, will recover to 2000 levels in 2002 or 2003 or shortly thereafter. As a result, the seven major airports in Table 3.2-3 currently operating at or near capacity are all planning major improvements to accommodate existing and future projected demand. In 2000, almost 25% of all flight arrivals were delayed for 9 minutes or more, a number significantly higher than the national average (Hansen et al. 2002).

Congested airways are one source of passenger delay for intercity trips; congested highways are another. According to the California Transportation Commission, California's major airports suffer from poor ground access and severe congestion, which directly impacts international trade (California Transportation Commission 2000). As shown in Section 3.1, Traffic, Transit, Circulation, and Parking, many of the highway segments and primary airport access routes to the study region airports have a LOS of E and F. *Level of service* describes the condition of traffic flow, ranging from excellent conditions at LOS A to overloaded conditions at LOS F. LOS D is typically recognized as an acceptable service level in urban areas.

3.2.3 Environmental Consequences

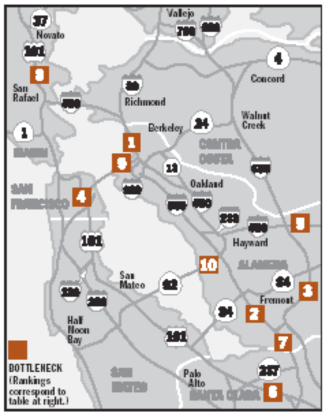
A. NO PROJECT ALTERNATIVE

The No Project Alternative includes programmed and funded transportation improvements to the existing transportation system that will be implemented and operational by 2030. The No Project Alternative involves increased intercity travel demand and the implementation of new infrastructure. Improvements (programmed and funded) focus on existing modes; therefore, the same modes of intercity transport will continue to be available. The programmed or funded transportation improvements assumed to be in operation by 2030 are not major systemwide capacity improvements (e.g., major new highway construction or widening, or additional runways) and will not result in a general improvement or stabilization of existing highway or air travel conditions across the study region. Connectivity is not expected to improve with the No Project Alternative because few major intermodal terminals are expected to be built over the next 20 years.

As described in Section 3.1, Traffic, Transit, Circulation, and Parking, existing facilities are operating at congested levels of service at many locations, and traffic conditions are projected to deteriorate further under the No Project Alternative. Of the 18 intercity highway locations analyzed in Section 3.1, more than half are operating during the peak period at LOS D or a volume-to-capacity (V/C) ratio more than 0.80 under existing conditions—with two of the locations at LOS F (V/C over 1.0). These conditions are expected to deteriorate further under the No Project Alternative for 2030. On average, across the 18 locations evaluated in the study region, the V/C ratios are estimated to deteriorate by more than 35% and have substantially more LOS F segments (11 of the 18 locations) under the No Project Alternative. Capacity in the No Project Alternative is insufficient to accommodate the projected growth in highway travel in the study region, including both the San Francisco Bay Area and the emerging urban areas in the Central Valley. Consequently, there would be no sustainable capacity improvement to the transportation system.

Although intercity travel is only a small percentage of all highway trips, it must compete for limited capacity on already congested infrastructure, which will become more congested by 2030. For instance, according to MTC, between years 2000 and 2020 in the Bay Area, total vehicles per household will increase by 5%, and average vehicle miles traveled per weekday will increase by about 30%, and even more by 2030. This projection is representative of conditions throughout the state (Metropolitan Transportation Commission 2003). In the Central Valley, the San Joaquin Council of Governments estimates that the percentage of time vehicles are delayed relative to the total travel time will increase in 2025, and that the percentage of miles traveled at congested levels of service (LOS E or F) will increase from 1.25% in 1999 to more than 6% in 2025—a more than six-fold increase (San Joaquin Council of Governments 2002). In most cases, these conditions could become manifest in deteriorating levels of service on highway segments and local streets or extended peak-period congestion on links that are already operating at near or total breakdown conditions. In many instances, the morning peak period could extend to 4 hours.

According to the California Aviation System Plan, almost 173 million passengers enplaned and deplaned in California in 1999, a number that is expected to more than double by 2020 (California Department of Transportation 2001). Under the No Project Alternative, no additional runways or other major capacity expansion projects would be implemented by 2030. Many of the airports in the study region that are currently at or near capacity could become severely congested under the No Project Alternative. Capacity constraints are likely to result in significant future aircraft delays, particularly at California's three largest airports. SFO has "one of the worst flight delay records of major U.S. airports—only 64% of SFO flights were on time during 1998" (San Francisco International Airport 2003). According to SFO, within 10 years the three Bay Area airports will not have the sufficient capacity to meet regional air traffic demand even on a good weather day. The projected delays at heavily used airports and forecasted highway congestion would continue to delay travel, negatively affecting the California economy and quality of life.



10 Worst Congestion Locations in 2001*

2001 Rank	Location	Delay in Vehicle Hours	2000 Rank
1	**Interstate 80, westbound, a.m.** — Alameda/Contra Costa County Route 4 to Bay Bridge metering lights	9,410	1
2	**Interstate 880, southbound, a.m.** — Alameda County South of Route 84 to north of Dixon Landing Road	8,880	3
3	**Interstate 680, southbound, a.m.** — Alameda County Sunol Road to south of Route 262	8,510	2
4	**Interstate 80, eastbound and U.S. 101, northbound, p.m.** — San Francisco County Army Street to west end of Bay Bridge	5,050	5
5	**Interstate 580, eastbound, p.m.** — Alameda County Hopyard Road to west of El Charro	5,030	13
6	**U.S. 101, southbound, p.m.** — Santa Clara County Great America Parkway to 13th Street	4,100	4
7	**Interstate 880, northbound, p.m.** — Santa Clara/Alameda County U.S. 101 to Dixon Landing Road	4,000	12
8	**U.S. 101, southbound, a.m.** — Marin County Rowland Boulevard to Interstate 580	3,230	6
9	**Interstate 880, northbound, a.m.** — Alameda County 1 mile north of 7th Street to Bay Bridge	2,920	10
10	**Route 84, westbound, a.m.** — Alameda County Newark to Dumbarton Bridge toll plaza	2,860	11

Source: Caltrans District 4

*Rankings are for routes in which continuous stop-and-go conditions occur with few, if any, breaks in the queue. Thus, corridors that have equally severe delays but where congestion is broken into several segments may rank lower in this

U.S. Department of Transportation
Federal Railroad Administration

Figure 3.2-2
Bay Area Locations of Worst Congestion
(as of 2001)

Given these travel trends, overall travel safety is also expected to worsen. As VMT continues to rise over the next 20 years under the No Project Alternative, the accident rate will not change appreciably, but the net number of accidents, injuries, and fatalities could increase, particularly for highway-based trips. As evidence of this trend, the National Highway Traffic Safety Administration reported that between 1998 and 2001 fatalities on California's roadways increased by an average 4% annually (National Highway Traffic Safety Administration 2001).

Travel costs are also expected to rise because of capacity constraints. Regions could attempt to control demand through congestion pricing for both the auto and air modes. This approach could result in more congestion-priced toll roads like SR-91 in Orange and Riverside Counties, and peak-period landing fees for airports statewide. Both of these costs would be passed along to the consumer either directly in tolls or indirectly in ticketed fares.

As summarized in Table 3.2-4, the No Project Alternative would result in either a deteriorated level of service or no change compared to existing conditions.

Table 3.2-4
Existing Conditions Compared to No Project Alternative

	No Project Alternative (2030)	
Travel Factor	Change from Existing Conditions	Comment
Travel Time	Deteriorate	Increased congestion could result in further delays.
Reliability	Deteriorate	Increased congestion and no change in modal options or characteristics could result in greater unreliability.
Safety	Deteriorate	No change in modal options would maintain existing fatality and injury rates; however, increased demand could result in greater number of fatalities.
Connectivity	None	No additional intercity intermodal connections or options, or increased frequencies will be available.
Passenger Cost	Deteriorate	Airfares are anticipated to increase beyond their current fare structures.

There are no travel-time benefits associated with the No Project Alternative because there are no significant improvements to capacity or modal options. The No Project Alternative would likely result in longer travel times in all cases as compared to existing conditions, and these increases would range between 18 and 64 minutes for the representative city pairs.

Reliability under the No Project Alternative is likely to be lower than under the HST alternatives for the following reasons.

- The No Project Alternative depends heavily on the automobile, which has been shown to have the worst reliability of the three modes.
- Existing congestion and reliability problems continue because the No Project Alternative provides no new highway or airport base capacity.
- Greater highway and aviation congestion and more reliability problems accrue because the No Project Alternative absorbs an increasing demand for travel with little increase in base capacity.

Although the rate of injury or fatality is not expected to increase under the No Project Alternative, the increase in highway travel would be expected to cause the number of injuries and fatalities to increase as compared to existing conditions.

Under the No Project Alternative, there would be no net improvement to the connectivity options in the state over the existing conditions. There would no introduction of new modes, no new intermodal terminals or connections, and no improvements in air transportation frequencies.

There is little to no sustainable capacity in the No Project Alternative. The future transportation infrastructure is severely constrained by the limited number of capacity improvements funded or programmed for 2020. Improvements associated with the No Project Alternative are generally to existing interchanges versus line capacity expansion or improvement projects. The highway system's sustainable capacity would require additional infrastructure to accommodate any growth in demand. To accommodate the theoretical system capacity of 31,500 passengers per hour, the highway system would require at least three additional lanes in each direction and the capacity of airports would also have to be significantly expanded. Therefore, the No Project Alternative would not accommodate the theoretical demand and would require extensive infrastructure expansion to have sustainable capacity.

With the No Project Alternative, auto passenger costs are considerably lower for short- and mid-range trips than airfares for short haul routes, such as Los Angeles to San Diego, Los Angeles to Fresno, or Sacramento to San Jose. For long-range trips, such as Los Angeles to San Francisco or Burbank to San Jose, the automobile remains competitive because of the access and egress costs associated with air travel.

B. HIGH-SPEED TRAIN ALTERNATIVES

This section presents expected travel conditions for the HST alternatives and compares relative differences between No Project and the HST. This section is organized by the five travel factors identified earlier. Implementation of the HST system would introduce a new mode to the California intercity transportation system. This new mode would result in major differences in expected travel conditions that would be similar for all the HST alternatives being considered in the study region. Some differences are noted that would occur, depending on the choice of network alternative. Each travel factor begins with a summary of the specific methods used to define and evaluate the effect of the HST system, followed by an evaluation of potential effects.

Travel Time

Travel time is a key travel factor that determines the attractiveness of a particular mode of travel to passengers. Travel time is also an important economic factor that directly affects productivity (travel time for workers and products to get to their destination). For the purpose of this analysis, improved travel time is a benefit to the traveler because it can improve the intercity travel experience. Travel time for this analysis was measured as the total (door-to-door) travel time for the example city pairs presented in Chapter 1.

Automobile Mode Characteristics

Travel time in an automobile largely depends on three factors: distance traveled, roadway design speed (and associated speed limit), and congestion levels. The design of a roadway dictates the time that will be required to travel between two destinations. The time of day and associated congestion also plays a role in how long a trip will take. For this analysis, it is assumed that the top speed of the automobile is 70 mph (113 kph).

Automobile travel times are based on driving times between the representative city pair origins and destinations (Table 3.2-5). The travel time for existing conditions is based on the *California High-Speed Rail Statewide Forecasting* model, which was validated using observed traffic counts in the year 2000. The 2030 No Project travel times were estimated using the same forecasting model, with 2030 land use and financially constrained networks from each of the four largest metropolitan transportation organizations (MPOs) in the state (San Francisco Metropolitan Transportation

Commission, Southern California Association of Governments, Sacramento Area Council of Governments, and the San Diego Association of Governments) and Caltrans (for all other areas of the state). The 2030 forecast assumptions and models used for the HST alternatives included a 50% increase in air and auto costs, representing the high ridership forecasts. As a result, the auto travel times for the HST alternatives were forecast to be 4–6% shorter because of the increased auto costs and the diversion of highway trips to the HST system (Cambridge Systematics 2007).

Table 3.2-5
Total Door-to-Door Peak Automobile Travel Times (Hours:Minutes)

City Pairs	Existing Conditions (2000)[a]	2030 Automobile Total Door-to-Door Travel Times[b]	
		No Project	HST
Los Angeles downtown to San Francisco downtown	6:28	6:50	6:32
Fresno downtown to Los Angeles downtown	3:32	3:41	3:38
Los Angeles downtown to San Diego downtown	2:37	2:41	2:39
Burbank (airport) to San Jose downtown	5:31	5:54	5:40
Sacramento downtown to San Jose downtown	2:29	2:32	2:24

[a] Metropolitan Transportation Commission and California High Speed Rail Authority High-Speed Rail Ridership and Revenue Forecasting Study, prepared by Cambridge Systematics 2007.
[b] 2030 No Project was estimated as the congested travel time for peak conditions by assigning the 2030 No Project trip table generated by the California High-Speed Rail Statewide Forecasting model to the statewide highway network for 2030, which is a financially constrained future year network.

Air Mode Characteristics

Air travel is the fastest line-haul mode at 530 mph (853 kph) maximum cruising speed. However, a significant portion of a passenger's trip is spent accessing the airport, passing through one or more security checkpoints, boarding and alighting from the aircraft, and egress travel from the airport. The components of a door-to-door air trip include the components listed below.

- Access time: time spent driving to the airport.
- Terminal time: time spent getting through the airport terminal.
- Wait time: time spent waiting at the gate for the aircraft to leave.
- Line-haul time: time spent on the aircraft.
- Arrival time: time spent getting to the final destination.

It is assumed that all air trips would require travel on the regional highway system with the exception of San Francisco, where some passengers could use the newly opened BART to SFO rail link. Also, passengers in the Los Angeles area could use a Metrolink connection to Burbank.

Total air travel times are summarized in Table 3.2-6. As shown, No Project travel times would increase between 0 and 10 minutes compared to existing conditions, depending on city pairs.[3] These changes are the result of increases in line-haul travel time that were observed between 2000 and 2005 and carried forward to 2030. It is estimated that air travel times would not change with the

3 This assumption is consistent with the high-end revenue and ridership assumptions for the Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Cambridge Systematics 2007.

HST system compared to No Project because the diversion of trips to HST does not significantly reduce airside congestion levels, and all other factors (arrival, terminal, and departure times) would remain constant. Although there would be an improvement of intercity highway travel times, this improvement is not meaningful for access trips to and from the airports.

Table 3.2-6
Total Door-to-Door Peak Air Travel Time (Hours:Minutes)

City Pairs	Airports	Existing Conditions (1999)	2030 Air Mode Total Door-to-Door Travel Times	
			No Project Alternative[a]	HST
Los Angeles downtown to San Francisco downtown	LAX, LGB, BUR, SNA, ONT, SFO, OAK, SJC	3:30	3:38	3:38
Fresno downtown to Los Angeles downtown	FAT, SNA, ONT, LAX, LGB, BUR	3:17	3:24	3:24
Los Angeles downtown to San Diego downtown	LAX, LGB, BUR, SNA, ONT, SAN	2:51	3:01	3:01
Burbank (Airport) to San Jose downtown	BUR and SJC	2:46	2:43	2:43
Sacramento downtown to San Jose downtown	SMF and SJC	3:33	3:33	3:33

[a] Total travel time for air is unaffected by the high-speed rail service or changing demand in air trips.
Source: Cambridge Systematics 2007.

High-Speed Train Mode Characteristics

With a maximum operating speed of 220 mph (354 kph), the HST is slower in line-haul speed than an airplane but considerably faster than an automobile. However, for most intercity trips within California, the quick arrival, terminal, and departure times make the overall HST travel time competitive with that of air travel. The HST would also connect closer city pairs, those less than 150 mi (241 km) apart, and for those trips would compete strongly with the automobile. For example, HST travel between Los Angeles and Bakersfield or Sacramento and Modesto would likely be faster than air transportation as well as automobile travel.

In Europe and the United States, rail travel time improvements have shifted travel demand from air to rail travel. Within a decade of its inauguration, France's TGV Sud-Est succeeded in capturing more than 90% of the travel market between Paris and Lyon (Meunier 2002). Amtrak's Acela and regional trains have 50% of the total air-rail market between New York and Washington. In Germany, recent passenger rail improvements between Frankfurt and Cologne were undertaken with the purpose of shifting air trips from congested airports where capacity was constrained and could not be expanded to high-speed rail that could more quickly serve the same markets. This same principle could apply to the major airports in California, including San Francisco and Los Angeles. The air operation time-slots released by substituting HST for local air service at these two airports could provide more opportunities for international and interstate flights.

HST would also provide direct connections to several airports. This connectivity, combined with the line-haul speed of the HST, could result in faster total travel times for air travelers who use a combination of air and HST to reach their final destination. For example, passengers arriving at San

Francisco could transfer to the HST and travel to Merced, and this connection could be competitive with or possibly faster than connecting to another flight, driving, or taking a bus or shuttle[4].

The train in this instance may be quicker for two reasons. First, trains may be boarded swiftly, often in less than 2 minutes because of the number of doors and ability to accommodate extra passengers. In contrast, boarding an airplane must be highly controlled for security and typically takes place through one door (or at most two doors), a process that can take up to half an hour. Second, current airline boarding practice requires passengers to be present at the gate at least 60 minutes before the scheduled departure time.

Another key difference between HST and air travel is the percentage of total travel time spent during the line haul. On a train, this proportion of time is quite high, and can be used for work, pleasure, or relaxation. For example, passengers traveling by HST between any of the below city pairs would be able to use their laptop computers or any number of personal audio, video, or game devices for approximately 70% of the total travel time, while passengers traveling by air would be able to use these devices for just 30% of their trip.[5]

Total travel times are summarized in Table 3.2-7. While these travel times are from downtown to downtown where HST has a distinct advantage over air travel because of terminal locations, the potential for many online stations could make the HST competitive for many other trips. Like air travel, the HST has the following door-to-door trip components. (See Appendix 3.2-B for more detailed explanation.)

- Access time: time spent driving to the train station.
- Terminal time: time spent getting through the train station.
- Wait time: time spent waiting at the gate for the train to leave.
- Line-haul time: time spent on the train.
- Arrival time: time spent getting to the final destination.

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4 Although this opportunity may increase overall ridership, these out-of-state connecting air travelers have not been included in the ridership forecasts provided in this document because of the difficulties in evaluating their competing modal opportunities and because the likely ridership is small compared to in-state ridership.

5 Although the line-haul time of the flight is about 33% of the total trip, due to restrictions on use of electronics during take off and landing, the productive time is reduced by another 10%.

Table 3.2-7
Total Door-to-Door Peak HST Mode Travel Times (Hours:Minutes)

City Pairs	2020 HST Total Door-to-Door Travel Times
Los Angeles downtown to San Francisco downtown	3:24
Fresno downtown to Los Angeles downtown	2:15
Los Angeles downtown to San Diego downtown	2:21
Burbank (airport) to San Jose downtown [1]	3:07
Sacramento downtown to San Jose downtown [2]	2:16

[1] Time based on the Pacheco Pass representative (base) network alternative. Altamont Pass representative (base) network alternatives 13 minutes longer.

[2] Time based on the Pacheco Pass representative (base) network alternative. Altamont Pass representative (base) network alternatives 34 minutes shorter.

Source: Cambridge Systematics 2007.

Existing conventional rail services are typically not competitive with other modes. For example, while the HST line-haul time (a component of total trip time) between downtown San Francisco and Los Angeles would be just over 2.5 hours, the only existing direct rail service between the Bay Area (Oakland) and Los Angeles (Coast Starlight service) has a line-haul time of more than 12 hours and operates one train daily in each direction. The San Joaquin service between Oakland and Los Angeles takes about 8 hours and 40 minutes but requires transferring to a bus for the Bakersfield to Los Angeles segment of the trip. The HST line-haul time between downtown Los Angeles and downtown San Diego would be about 1 hour and 29 minutes, as compared with current Surfliner line-haul time of 2 hours and 0 minutes to 2 hours and 50 minutes. Caltrans and Amtrak plan to reduce travel times by up to 30% on key intercity routes, such as the Pacific Surfliner and Capitol Corridor services, over the next 20 years; however, the projects required to reach these goals are not yet funded.

Travel Time Effects of the High-Speed Train

Because of its faster line-haul speed, HST would compete with the automobile for shorter distance intercity trips. Because of its shorter terminal processing times, HST would also compete with the airplane for longer distance intercity trips. In the Central Valley, HST would provide shorter travel times than both the highway and air modes for travelers headed to locations near HST stations. The travel time benefits vary considerably between the different HST Network Alternatives depending upon the location and number of HST stations. For example, the Pacheco Pass network alternative that terminates in San Jose would result in an increased total travel time of 25 minutes to downtown San Francisco by auto (transferring to Caltrain commuter rail service would take an additional 69 minutes compared to HST) and/or 26 minutes to Oakland by auto, as compared to Pacheco Pass Alternatives that serve downtown San Francisco and/or Oakland directly. The Altamont Pass Alternative that terminates in Union City would increase total travel times using auto to downtown San Jose by 14 minutes, to San Francisco by 6 minutes, and Oakland by 15 minutes.

Reliability

In its simplest form, *reliability* can be defined as variation in travel time, hour-to-hour and day-to-day for the same trip. Reliability is important for almost any travel need and on any travel mode. Business travelers want to be able to predict how long it will take them to arrive at a meeting, either across town or across the state. Express shippers need to know where packages are at all times and when they will be available for delivery. Vacationers who want to spend as little of their time off as possible traveling to and from their destinations often find themselves making their trips during the most congested days of the year. Reliable travel means fewer late arrivals, improved efficiency, saved time, and reduced frustration.

Travel on most transportation modes is consistent and repetitive, yet at the same time highly variable and unpredictable. This apparent contradiction occurs because travel is consistent and repetitive because peak usage periods occur regularly and can be predicted. The relative size and timing of rush hour is well known in most communities. Simultaneously, travel is variable and unpredictable because, on any given day, unusual circumstances such as a rainstorm or an auto accident can cause serious delays at any time.

The traveling public's experience with variations in travel reliability affects their decisions of how and when to travel, so that they have a reasonable expectation that they will arrive at their destination at a particular time. For example, if a highway is known to have highly variable traffic conditions, a traveler using that route to catch a flight routinely leaves extra time to reach the airport.

Factors Influencing Reliability

Travel time reliability is the direct result of the variable and often unpredictable events that can occur on different travel modes and at any time of day. The traditional way of measuring and reporting travel times experienced by highway users is to consider only average or typical conditions. However, the travel times experienced by users are seldom constant, even for travel on the same facility in the same peak or off-peak time period. Reliability is influenced by several underlying factors that vary over time and that influence the environment in which transportation operates. These factors are listed below.

Incidents

Incidents are events that disrupt normal travel flow, such as obstructions in the travel lanes of highways. Events such as vehicular crashes, mechanical breakdowns, and debris in travel lanes are the most common form of incidents for any mode. On highways, events that occur on the shoulder or roadside can also influence traffic flow by distracting drivers, leading to changes in driver behavior and ultimately to the quality of traffic flow.

Inclement Weather

Inclement weather and related environmental conditions (e.g., rain, fog, snow, ice, and sun glare) can lead to changes in operator behavior, vehicle performance, and operational control requirements that affect traffic flow. Motorists respond to inclement weather by reducing their speeds and increasing their headways. Airport and civil aviation authorities respond by grounding flights or delaying takeoffs and landings. In cases of severe weather, authorities respond by closing roadways and creating vehicle caravans.

Construction

Construction can often reduce the number, width, or availability of travel lanes, rail tracks, and runways. Nearby construction activities can also reduce reliability if operating rules or conditions are changed (e.g., slow orders on rail tracks). Delays caused by work zones have been cited by highway travelers as one of the most frustrating conditions they encounter on trips.

Volume Variation

Volume variation is day-to-day variability in demand that leads to some days with higher travel volumes than others. Different demand volumes superimposed on a system with fixed capacity results in variable, less reliable travel times.

Special Events

Special events, such as concerts, fairs, and sports events, cause localized congestion and disruption in the vicinity of the event that is radically different from typical travel patterns in the region.

Traffic Control Devices and Procedures

Traffic control devices and procedures can lead to intermittent disruption of travel flow through means such as air traffic control, railroad signals and switches, railroad grade crossings, drawbridges, and poorly timed signals.

Base Capacity

Base capacity refers to the physical capacity of a transportation system, such as the number the highway lanes or runways. The interaction of base capacity with the other influences on reliability has an effect on transportation system performance. This effect is caused by the nonlinear relationship between volume and capacity on any mode. When congested conditions are approached, small changes in volume lead to diminished throughput of the transportation system and consequent large changes in delay. Further, facilities with greater base capacity are less vulnerable to disruptions; for example, an incident that blocks a single lane has a greater impact on a highway with two travel lanes than a highway with three travel lanes.

Vehicle Availability and Routing

These can directly affect a traveler's ability to make an on-time trip, particularly on a common carrier, such as airplane and train, or by rental car. End-to-end routing, hubbing,[6] and other strategies to maximize vehicle operation time can affect reliability when a vehicle that is needed in one location first has to complete a trip from a different location. Short layovers, or *pads*, that are scheduled between trips for a given vehicle also affect vehicle availability.

The extent to which these eight factors affect each of the major intercity travel modes, and by extension the HST, is analyzed and compared on a qualitative basis by describing and ranking the extent to which each travel mode is potentially susceptible to each of the eight factors. It is presented in Table 3.2-8 and further detailed below. Because trips are composed of combinations of modal elements (including different modes for trip segments such as station or terminal access), modal rankings have been combined, providing a qualitative understanding of the reliability of each mode.

Table 3.2-8
Modal Reliability

Factor	Relative Susceptibility to Reliability Factors*		
	Air	Automobile	High-Speed Train
Incidents	Low Air travel has very few major incidents and is generally not influenced by incidents on other modes.	High Automobile travel can be influenced by minor and major incidents at any location along the roadway and is frequently affected by incidents outside the right-of-way.	Low HST has very few major incidents and is generally not influenced by incidents on other modes because the number of grade crossings is minimal or nonexistent.
Inclement weather	High A variety of weather conditions anywhere in the country can affect air travel.	High A variety of weather conditions can degrade operator ability, make roadways impassible, or damage roadways.	Low Trains can operate under virtually any conditions. Guideway is constructed to minimize weather impact.

6 Hubbing is a reference to the "hub and spoke" operations practice where airlines coordinate a large number of their flights to arrive at a major terminal at the same time to allow passengers to transfer from one plane to the next to complete their trip to their final destination.

Factor	Relative Susceptibility to Reliability Factors*		
	Air	Automobile	High-Speed Train
Construction	Low Most activities scheduled for periods of low airport usage. High-quality construction minimizes routine maintenance needs.	Moderate Construction activities (major and minor) are common, but generally occur during warm weather months. Lane closures are often of long-term duration.	Low Most activities are scheduled for hours when system is closed. High-quality construction minimizes routine maintenance needs.
Special events	Low Special events (e.g., air space closure) are generally rare but can lead to rerouting or airport closure when they do occur.	Moderate Special events are common and can create volume fluctuations or short-term lane closures.	Low Most special events can be easily accommodated on HST without effect on travel time. Guideway closures are uncommon for this factor.
Traffic control devices or procedures	Moderate Reliability strongly influenced by air traffic control rules and capabilities.	Moderate Auto travel influenced by traffic signals, railroad crossings, and other devices. Influence depends on level to which devices are optimized.	Low HST operates in exclusive, grade-separated right-of-way, minimizing external influences. Double-tracked guideway minimizes switching needs. HST control systems are redundant and highly automated, allowing for a high level of precision in dispatching and control.
Inadequate base capacity	Moderate Capacity can be strong influence because of complex procedures for gate usage, taxiing, and takeoffs/ landings. This factor has strong interaction with weather at certain airports.	High This is one of the strongest influences on highway reliability, particularly for facilities with three or fewer lanes per direction. Travel time degrades quickly as capacity is approached.	Low HST system generally has large capacity reserve. Operations are not allowed to exceed design capacity. Exclusive guideway maintains high level of base capacity at all times.
Volume variation	Moderate–High Air travel demand and number of scheduled flights fluctuates broadly from day to day. Aircraft loading and unloading times directly affected by passenger volumes.	High Peak-period travel in medium to large urban areas highly influenced by day-to-day or seasonal volume variations. Strong interaction with inadequate base capacity.	Low Day-to-day variation in train volumes tends to be low. Passenger volume variation generally does not influence travel times.
Vehicle availability or routing	High Airplanes are used multiple times in a given day, and availability can be affected by factors anywhere in the world and with any type of routing system (point-to-point or hub-and-spoke). High capital cost discourages airlines from keeping large reserve fleet.	Low Private automobiles are ubiquitous and are widely available for rental in emergency situations. The road and highway network provides alternative routes for most trips.	Moderate HST vehicles complete multiple end-to-end trips in a day, potentially affecting availability at specific times and locations; simple routing schemes generally followed.

* *High* indicates that the factor can exert a strong negative influence on travel time reliability for the mode. Conversely, *low* indicates that the factor generally does not play a role in influencing travel time reliability for the mode.

Source: Cambridge Systematics 2003.

Automobile Mode Characteristics

On a day-by-day basis, automobiles tend to be the least reliable of the three modes. Highway travel is highly or moderately susceptible to seven of the eight factors described above. It is only when considering the influence of vehicle availability and routing that automobiles potentially would have a lower susceptibility than other modes.

Recent research provides further evidence on the unreliability of highway travel (Texas Transportation Institute and Cambridge Systematics 2003). This research, which used actual travel time data covering 579 mi (932 km) of freeways in the Los Angeles area, shows that reliability problems exist on highways at all times of the day, all days of the week, and all weeks of the year. This research expressed unreliability in terms of a buffer index, the amount of extra time motorists would need to budget to be certain of arriving on time at their destination 95% of the time. Results showed that a motorist in Los Angeles would need to allow an additional 45 minutes for a typical 1-hour highway trip—fully 75% of normal driving time. Even in midday periods, a traveler would need to budget an additional 30 minutes for the same 1-hour trip, or 50% of the normal time. It is important to note that a buffer does not represent certainty, and on any given day this buffer may or may not be needed.

Air Mode Characteristics

Despite its high average speed, air travel often suffers from reliability problems as a result of several factors. The data in Table 3.2-8 suggest that air travel is moderately or highly susceptible to weather, vehicle availability, volume variation, inadequate base capacity, and traffic control procedures. Air travel is more susceptible than the other two modes to reliability problems arising from weather and vehicle availability. Bad weather and a shortage of aircraft in other states can impact service in California. Air travel reliability is generally not, however, influenced by incidents, construction, or special events.

Airline on-time statistics compiled by the FAA show air travel reliability problems are widespread in California. Airline on-time statistics are available through the Bureau of Transportation Statistics Web site (http://www.bts.gov/ntda/oai). These statistics were reviewed to compare actual versus scheduled flight times for flights departing from Sacramento (SMF), SFO, LAX, and San Diego (SAN) in June 2002.[7] The statistics were analyzed to determine the median scheduled flight time and the 95th percentile actual flight time for flights departing from these four airports.[8] These times and the resulting buffer are shown in Table 3.2-9.[9]

The data in Table 3.2-9 indicate that air travel is generally more reliable than highway travel, as suggested by the smaller buffers (10 to 15% for air travel versus 50 to 75% for highway travel). Nonetheless, the data also show that air travelers at these four airports still need to budget an additional 9 to 18 minutes of in-vehicle travel time to account for unforeseen reliability problems that often arise with air travel.

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[7] Statistics were analyzed for all flights operated by Alaska, America West, American, American Eagle, Delta, Southwest, United, and United Express. These eight airlines account for more than 95% of domestic departures at these four airports. More than 29,000 individual flights were included in the sample.

[8] The 95th percentile was chosen to maintain consistency with the research results reported for the highway mode.

[9] As with the highway mode, the buffer indicates the additional time needed above the average (median) time air travelers would need to budget to arrive on time for their flight with 95% certainty. For air travel, the buffer is expressed as a percentage of the median flight time.

Table 3.2-9
Reliability Statistics for Air Travel in California

Airport	Time (minutes)		Percent Buffer (Delay/Scheduled Flight Time)
	Delay (95th Percentile Travel Time)	Scheduled Flight Duration (Median)	
Sacramento (SMF)	9	85	10.6
San Diego (SAN)	12	90	13.3
San Francisco (SFO)	18	118	15.3
Los Angeles (LAX)	12	110	10.9
Source: Bureau of Transportation Statistics 2002.			

HST has been shown to have a low susceptibility to nearly all of the major factors that affect reliability. It is only on the issue of vehicle availability that HST, like all common carrier modes, has a higher level of susceptibility than highways. Also, HST has the same or lower level of susceptibility on all eight factors compared with air travel or even conventional rail.

Statistics from HST operations in Europe and Asia further confirm the high level of reliability that is inherent with HST. In France, more than 98% of TGV train runs have been completed within 1 min of schedule. In Spain during 2002, 99.8% of AVE runs were completed within 5 min of schedule. In Japan, the JR Central Shinkansen line averaged a 16-second delay per train in 2002. Using the buffer concept that was described for highways and air, these data suggest that HST travelers would likely need to have a schedule buffer less than 1 minutes (less than 1% of scheduled travel time) to account for unforeseen delay and reliability. This in-vehicle travel time buffer is extremely small compared to all other modes.

HST systems have proven worldwide to be far more reliable than conventional U.S. intercity rail services. Several factors account for this reliability.

- Intercity rail service involves mixed operations between conventional intercity passenger services and heavy freight traffic, whereas the HST service would not share tracks with heavy freight services.
- Depending on location and number of operations, the quality of train signal/control/dispatch systems for freight rail systems vary, whereas the HST services would use state-of-the-art automated control systems.
- Most conventional intercity passenger rail routes operate on freight railroads that are dispatched by the host freight railroad. Therefore, dispatching decisions may be based first on the needs of the host railroad, and then on the needs of the passenger train. For example, if a freight train is too long to go into a siding, the dispatcher will have to put the passenger train in the siding to wait until the longer freight train passes. This is just one type of delay for passenger trains using freight railroads.
- Grade crossings are inherently dangerous, providing the opportunity for vehicle and pedestrian collisions and delay due to malfunction of grade-crossing protection equipment. The HST service would be completely double-tracked, fenced, and grade-separated.

  Although detailed statistics were not available, reports on rail operations in California suggest that conventional rail reliability is low (California Department of Transportation 2002). Although Amtrak strives to complete a minimum of 90% of its train runs on time, the most recent data show that the Capitol Corridor is on time about 75% of the time, while intercity service within the LOSSAN corridor is on time about 78% of the time.

Reliability Effects of the HST Alternatives

The HST is likely to provide a greater degree of travel reliability than the No Project Alternative for the following reasons.

- HST would divert significant levels of intercity demand from less reliable modes, particularly highways.
- HST would provide a completely separate transportation system that would have less susceptibility to many factors influencing reliability.
- Highway and air travel reliability would improve because HST would reduce travel demand on highways and air.

The HST alternatives would not be likely to exhibit appreciable differences in system reliability because system capacity and demand would be roughly equivalent. Major design differences (e.g., extent of tunneling) would not make a meaningful difference in reliability, and differences in base travel times on HST would not influence reliability. The reliability of the HST system would not change for the various HST Network Alternatives. However, for HST passengers, adding transfers to other modes and/or longer automobile access/egress trips would have a negative impact on reliability of their total trip.

Sensitivity to Travel Demand Forecasts

As with travel time, reliability is also influenced by the level of travel demand. Other things being equal, reliability is expected to be better on facilities that have lower travel demand (or experience lower V/C ratios) because of the nonlinear relationship between volume and capacity, as mentioned above. Therefore, lower levels of highway or air travel demand with the HST, such as those suggested by the ridership forecasts, would be expected to improve reliability for the highway and air modes. Given the large reliability advantage enjoyed by the HST mode, the HST alternatives would be expected to provide the greatest degree of travel reliability across the range of travel demand scenarios.

Safety

In transportation, three basic characteristics interact to influence the safety of a mode.

- Operator: His or her training, regulation, and experience.
- Vehicle: Its condition, regulation, control systems, and crashworthiness.
- Environment: Weather, guideway type, guideway condition, and terrain.

Each of these characteristics plays a role in the overall safety of the modes, which for this analysis is quantified as the probability of passenger fatality. Injuries are more difficult to compare between modes because they are categorized differently by mode and different injury ratings are used. For instance, automobile injuries are generally related to automobile crashes, while for air, bus, and rail they can include injuries that occur as part of a crash, while boarding/alighting, or in the terminal. The severity of these injuries can vary from scrapes and bruises to life-threatening ones. For the purposes of this analysis, injuries by mode will be discussed but are not measured as a key indicator of safety. This analysis also only considers injuries and fatalities of passengers and does not include employees or other staff.

To assess the relative safety effect of implementing the HST system, analysis has focused on fatalities measured by rate of fatality per 100 million passenger miles traveled. For this analysis the high-end HST ridership forecasts were used because this approach would present the worst case for potential fatalities for all modes and alternatives. The safest mode is the one that has the lowest number of fatalities per 100 million passenger miles traveled (PMT).

Automobile Mode Characteristics

The automobile is unquestionably the most used and the most dangerous of highway, air, and rail modes. The National Highway Traffic Safety Administration estimates that the national motor vehicle fatality rate is 0.80 fatalities per 100 million passenger miles traveled. Nationally in 2000, there were about 6.4 million reported motor vehicle crashes that resulted in 42,000 fatalities and 3.2 million injuries. About 4.2 million crashes involved property damage only (National Highway Traffic Safety Administration 2001). The National Highway Traffic Safety Administration estimates that deaths and injuries resulting from motor vehicle crashes are the leading cause of death for persons between the ages of 4 and 33, while traffic-related fatalities account for more than 90% of all transportation-related fatalities. According to the California Highway Patrol, in 2000 there were 3,331 fatal crashes in California alone (California Highway Patrol 2000). The risk to an individual depends most strongly on the time spent behind the wheel or in the passenger seat. The longer the journey or the more frequently the journey is made, the greater the risk of a crash. Some of the factors that influence auto and highway safety are listed below.

- Operator.
  - Drivers vary in age, experience, ability, and many other factors.
  - Nonprofessional drivers typically operate automobiles.
  - Limited regulatory requirements govern who can operate an automobile and the type of training that is needed, and these requirements vary between states.
- Vehicle.
  - Privately owned vehicles are mechanically not as reliable as the public transportation modes.
  - Maintenance and inspections are not regulated, and are performed by mechanics of varying skill levels.
  - Crashworthiness and roadworthiness varies depending on make and model.
  - Minimum requirements rather than optimum standards dictate safe operating conditions.
- Environment.
  - Highways provide no latitudinal or longitudinal control to individual automobiles.
  - Fixed objects (e.g., trees, light poles, sign posts) are frequently placed within the highway right-of-way.
  - Weather and lighting conditions (wind, rain, fog, snow, ice, darkness, and sun glare) can adversely impact vehicle and driver performance.
  - Traffic control systems that regulate the speed and safe operation of an automobile are limited in influence.
  - Roadway conditions and designs are varied and can include systems based on different design speeds, vehicles, and operating conditions.
  - Drivers are subject to a multitude of potential distractions and interferences.

Air Mode Characteristics

Air travel is a safe mode of travel and in recent years has become even safer with the introduction of improved aircraft and state-of-the-art air traffic control systems. According to the U.S. Department of Transportation (DOT), the likelihood of fatality due to commercial air travel is relatively small (0.02 fatalities per 100 million PMT). According to the University of Michigan Transportation Research Institute, flying a typical nonstop flight is 65 times safer than driving the same distance. Takeoff and landing presents the greatest safety risk during a flight; between 1991 and 2000, 95% of all airline fatalities occurred either during takeoff or landing, and just 5% of fatalities occurred at cruising altitudes (Sivak and Flannagan 2002). Consequently, the risks of flying depend mostly on the number of segments flown and not on the distance flown. Injuries associated with air travel can occur during the process of boarding and alighting, and during flight. Most are relatively minor and include scrapes, bruises, broken bones, and a few serious falls. Some of the factors that influence air travel safety are listed below.

- Operator.
  - Commercial aircraft can only be operated by professional pilots, who are rigorously trained and must update their proficiency regularly.
  - Other airline personnel such as flight attendants are trained to provide immediate assistance in emergency situations.
  - Pilots are subject to drug tests and are regulated by the FAA.
  - Automation of fight operations is well developed and commonly installed.
- Vehicle.
  - Aircraft are regularly maintained to high standards and the FAA regularly inspects these maintenance records.
  - Aircraft themselves are constructed of high-grade metals and, provided they are maintained regularly, can be in active service for decades.
  - All aircraft occupants are required to wear seatbelts during takeoffs and landings, the two procedures that present the greatest safety risk.
  - Air traffic control systems in the United States are standardized and are some of the safest, most reliable systems in the world for controlling commercial aircraft and warning them of potential dangers.
- Environment.
  - One of air travel's greatest weaknesses is its vulnerability to weather. Although most commercial aircraft can fly above or below most storm systems, they often have no choice during takeoffs and landings but to fly through thunderstorms, snow, ice, and fog. Particularly severe weather conditions can ground all aircraft and prevent those in flight from landing.
  - Unexpected turbulence during flight can injure passengers. For this reason, passengers are often required to wear seat restraints and are discouraged from walking or standing during flight.
  - Aircraft have no guideway to provide latitudinal or longitudinal control and therefore run the risk of striking fixed or other flying objects while on the ground or during flight.

High-Speed Train Mode Characteristics

Based on statistics from Europe and Japan, HST is the safest mode of travel.[10] Since 1988, there have been 85 injuries and 14 fatalities[11] reported on all dedicated HST systems in Europe. In Japan's

[10] There are no statistics for HST safety in the United States.

34 years of HST operations, no passenger fatalities have been reported. For the purposes of this analysis and for comparison purposes only, it is assumed that the fatality rate for HST is less than air travel but greater than 0.0, or 0.001 per 100 million PMT. Similar to air travel, the likelihood of injury is associated with boarding and alighting, and during operation, with injuries ranging from minor to severe. The distinguishing reasons for the safety of HST travel relative to air and highway travel are summarized below. The HST mode would be much safer than conventional intercity rail services in California, which operate on freight railroads that have a mix of rail traffic and grade crossings.

- Operator.
  - HST operators would be rigorously trained and tested and would be required to update their qualifications regularly.
  - HST operators would be required to submit to drug tests and would be subject to regulation by the FRA and operating railroads.
  - The train would be completely automated and the train operator would be a failsafe redundant system component that could act in the unlikely case that a system malfunction or other problem occurs.
- Vehicle.
  - The FRA passenger equipment safety standards (49 CFR Part 238) dictate the buff strength or amount of force a train can withstand in a collision, for all passenger equipment. The buff strength is adjusted to the operating and rail traffic conditions and is designed to minimize injuries or fatalities caused by rail crashes.
  - The trains would be completely automated, allowing for centralized command and control of the train system, effectively eliminating the chance of operator error. Much like the BART system in the San Francisco Bay Area, a centralized system would control the operation of the train while the operator would be the physical eyes and ears of the train ensuring passenger safety.
  - Like airplanes, trains and the infrastructure they operate on (tracks, control systems, and electrification systems) would be maintained on a regular schedule. Maintenance records would be subject to inspection by the FRA.
  - Like aircraft, passenger train equipment is built for a long service life. If maintained properly, a modern train car can have a useful life of at least 30 years.
  - HST traffic control and communications systems are state-of-the-art, regulated, and managed during all hours of operation. These systems control the train's speed, schedule, routing, and headway (following distance behind another train). These systems, combined with the operator, have integral redundancy and ensure safety.
- Environment.
  - The HST system would be fully access controlled and grade-separated (including grade crossings), virtually eliminating pedestrian and motor vehicle conflicts.
  - The HST system would be closed to all other rail traffic, greatly reducing the possibility of collision with other trains. An exception is the Caltrain corridor between Gilroy and San Francisco, where the HST would travel at reduced speeds and share the track with express commuter passenger trains.

[11] The worst accident on a dedicated high-speed right-of-way was a derailment in Piacenza, Italy in 1997, which resulted in eight fatalities.

- Inclement weather has only a minimal impact on HST operations. Because it is nearly impossible to read line side signals flashing by at 200 mph (322 kph), HSTs use a cab signaling system that transmits commands directly to the driver. This technology makes high-speed operation possible in darkness, rain, and fog. In Japan, even moderate snowfall does not slow the Shinkansen because of special ice-melting equipment built into the rail bed.
- Unlike aircraft, HST systems are not subject to turbulence. Passengers may sit without seat restraints and may stand and walk comfortably even at maximum speeds and around curves.
- Although HST systems do operate in highly seismic areas, such as Japan, no fatalities have ever occurred as a result of a seismic event. Failsafe technology would stop the trains when an earthquake is detected, and at-grade construction in fault zones would further improve safety.
- The HST system, like other public intercity modes, would be inspected on a regular schedule as required in federal regulations. This regular inspection of both rolling stock and track would ensure the safety of the HST.

The safety characteristics of each mode are summarized in Table 3.2-10. This table shows that for all three safety characteristics, the HST mode has the best safety performance. While air and HST are similar in regard to operator and vehicle characteristics, HST performs better with regard to the environment because the HST mode is capable of operating safely and comfortably in a variety of climatic conditions compared to aircraft, without the need for passenger restraints. The automobile mode fares poorest in terms of safety.

Table 3.2-10
Safety Performance by Mode

Mode	Safety Performance Characteristics		
	Operator (Training, Regulation, Experience)	Vehicle (Condition, Regulation, Control Systems, Crashworthiness)	Environment (Weather, Guideway Condition, Terrain)
Automobile	Poor	Good	Poor
Air	Excellent	Excellent	Poor
HST	Excellent	Excellent	Excellent

Safety Effects of the HST Alternatives

The HST alternatives would provide a safety benefit compared to the No Project Alternative. HST would divert up to 21 million annual intercity highway trips compared to the No Project Alternative, resulting in fewer injuries and fatalities annually. The HST alternatives would have the best overall safety performance, primarily because they divert passengers from the least safe automobile mode to HST, the safest mode. This demand shift combined with the rigorous requirements of HST operators, regular vehicle inspection, maintenance, control systems, crashworthiness, and ability to operate in virtually all weather conditions, make the HST alternatives superior to the No Project Alternative. For the HST Network Alternatives, the safety benefit would vary, depending on the ridership potential of the alternative. The HST Network Alternatives with the highest ridership potential would promote the best overall safety performance.

Connectivity

Connectivity in the study region and the state can be measured qualitatively and quantitatively using the number of modal options that offer competitive transportation services, the availability of intermodal connections, and the frequency of service (number of departures). A greater number of competitive modal options is considered a benefit because it increases the diversity, redundancy, and flexibility of the overall transportation system and provides travelers with greater choices.

- *Modal options* are a measure of the intercity modal diversity of each of the alternatives.
- An *intermodal connection* or facility allows passengers to transfer from one mode to another to complete a trip. A connection can be as simple as a timed connection between a train and a bus or as elaborate as the BART connection to SFO where air, rail, and bus all converge to give multiple transportation options.
- *Frequency* is measured as the number of departures available to travelers in the study region and state. High service frequency benefits travelers because it increases the number of possible connections to different modes and the number of options available for travel to a destination.

Modal Options

The No Project Alternative provides four modal options: automobile, air, intercity rail, and intercity bus. However, intercity travel in California is dominated by automobile and air transportation. The automobile accounts for over 95% of all intercity trips, with air transportation representing more than 3% and conventional rail carrying most of the remaining trips. Although the automobile and air modes compete against one another for the longer-distance intercity trips, such as San Francisco to Los Angeles, the automobile is without rival for many intermediate intercity trips. Table 3.2-11 shows intercity trips by mode between the major metropolitan regions for the proposed HST system. Between the San Francisco Bay Area and the Los Angeles Metropolitan Area, air transportation serves almost 43.4% of the travel market, and the automobile accounts for 56.6%. Air transportation offers fast enough travel times to compete for the long-distance business travel market. Trips between the Central Valley and either the San Francisco Bay Area or the Los Angeles Metropolitan Area are good examples of intermediate intercity trips. For these markets, the automobile serves 97.4% of the travel market, while air transportation serves 1.5% and conventional rail serves about 1.1%.

Table 3.2-11
2005 Intercity Trip Table Summary[a]

Market	2005 Base Trips		
	Auto	Air	Conventional Rail
Los Angeles to Sacramento	3,461,478	1,819,829	-
Los Angeles to San Diego	103,881,859	26,523	3,388,599
Los Angeles to San Francisco	11,186,216	8,562,048	-
Sacramento to San Francisco	49,821,831	7,665	1,860,770
Sacramento to San Diego	95,143	1,099,745	-
San Diego to San Francisco	2,596,853	4,842,881	-
Los Angeles/San Francisco to Valley Cities	83,490,526	1,257,364	922,355
To/From Monterey/Central Coast	118,482,711	177,573	537,584
To/From Far North	109,606,519	1,040,311	327,101
To/From W. Sierra Nevada	75,634,813	1,039,763	67,038
Total	581,985,626	20,094,345	7,136,298

Market	2005 Base Trips		
	Auto	Air	Conventional Rail

[a] Air trips in this table are “local” (or true origin/destination) air trips between metropolitan areas. Connect air trips (which are not destined to a city within the corridor), and their potential for diversion to HST were not forecast in this study. The diversion to HST of connect trips is small in absolute numbers and limited to a few shorter distance intercity markets.

[b] Conventional rail trips do not include rail operators that run buses to extend rail service into additional cities because demand for these services is very small.

Source: Cambridge Systematics 2007.

The HST system would provide a new intercity and regional passenger mode of transportation that would improve connectivity to other existing transit modes and airports. HST would bring competitive travel times and frequent and reliable service to the traditional urban centers of the San Francisco Bay Area, Los Angeles Metropolitan Area, Sacramento, and San Diego. It would significantly improve the modal options available in the Central Valley and other areas of the state not well served by public transport (bus, rail, or air) for intercity trips.

Tables 3.2-12 (low end) and 3.2-13 (high end) show intercity trips by mode between the major metropolitan regions in the state projected for 2030 with a statewide HST system. Under the low-end, or base case, assumptions, between the San Francisco Bay Area (MTC region) and the Los Angeles Metropolitan Area (SCAG region), HST is projected to capture at least 41% of the travel market. Air transportation would serve up to 27% of the travel market, the automobile up to 32%, and conventional rail virtually none of the market. For the high-end ridership assumptions, between the San Francisco Bay Area and the Los Angeles Metropolitan Area, HST is projected to capture up to 71% of the travel market, with the automobile as low as 25%, air transportation serving as little as 4%, and conventional rail virtually none of the market. For trips between the Central Valley and either the San Francisco Bay Area or the Los Angeles Metropolitan Area, the automobile would serve 88% of the intercity travel market, while HST would capture 9% for the low-end forecasts (85% automobile trips and 13% HST trips for the high-end forecasts). The HST system would provide similar benefits to other intermediate intercity markets it serves. For longer-distance intercity trips, HST would provide a competitive alternative to driving and flying. For shorter intercity trips, HST would also be an attractive alternative to driving. Between the San Diego and Los Angeles metropolitan regions, HST captures 17% of the market, but this is a large intercity market and results in 22 million HST trips in 2030 (or 28 million HST trips in the high-end scenario).

Table 3.2-12
2030 Intercity Trip Table Summary for the Base Case Scenario

	Auto	Air	Amtrak Rail	HST	Total	Portion
Los Angeles to Sacramento	2,447,325	1,956,035	-	3,314,200	7,717,560	1%
Los Angeles to San Diego	108,245,472	14,609	3,578,088	22,297,219	134,135,388	15%
Los Angeles to San Francisco	6,654,680	5,572,820	-	8,358,500	20,586,000	2%
Sacramento to San Francisco	61,404,194	2,199	4,096,594	2,685,366	68,188,353	8%
Sacramento to San Diego	53,501	1,803,903	-	123,606	1,981,010	0%
San Diego to San Francisco	1,035,505	4,134,720	-	3,422,970	8,593,195	1%
Los Angeles/San Francisco to Valley Cities	120,816,701	2,384,427	1,631,124	12,666,311	137,498,563	15%
Other	198,613,326	496,401	1,218,372	4,247,149	204,575,248	23%
To/From Monterey/ Central Coast	151,777,421	1,616,825	639,414	4,523,086	158,556,746	18%
To/From Far North	115,344,917	1,350,252	339,208	2,654,082	119,688,459	13%
To/From W. Sierra Nevada	34,142,605	313,313	100,691	1,218,470	35,775,079	4%
Total	800,535,647	19,645,504	11,603,491	65,510,959	897,295,601	100%

Table 3.2-13
2030 Intercity Trip Table Summary Sensitivity Analysis Scenario (High-End)

	Auto	Air	Amtrak Rail	HST	Total	Portion
Los Angeles to Sacramento	1,704,185	460,630	-	5,454,195	7,619,010	1%
Los Angeles to San Diego	98,986,175	-	6,439,695	28,173,985	133,599,855	15%
Los Angeles to San Francisco	5,126,790	836,215	-	14,478,090	20,441,095	2%
Sacramento to San Francisco	58,451,465	-	5,407,475	3,378,440	67,237,380	7%
Sacramento to San Diego	72,270	654,810	-	1,095,000	1,822,080	0%
San Diego to San Francisco	601,155	644,955	-	7,186,850	8,432,960	1%
Los Angeles/San Francisco to Valley Cities	114,560,725		2,557,555	18,074,070	135,192,350	15%
Other	195,926,890	293,460	1,738,860	5,865,915	203,825,125	23%
To/From Monterey/Central Coast	148,689,320	255,135	927,830	6,419,985	156,292,270	17%
To/From Far North	111,904,255	547,135	444,570	3,436,475	116,332,435	13%
To/From W. Sierra Nevada	43,574,276	159,147	390,305	2,944,987	47,068,715	5%
Total	779,597,506	3,851,487	17,906,290	96,507,992	897,863,275	100%

Intermodal Connections

The automobile can be used to go virtually anywhere in California. Unlike common carrier transportation modes (air, bus, or rail), the automobile does not require or depend on intermodal connections to get from the trip origin to the trip destination. The flexibility of the automobile mode would be unaffected by the HST.

Scheduled airline service allows a traveler to reach any destination served by commercial airlines in a relatively short travel time. Unlike the automobile, commercial air travel requires intermodal connections to get to the airport and to a final destination. Moreover, airports are predominately located outside major city centers, a considerable distance from the major transit hubs, which are typically downtown. With the exception of the San Francisco and Burbank airports, which are served directly by rail, all airports in California require transfers to automobiles or road-based public transportation.

It is assumed that there would be limited new intermodal connections under the No Project Alternative because a limited number of these improvements are currently planned and programmed.

HST stations would be generally located at existing transportation centers that could serve a wider area through public transit and would enhance intermodal connections in each region. HST stations in the traditional urban cores of the Sacramento area, the San Francisco Bay Area, and Los Angeles area would connect to the heart of the established public transit networks. For example, Los Angeles Union Station (LAUS) is projected to be the most heavily used HST station. LAUS is the transit hub of Los Angeles County and is the primary destination for the Metrolink Commuter rail services, the Los Angeles Metro Red Line, the Pasadena Gold Line, the Amtrak Surfliner service, and the regional bus transit services. The proposed Transbay Transit Center in San Francisco would be located in the heart of San Francisco's financial district and within walking distance of all major downtown hotels, the convention center, and Union Square retail. The Transbay Transit Center would also serve Caltrain commuter rail, all the major bus services to downtown San Francisco, BART, and the extensive San Francisco Municipal Railway (Muni) light-rail system.

The HST could have a profound effect on the Central Valley and on outlying areas that are not well served by other forms of public transportation. The HST would provide convenient and reliable connections to the airports and downtowns of San Francisco and Los Angeles and to Central Valley cities. All of the potential HST station sites in the Central Valley would either be in city centers or at transportation hubs (airports and Amtrak stations).

Frequency

The automobile, by offering unlimited potential frequency and because it can be driven at virtually any time and to virtually any destination, has the highest connectivity of any mode.

Although 17 commercial airports are in the area that would be served by the HST system, the range of city pairs served is considerably narrower because little to no commercial service exists between some of the city pairs. Air travel is market-driven and consequently airlines concentrate their operations on markets that are profitable. The San Francisco Bay Area to Los Angeles Metropolitan Area corridor is the most heavily traveled air corridor in the world. This intercity travel market and the long distance markets to/from Sacramento and to/from San Diego have many daily departures and arrivals. In other regions such as the Central Valley, where demand is lower and the distances shorter, the number of daily flights serving California intercity markets is far more limited. Table 3.2-14 shows the daily 2005 average air frequencies by airport pair (Cambridge Systematics 2007). While LAX has service to ten airports in California with more than 400 flights per day total, Bakersfield has flights to only four airports in the state and 45 flights per day total. Arcata and Modesto have service to only three airports in the state, and Santa Barbara serves only two airports in California. There is virtually no air service between cities within the Central Valley (Modesto, Bakersfield, Merced, and Fresno).

The HST system would be a new intercity service in the statewide intercity transportation network that would offer a variety of services with different stopping patterns (express, skip-stop, and local services) to serve long-distance, intermediate, and shorter-distance intercity trips. Consequently, HST would increase frequencies for some city pairs that are not well served by air transportation. In addition to the major city pairs, smaller cities in the Central Valley and suburban cities surrounding the major markets would be directly connected with frequent intercity service.

Table 3.2-14
2005 Average Air Frequencies (Flights per Day) by Airport Pair (Each Direction)[a,b]

City	Code	SAN	SNA	LGB	LAX	ONT	BUR	SJC	SFO	OAK	SMF	MRY
San Diego	SAN	-	-	-	-	-	-	-	-	-	-	-
Santa Ana	SNA	-	-	-	-	-	-	-	-	-	-	-
Long Beach	LGB	-	-	-	-	-	-	-	-	-	-	-
Los Angeles	LAX	47	-	-	-	-	-	-	-	-	-	-
Ontario	ONT	-	-	-	-	-	-	-	-	-	-	-
Burbank	BUR	-	-	-	-	-	-	-	-	-	-	-
San Jose	SJC	31	20	-	54	8	9	-	-	-	-	-
San Francisco	SFO	60	35	-	101	22	30	-	-	-	-	-
Oakland	OAK	29	23	7	60	17	16	-	-	-	-	-
Sacramento	SMF	39	14	9	42	18	21	-	15	-	-	-
Palm Springs	PSP	33	-	-	23	-	-	9	20	12	11	-
Oxnard	OXR	-	-	-	-	-	-	-	8	5	8	-
Santa Barbara	SBA	-	-	-	-	-	-	-	14	-	10	-
Bakersfield	BFL	10	17	-	10	-	-	-	-	-	-	8
Fresno	FAT	18	23	-	29	6	14	-	11	-	-	2
Monterey	MRY	-	-	-	25	-	-	3	10	5	4	-
Arcata	ACV	9	7	-	10	-	-	-	-	-	-	-
Modesto	MOD	7	7	-	11	-	-	-	-	-	-	-

[a] Three-digit codes for airports used as the column headings correspond to the airport names in the row headings.
[b] Source: Federal Aviation Administration data from the 10% ticket sample, supplemented with internet queries in August 2006. This includes direct and connecting service for intra-state flights where demand in 2005 is greater than one trip per day (400 annual trips).

The proposed HST system would serve about 20–30 stations (depending on alignment alternative selected). Table 3.2-15 shows the number of daily trains (for each direction) served for each station pair, as assumed for the base case Altamont and Pacheco Pass representative alternatives. This table shows that, compared to air transportation, the addition of HST service would greatly increase the number of trains serving major and intermediate destinations. For example, Fresno and Bakersfield are expected to have service to 25 stations/cities with frequencies of 26 trains daily in each direction. Central Valley cities, such as Merced, Modesto, Stockton, and Visalia as well as additional urban markets in the San Francisco Bay Area and southern California, such as East San Gabriel Valley, Palo Alto/Redwood City, Riverside, Sylmar, and Escondido, would receive frequent service to all HST stations.

Connectivity Effects of the HST Alternatives

The HST alternatives would be a new mode in the state's intercity transportation system. The HST would create a variety of new intermodal connections to local, regional, and intercity modes. The HST would add frequencies to the state's intercity travel network, allowing greater flexibility in travel time and location; however, the HST could result in some decreases in air frequencies in some markets. As compared to the No Project Alternative, the HST alternatives provide the highest level of connectivity in the study region and state, particularly between the Central Valley cities and the city centers of the major metropolitan areas. The level of improvement in connectivity varies among the HST Network Alternatives. The network alternatives that directly serve San Francisco, Oakland, and San Jose would provide the greatest connectivity benefit.

Passenger Cost

Passenger cost is a measure of the relative differences in travel costs between the No Project and HST alternatives. Passenger cost for this analysis means the total cost of the trip, including the cost of traveling to the airport or station, the airplane or train fare, and other associated expenses. Cost is one of the key factors that can influence passenger choice of modes.

There is a range of existing intercity travel options, from relatively inexpensive intercity bus to premium air. For example, the cost of traveling round-trip between Los Angeles and San Francisco (one of the busiest travel corridors in the world) can be as little as $25 for an intercity bus ticket to as much as $350 for a walk-up fare for airline travel. The air travel market particularly features large variations in fares. Sources of these variations include the following factors.

- Time of travel: Peak-period travel tends to be more expensive, and Saturday night stays tend to be less expensive.
- Time of booking: Early bookings tend to be less expensive, while last-minute bookings are more expensive.
- Airport choice: Travel between major destinations such as Los Angeles and San Francisco boasts a variety of options and fares, while travel to or from smaller airports with limited service, such as Fresno and Bakersfield, have greatly limited fare and travel choices.

Passenger cost is quantitatively measured by actual costs to the passenger associated with a typical door-to-door trip. The representative city pairs presented in the travel time discussion earlier in the section are used as a basis to compare the relative differences in cost

Automobile Mode Characteristics

For highway travel, it is assumed that the entire door-to-door trip is made with a private automobile and that there are no ancillary access costs. Automobile travel costs are shown as the total costs per auto. The total costs of operating a vehicle include maintenance, repairs, and taxes, which are shown on a per-auto basis in Table 3.2-16. These costs do not include other costs of owning an auto, such as depreciation, financing, or insurance. The ridership and revenue estimates are based on the perceived costs of making an automobile trip (e.g., fuel and maintenance) and do not include all of the true costs associated with owning and operating a vehicle.

Table 3.2-17 summarizes the costs for making a one-way trip for the representative city pairs. Tolls and parking are included in these estimates. All-day parking in downtown San Francisco or Los Angeles was set at $25. As shown in the table, the door–to-door average perceived one-way cost per person for traveling between representative city pairs by highway range from $40 to $137 for total costs.

Table 3.2-15
2030 High-Speed Train Frequencies (Trains per Day) by Station Pair (Each Direction)

Pacheco Pass

	San Francisco (Transbay)	Millbrae	Redwood City	San Jose	Gilroy	Sacramento	Stockton	Merced	Fresno	Bakersfield	Palmdale	Sylmar	Burbank	Los Angeles Union Station	Norwalk	Anaheim	Irvine	Ontario	Riverside	Temecula	Escondido	University City	San Diego	Morgan Hill	City of Industry
San Francisco (Transbay)																									
Millbrae[1]	54																								
Redwood City	54	54	-																						
San Jose	28	54	54																						
Gilroy	53	53	53	53	-																				
Sacramento	36	18	18	36	18	-																			
Stockton	18	18	18	18	18	47	-																		
Merced	18	18	18	18	18	26	26	-																	
Fresno	36	20	20	36	20	23	23	8	-																
Bakersfield	36	20	20	36	20	23	23	8	55	-															
Palmdale	32	32	32	32	31	20	20	8	30	36	-														
Sylmar	32	32	32	32	31	20	20	8	30	36	54	-													
Burbank	32	32	32	32	31	20	20	8	30	36	54	54	-												
Los Angeles Union Station[1]	28	32	32	28	31	37	29	8	55	61	54	54	54												
Norwalk	3	3	3	3	3	3	3	3	3	3	5	5	5	5	-										
Anaheim	15	5	5	15	6	7	5	6	7	8	7	7	7	22	5	-									

Table 3.2-15. Continued

	San Francisco (Transbay)	Millbrae	Redwood City	San Jose	Gilroy	Sacramento	Stockton	Merced	Fresno	Bakersfield	Palmdale	Sylmar	Burbank	Los Angeles Union Station	Norwalk	Anaheim	Irvine	Ontario	Riverside	Temecula	Escondido	University City	San Diego	Morgan Hill	City of Industry
Irvine	15	5	5	15	6	7	5	6	7	8	7	7	7	22	5	22	-								
Ontario	32	27	27	32	27	24	20	8	32	37	47	47	47	58	5	26	26	-							
Riverside	32	27	27	32	27	24	20	8	32	37	47	47	47	58	5	26	26	58	-						
Temecula	32	27	27	32	27	24	20	8	32	37	47	47	47	58	5	26	26	58	58	-					
Escondido	32	27	27	32	27	24	20	8	32	37	47	47	47	58	5	26	26	58	58	58	-				
University City	32	27	27	32	27	24	20	8	32	37	47	47	47	58	5	26	26	58	58	58	58	-			
San Diego	48	27	27	48	27	30	26	8	48	53	47	47	47	80	5	26	26	58	58	58	58	58	-		
Morgan Hill	53	53	53	53	56	18	18	18	22	25	34	34	34	34	3	3	3	31	31	31	31	31	31	-	
City of Industry	32	27	27	32	27	24	20	8	32	37	47	47	47	58	5	26	26	55	55	55	55	55	55	27	-
Modesto (Briggsmore)	18	18	18	18	18	35	35	26	18	18	8	8	8	18	3	6	6	6	6	6	6	6	12	18	6

Altamont Pass

	San Francisco (Transbay) (1)	Millbrae	Redwood City	San Jose	Sacramento	Stockton	Tracy DT	Modesto/SP Downtown	Merced	Fresno	Bakersfield	Palmdale	Sylmar	Burbank	Los Angeles Union Station	Norwalk	Anaheim	Irvine	Ontario	Riverside	Temecula	Escondido	University City	San Diego	Bernel / 680	City of Industry
Millbrae	38																									
Redwood City	38	38																								
San Jose	43	37	37																							
Sacramento	18	14	14	18																						
Stockton	17	14	14	5	49																					
Tracy DT	38	38	38	22	22	16																				
Modesto/SP Downtown	10	10	10	11	17	15	21																			
Merced	10	10	10	11	8	5	21	26																		
Fresno	24	10	10	17	23	23	21	36	26																	
Bakersfield	25	15	15	8	23	23	19	33	22	57																
Palmdale	22	22	22	9	18	20	33	22	22	27	36															
Sylmar	22	22	22	9	18	20	33	22	22	27	36	54														
Burbank	22	22	22	9	18	20	33	22	22	27	36	54	54													
Los Angeles Union Station[1]	14	22	22	13	37	29	33	33	22	57	61	54	54	54												
Norwalk	3	3	3	5	5	3	5	3	3	8	3	5	5	5	5	-										
Anaheim	8	4	4	6	5	4	7	4	3	18	8	7	7	7	22	5	-									
Irvine	8	4	4	6	5	4	7	4	3	18	8	7	7	7	22	5	22	-								
Ontario	18	18	18	12	24	20	26	22	20	23	37	47	47	47	58	5	26	26	-							
Riverside	18	18	18	12	24	20	26	22	20	23	37	47	47	47	58	5	26	26	58	-						
Temecula	18	18	18	12	24	20	26	22	20	23	37	47	47	47	58	5	26	26	58	58	-					

	San Francisco (Transbay) (1)	Millbrae	Redwood City	San Jose	Sacramento	Stockton	Tracy DT	Modesto/SP Downtown	Merced	Fresno	Bakersfield	Palmdale	Sylmar	Burbank	Los Angeles Union Station	Norwalk	Anaheim	Irvine	Ontario	Riverside	Temecula	Escondido	University City	San Diego	Bernel / 680	City of Industry
Escondido	18	18	18	12	24	20	26	22	20	23	37	47	47	47	58	5	26	26	58	58	58	-				
University City	18	18	18	12	24	20	26	22	20	23	37	47	47	47	58	5	26	26	58	58	58	58	-			
San Diego	28	18	18	18	32	26	26	30	20	39	53	47	47	47	80	5	26	26	58	58	58	58	58	-		
Bernal / 680	31	38	38	41	36	22	66	21	21	41	48	41	41	41	27	6	17	18	44	44	44	44	44	61		
City of Industry	18	18	18	12	24	20	26	22	20	29	37	47	47	47	58	5	26	26	55	55	55	55	55	55	30	-
Warm Springs	25	22	22	14	16	10	22	11	11	11	10	19	19	19	19	7	15	15	19	19	19	19	19	19	28	19

Source: Parsons Brinckerhoff 2007.

[1] The express service between San Francisco and Los Angeles is included in the HSR forecasting model as the primary service for modal choice because the shorter travel times (but longer headways) offer a premium service for this market. As a result, the number of trains represented here is for express service only and does not include the many local trains that offer service between San Francisco (Transbay) and Los Angeles Union Station. For example, this is why there are more trains from Burbank or Riverside to San Francisco.

Table 3.2-16
Auto Ownership and Operating Costs by Category (in 2005 Dollars)

Cost Category	Percent of Cost	Cents per Mile	
		Low-End (Base) Forecast[a]	High-End Forecast[b]
Fuel tax	11	2.3	3.4
Fuel	60	12.0	18.0
Repairs	6	1.1	1.7
Maintenance	14	2.9	4.3
State fees	9	1.7	2.6
Total	100	20.0	30.0

[a] Auto operating cost based on auto operating cost observed in 2005 and increasing with inflation only to 2030 (i.e., no real increase in costs) to represent the base, or low–end, forecasts.

[b] Auto operating cost based on a 50% increase in auto operating cost between 2005 and 2030 to represent the high-end forecasts.

Source: Metropolitan Transportation Commission 2006.

Table 3.2-17
One-Way Door-to-Door Trip Automobile Costs (in 2005 Dollars)'

City Pair	Cost per Trip (dollars)	
	Low-End (Base) Forecast[a]	High-End Forecast[b]
Los Angeles downtown to San Francisco downtown	98	137
Fresno downtown to Los Angeles downtown	58	81
Los Angeles downtown to San Diego downtown	38	50
Burbank (airport) to San Jose downtown	74	108
Sacramento downtown to San Jose downtown	23	34

[a] Auto operating cost based on auto operating cost observed in 2005 and increasing with inflation only to 2030 (i.e., no real increase in costs) to represent the base, or low–end, forecasts. Auto costs include parking, tolls, and auto operating cost.

[b] Auto operating cost based on a 50% increase in auto operating cost between 2005 and 2030 to represent the high-end forecasts. Auto costs include parking, tolls, and auto operating cost.

Source: Cambridge Systematics 2007.

Air Mode Characteristics

The passenger cost of air travel is primarily determined by the available fare. Depending on the airport, airline, time of year, day of the week, and even certain hours of the day, the price of an air ticket can vary greatly. Regions with competing airports or alternative submarkets (i.e., Ontario and Oakland) have more fare, schedule, and airline options compared to airports with limited service (e.g., Fresno and Bakersfield). In California, because most air operations are scheduled to serve longer distance markets, some major airports, such as San Francisco and Los Angeles, have a more limited choice of airlines and fare options for intra-California travel. Airports that provide more limited service, such as Fresno and Bakersfield, typically have only a few flights available per day and typically one or two airlines that serve that market. However, airports like Ontario and Oakland have frequent intra-California flights from a range of airlines at highly competitive fares.

Average total air costs were calculated including access, egress, and airfare costs. The access and egress sum cost ranges from $15 to $31 per trip, including the cost of parking at the airport and tolls needed to drive to the airport. Air trips require at least one other mode to travel from a different location (e.g., home/office) to the airport, which may include public transit (bus or rail), taxi/shuttle, or private auto (may require parking or drop-off). The access and egress costs reported here are costs associated with driving to/from the airport, which are typically higher than the costs for public transit.

A range of airfares are available that depend on time of purchase (e.g., 21-day advance purchase versus same-day fare), duration of visit (e.g., same-day or Saturday night stay), and departure time (e.g., peak versus off-peak). Table 3.2-18 summarizes the average total cost for air travel between city pair destinations for the low-end base (average fares for 2005) and based on the high-end forecast assumptions of a 50% increase in air fares between 2005 and 2030 (in 2005 dollars). No significant differences were found in the observed data between business and nonbusiness travel, so these fares are equal. As shown, airfares vary widely and can range from $153 between Burbank and San Jose to $263 between Sacramento and San Jose for business travel.

Table 3.2-18
Average Air One-Way Door-to-Door
Trip Passenger Costs (in 2005 Dollars)

City Pair	Cost Per Trip (dollars)	
	Low-End (Base) Forecast[a]	High-End Forecast[b]
Los Angeles downtown to San Francisco downtown	133	200
Fresno downtown to Los Angeles downtown	175	263
Los Angeles downtown to San Diego downtown	166	249
Burbank (airport) to San Jose downtown	153	230
Sacramento downtown to San Jose downtown	152	228

[a] Based on high-end revenue and ridership forecasts, which are 50% higher in 2030 than in 2005.
[b] Sample costs include fares, but parking, taxi fares, and other access/egress costs are not included.
Source: Cambridge Systematics 2007.

High-Speed Train Mode Characteristics

Similar to air travel, the primary cost associated with HST travel is the cost of the train ticket. In some locations, such as LAUS and San Francisco Transbay Transit Center, the parking charges are $25 and contribute significantly to the overall cost of the trip. For this analysis, the fare schedule developed from similar assumptions used in the Business Plan were used to compare the representative city pairs (Table 3.2-19). However, based on experience in Asia and Europe, HST fares may vary the way airfares do with the time of year, day of week and duration of stay. New competition may also develop between the different modes that may affect HST fares. The HST could also offer premium and economy services, with corresponding fares, depending on the markets that develop.

As with air travel, both an access fee and an egress fee ranging from $15 to $31 round trip are part of the HST average total costs. HST travel requires at least one mode change to access the nearest

HST station. Because the HST stations are generally located in the city centers, they are assumed to be located closer to larger population and work centers than airports. The HST line-haul travel fare was estimated using the fare schedule presented in the *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study Levels-of-Service Assumptions and Forecast Alternatives Report* (Cambridge Systematics 2007). Interregional and intraregional fares were set using a different set of assumptions to compete more directly with air and commuter rail, respectively.

Table 3.2-19
High-Speed Train One-Way Door-to-Door Trip Passenger Costs (in 2005 Dollars)[a]

City Pairs	Average Total Cost (dollars)
Los Angeles downtown to San Francisco downtown	82
Fresno downtown to Los Angeles downtown	63
Los Angeles downtown to San Diego downtown	43
Burbank (airport) to San Jose downtown	67
Sacramento downtown to San Jose downtown	55

[a] Based on fares plus parking costs, auto operating costs, and tolls paid to access or egress from a train station.

Source: Cambridge Systematics 2007.

Depending on city pair, level of state support for fare subsidies, and competition, intercity passenger rail would be cost-competitive with the HST. On average, given current fares for Amtrak service and the proposed fares for HST, conventional intercity service would cost 4 to 17% less than the HST for the Los Angeles to San Diego and Sacramento to San Jose city pairs listed above, respectively (assuming the same access and egress fees as the HST). These are the only two city pairs with current conventional rail service. Conventional rail would also be considerably less expensive than air, based on the representative city pairs.

Cost Effects of the High-Speed Train Alternatives

The HST alternatives could provide an overall passenger cost savings for all city pairs analyzed. On average, passengers could save from 22% to 87% on the HST, depending on city pair compared with the No Project Alternative. The HST mode is significantly less expensive than the highway mode for long distance travel, is cost-competitive with the highway mode for shorter distance trips between regions, and is always less expensive than the air mode. For all city pairs, the HST provides a price-competitive alternative to existing airline service and the automobile. The passenger costs would not vary noticeably between the HST Alignment Alternatives.

3.2.4 High-Speed Train Network Alternatives and Station Location Options Comparison

Travel conditions do not vary considerably between the different HST Alignment Alternatives. Within each corridor, the HST Alignment Alternatives serve similar potential markets and would have the same infrastructure requirements. HST travel time, connectivity, and passenger costs would vary with the HST Network Alternatives. This section discusses the relative travel condition differences between the HST Network Alternatives and station location options.

The Altamont Pass network alternatives include a potential station at Tracy and the Tri-Valley (at Livermore or Pleasanton) and place Merced on the San Francisco to Los Angeles segment of the HST system, which would result in a higher frequency of service to/from Merced. The Tracy station would serve other nearby Central Valley communities (such as Manteca), and the Tri-Valley station would serve not only the Livermore, Pleasanton, and Dublin area but would also be the nearest station for many cities in Contra Costa County. The Altamont Pass network alternatives would therefore improve travel conditions to these markets.

The Pacheco Pass alignment includes a potential station at Gilroy (or Morgan Hill), and Pacheco Pass network alternatives would have more frequent service to San Jose. The populations that would be served by the Gilroy station would have improved travel conditions (including shorter access times and access costs) with the Pacheco Pass network alternatives. The potential Gilroy/Morgan Hill station would have impact on travel conditions for a large area because, in addition to serving Southern Santa Clara County, it would also be the most accessible station location for serving the Santa Cruz, Monterey/Carmel, and Salinas populations.

The selection of an HST network alternative to serve the Bay Area cities will consider many factors, including the ability to meet the purpose and need of the HST system in the Bay area. This Program EIR/EIS evaluates potential service to the Bay Area along the San Francisco Peninsula and/or potential service along the East Bay. If service to San Francisco, Oakland, and San Jose were pursued, the number of intermodal connections would be greatly increased. However, if only one or two of these cities were directly served by the proposed HST system, service to each of the remaining termini stations would be greatly increased. However, the access times and access costs would increase significantly, and the competitiveness of the new mode on the part or parts of the Bay not served would also be reduced. For example, if the East Bay is not directly served, all trains bound for the Bay Area would terminate in downtown San Francisco and/or San Jose. However, there would be no HST link to directly serve Oakland or the Oakland Airport. Potential HST passengers from much of the East Bay would have to either use the Capitol Corridor, mass transit, or drive to San Francisco, San Jose, or the peninsula to use the HST service.

Potential Station Locations

- For service to downtown San Francisco, the Transbay Transit Center and the 4th and King Station were selected for further evaluation. The 4th and King Station is the existing terminus for the Caltrain commuter rail service. This station site (adjacent to AT&T Park) is well connected to the San Francisco Muni system but stops more than 1 mi short of the financial district of downtown San Francisco and does not connect to BART. The Transbay Transit Center would offer significantly greater connectivity to San Francisco and the greater Bay Area than the existing 4th and King site because of its location in the heart of the downtown San Francisco financial district, where many potential HST passengers could walk to the station. In addition, the Transbay Transit Center would serve as the transit hub for all of the major services to downtown San Francisco, with the advantage of direct connections to BART and San Francisco Muni. The 4th and King Station would have about a 2.5-minute shorter line-haul travel time to San Francisco than the Transbay Transit Center because the trains would travel at relatively slow speeds between 4th and King and the Transbay Transit Center, a distance of 1.2 mi (1.9 km). However, because the Transbay Transit Center would offer greater connectivity to San Francisco and the greater Bay Area than the existing 4th and King site, total travel times to downtown destinations via the Transbay Transit Center are expected to be superior.
- The West Oakland station and the 12th Street/City Center station were selected for further consideration for the Oakland terminus station. Both of these potential stations would directly connect with BART, and both would have good freeway access. The 12th Street/City Center station would have superior connectivity because it is located in the heart of downtown Oakland, where many potential HST passengers could walk to the station. The 12th Street/City Center BART station is also a transfer station, providing greater connectivity to the regional rail transit system.
- A potential station to serve San Mateo County would be located either at Redwood City or Palo Alto. Both would be multimodal stations at existing Caltrain station locations. The Palo Alto

station would be a stop for the Caltrain express services and therefore would have better connectivity to the regional commuter service and to the peninsula. Altamont Pass options to San Francisco via the Dumbarton Crossing could serve only the Redwood City station site.

- A potential station to serve southern Alameda County would be located at Union City, Shinn, or Fremont (Warm Springs). Both Union City and Fremont station location options would offer a high level of connectivity. The Union City station would connect to BART, the Capitol Corridor, and AC Transit, whereas the Fremont (Warm Springs) station would have good access to the I-880 freeway and a future BART extension.
- South Santa Clara County potentially would be served by a station at either Gilroy or Morgan Hill. Both of these two potential stations would be at Caltrain commuter rail station locations. The Gilroy Station is about 10 mi (16 km) south of Morgan Hill and therefore provides better connectivity, travel times, and lower access costs to the Santa Cruz, Monterey/Carmel, and Salinas markets.
- Diridon Station in downtown San Jose would be a multimodal hub maximizing connectivity to downtown San Jose and the Southern Bay Area. Diridon Station would serve Caltrain, ACE Commuter Rail, the Capitol Corridor, Amtrak, VTA buses and light rail, and a possible link to BART. None of the three airport stations would be in the airport terminals, but each would permit easy access by people movers or shuttles (at SFO, BART currently provides a direct connection from the Millbrae Caltrain Station to the SFO international terminal).
- A potential station to serve the Tri-Valley would be located at either Pleasanton or Livermore. The Pleasanton station would be located at the Pleasanton BART Station or at the existing Pleasanton ACE station along Bernal Road (I-680/Bernal Road). The Pleasanton (BART) station would maximize connectivity with the BART, whereas the I-680/Bernal Road location would link to the existing ACE service. Both locations would provide convenient freeway access. A potential station in Livermore would be located on I-580, in downtown Livermore, or at Greenville Road. The Livermore (Downtown) option would provide direct connectivity with ACE commuter service. Each of these options would have good freeway access; however, the Pleasanton station location options are more centrally located in the Tri-Valley and more accessible to Contra Costa County. The Greenville Road station site has the least connectivity and accessibility. As a part of the regional rail planning efforts, the region is investigating the possibility of extending BART Livermore.
- Two potential sites are evaluated to serve Tracy: a potential downtown station and the existing ACE station. The downtown station maximizes connectivity with downtown Tracy, whereas the existing ACE station would provide a multimodal link to the existing commuter rail service. As part of the regional rail planning effort, the region is assuming that if HST were to provide direct service to downtown Tracy, ACE would be moved to this location as well.
- Millbrae (SFO) and Oakland Airport (Coliseum/BART) are two potential airport stations that would have direct connections to local and regional commuter rail services and would minimize potential travel times and costs for HST passengers who would use the trains for access to the airports.
- Two potential station location options are evaluated to serve Modesto: a potential downtown station on the UPRR rail alignment and the existing Amtrak Briggsmore station on the BNSF alignment. The downtown station maximizes connectivity to downtown Modesto and provides convenient access to SR 99, whereas the Amtrak Briggsmore Station is about 5 mi (8 km) east of downtown Modesto. The selection of the alignment between Stockton and Modesto would determine the station site for Modesto.
- To serve Merced, potential station location options are evaluated at downtown Merced along the UPRR alignment and at Castle AFB. The downtown station is located near the city center and transit hub of Merced, has good access to SR 99, and would have the higher level of connectivity of the two locations. The Castle AFB site is about 7 mi (11 km) from downtown Merced but

would provide easy access to the developing University of California, Merced campus via a new highway alignment along Bellevue Avenue.

3.3 Air Quality and Global Climate Change

This section describes the potential effects on state and regional air quality under the No Project Alternative and proposed HST Alignment Alternatives, using the existing and No Project conditions for comparison. Included in this section is an overview of the air basins studied and a description of the air pollutants and conditions of these air basins.

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Eight air pollutants have been identified by the EPA as being of concern nationwide: carbon monoxide (CO), sulfur oxides (SO_X), hydrocarbons (HC), oxides of nitrogen (NO_X), ozone (O_3), particulate matter 10 microns in diameter or less (PM10), particulate matter 2.5 microns in diameter or less (PM2.5), and lead. Except for HC (also referred to as total organic gases [TOG]), all of these pollutants (NO_X in the form of nitrogen dioxide [NO_2] and SO_X in the form of sulfur dioxide [SO_2]) are collectively referred to as criteria pollutants. Criteria pollutants are pollutants that have standards.

Along with criteria pollutants, pollutants that are considered greenhouse gases (GHGs) are also of concern. GHGs are gases that trap heat in the atmosphere. GHGs include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated fluorocarbons (HCFCs), O_3, perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCsCO_2 and N_2O are the two GHGs released in greatest quantities from mobile sources burning gasoline and diesel fuel). Based on a recent FHWA memo from their headquarters to their division offices, the transportation sector directly accounted for approximately 33% of U.S. CO_2 emissions and about 28% of total U.S. greenhouse emissions (American Association of State Highway and Transportation Officials 2008) in 2005. Transportation is the fastest-growing source of U.S. GHGs and the largest end-use source of CO_2, which is the most prevalent GHG.

GHGs are necessary to life as we know it because they keep the planet's surface warmer than it otherwise would be. This is referred to as the greenhouse effect. As concentrations of GHGs are increasing, however, the Earth's temperature is increasing. Many scientists believe that recently recorded increases in the earth's average temperature are the result of increases in concentrations of GHGs. According to the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) data, the Earth's average surface temperature has increased by about 1.2 to 1.4ºF in the last 100 years. Eleven of the last twelve years rank among the twelve warmest years on record (since 1850), with the warmest two years being 1998 and 2005. Most of the warming in recent decades is very likely the result of human activities. Other aspects of the climate are also changing, such as rainfall patterns, snow and ice cover, and sea level. These changes are referred to as global climate change.

3.3.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

<u>Federal Regulations</u>

Air quality is regulated at the federal level under the CAA of 1970 and the Final Conformity Rule (40 CFR Parts 51 and 93). The Clean Air Act Amendments of 1990 (Public Law [PL] 101–549, November 15, 1990) direct the EPA to implement strong environmental policies and regulations that will ensure better air quality. According to Title I, Section 101, Paragraph F of the Clean Air Act Amendments (42 USC § 7401 *et seq.*): "No federal agency may approve, accept, or fund any transportation plan, program, or project unless such plan, program or project has been found to conform to any applicable SIP in effect under this act." Title 1, Section 101, Paragraph F of the amendments, amends Section 176(c) of the CAA to define *conformity* as follows: conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National

Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards; such activities will not cause any of the following occurrences.

- Cause or contribute to any new violation of any NAAQS in any area.
- Increase the frequency or severity of any existing violation of any NAAQS in any area.
- Delay timely attainment of any NAAQS or any required interim emissions reductions or other milestones in any area. (42 USC § 7506[c][1].)

Federal Climate Change Policy

According to the EPA, "the United States government has established a comprehensive policy to address climate change" that includes slowing the growth of emissions; strengthening science, technology, and institutions; and enhancing international cooperation. To implement this policy, "the Federal government is using voluntary and incentive-based programs to reduce emissions and has established programs to promote climate technology and science." The federal government's goal is to reduce the GHG intensity (a measurement of GHG emissions per unit of economic activity) of the American economy by 18% over the 10-year period from 2002 to 2012. In addition, the EPA administers multiple programs that encourage voluntary GHG reductions, including "ENERGY STAR," "Climate Leaders," and methane voluntary programs. However, at this time there are no adopted federal plans, policies, regulations, or laws directly regulating GHG emissions.

State Regulations

Air quality is regulated at the state level by the California Air Resources Board (CARB), the agency designated to prepare the SIP required by the CAA under the California Clean Air Act of 1988 (Assembly Bill [AB] 2595) and other provisions of the California Health and Safety Code (Health and Safety Code § 39000 *et seq.*). California's Clean Air Act (CCAA) requires all districts designated as nonattainment for any pollutant to "adopt and enforce rules and regulations to achieve and maintain the state and federal ambient air quality standards in all areas affected by emission sources under their jurisdiction."

The responsibility for controlling air pollution in California is shared by 35 local or regional air pollution control and air quality management districts, CARB, and EPA. The districts issue permits for industrial pollutant sources and adopt air quality management plans and rules. CARB establishes the state ambient air quality standards, adopts and enforces emission standards for mobile sources, adopts standards and suggested control measures for toxic air contaminants, provides technical support to the districts, oversees district compliance, approves local air quality plans, and prepares and submits the SIP to EPA. EPA establishes NAAQS, sets emission standards for certain mobile sources (airplanes and locomotives), oversees the state air programs, and reviews and approves the SIP. CARB inventories sources of air pollution in California's air basins and is required to update the inventory triennially, starting in 1998 (Health and Safety Code §§ 39607 and 30607.3). CARB also identifies air basins that are affected by transported air pollution (Health and Safety Code § 39610; 17 C.C.R. Part 70500).

On June 1, 2005, Governor Arnold Schwarzenegger signed Executive Order S-3-05. The goal of this executive order is to reduce California's GHG emissions to: 1) 2000 levels by 2010, 2) 1990 levels by the 2020 and 3) 80% below the 1990 levels by the year 2050. In 2006, this goal was further reinforced with the passage of Assembly Bill 32 (AB 32), the Global Warming Solutions Act of 2006. AB 32 sets the same overall GHG emissions reduction goals while further mandating that CARB create a plan, which includes market mechanisms, and implement rules to achieve "real, quantifiable, cost-effective reductions of greenhouse gases." Executive Order S-20-06 further directs state agencies to begin implementing AB 32, including the recommendations made by the state's Climate Action Team.

Climate change and GHG reduction is also a concern at the federal level; however, at this time, no legislation or regulations have been enacted specifically addressing GHG emissions reductions and climate change.

Assembly Bill 32, the California Climate Solutions Act of 2006 (Health and Safety Code § 38500 et seq.)

In September 2006, Governor Arnold Schwarzenegger signed AB 32, the California Climate Solutions Act of 2006, into law. AB 32 was intended to effectively end the scientific debate in California over the existence and consequences of global warming. In order to be effective, measures to reduce GHG will have to occur in connection with similar reductions by other states and countries. Through AB 32, California is attempting to take on a leadership role in the abatement of climate change and offer a model for other states and countries to reduce GHG emissions. In general, AB 32 directs CARB to do the following:

- On or before June 30, 2007, publicly make available a list of discrete early action GHG emission reduction measures that can be implemented prior to the adoption of the statewide GHG limit and the measures required to achieve compliance with the statewide limit;
- By January 1, 2008, determine the statewide levels of GHG emissions in 1990, and adopt a statewide GHG emissions limit that is equivalent to the 1990 level (an approximately 25% reduction in existing statewide GHG emissions);
- On or before January 1, 2010, adopt regulations to implement the early action GHG emission reduction measures;
- On or before January 1, 2011, adopt quantifiable, verifiable, and enforceable emission reduction measures by regulation that will achieve the statewide GHG emissions limit by 2020, to become operative on January 1, 2012, at the latest. The emission reduction measures may include direct emission reduction measures, alternative compliance mechanisms, and potential monetary and non-monetary incentives that reduce GHG emissions from any sources or categories of sources as CARB finds necessary to achieve the statewide GHG emissions limit; and
- Monitor compliance with and enforce any emission reduction measure adopted pursuant to AB 32.

AB 32 also takes into account the relative contribution of each source or source category to protect adverse impacts on small businesses and others by requiring CARB to recommend a minimum threshold of GHG emissions below which emissions reduction requirements would not apply. AB 32 also allows the governor to adjust the deadlines mentioned above for individual regulations or the entire state to the earliest feasible date in the event of extraordinary circumstances, catastrophic events, or threat of significant economic harm.

Governor's Low Carbon Fuel Standard (Executive Order #S-01-07)

Executive Order #S-01-07 establishes a statewide goal to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020 through establishment of a Low Carbon Fuel Standard. The Low Carbon Fuel Standard shall be incorporated into the State Alternative Fuels Plan required by AB 1007 and is one of the proposed discrete early action GHG reduction measures identified by CARB pursuant to AB 32.

Senate Bill 97 (SB 97)

Senate Bill 97 was signed by the governor on August 24, 2007. This bill provides that in an environmental impact report, negative declaration, mitigated negative declaration, or other document required by CEQA for either transportation projects funded under the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, or for projects funded under the Disaster Preparedness and Flood Prevention Bond Act of 2006, the failure to analyze adequately the effects of

GHG emissions otherwise required to be reduced pursuant to regulations adopted under the Global Warming Solutions Act of 2006 does not create a cause of action for a violation of CEQA. The bill provides that this provision shall apply retroactively for any of the above documents that are not final and shall be repealed on January 1, 2010.

The bill requires the Office of Planning and Research (OPR), by July 1, 2009, to prepare, develop, and transmit to the resources agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, as required by CEQA, including, but not limited to, effects associated with transportation or energy consumption. The resources agency would be required to certify and adopt those guidelines by January 1, 2010. The OPR is required to periodically update the guidelines to incorporate new information or criteria established by the CARB pursuant to the California Global Warming Solutions Act of 2006.

Climate Action Program at Caltrans

In December 2006, the California Department of Transportation, Business, Transportation, and Housing Agency, issued a Climate Action Program. The goal of the Climate Action Program is to promote clean and energy efficient transportation, and provide guidance for mainstreaming energy and climate change issues into business operations. The overall approach to lower fuel consumption and CO_2 from transportation is twofold: (1) reduce congestion and improve efficiency of transportation systems through smart land use, operational improvements, and Intelligent Transportation Systems; and (2) institutionalize energy efficiency and GHG emission reduction measures and technology into planning, project development, operations, and maintenance of transportation facilities, fleets, buildings, and equipment.

The reasoning underlying the Climate Action Program is the conclusion that “the most effective approach to addressing GHG reduction, in the short-to-medium term, is strong technology policy and market mechanisms to encourage innovations. Rapid development and availability of alternative fuels and vehicles, increased efficiency in new cars and trucks (light and heavy duty), and super clean fuels are the most direct approach to reducing GHG emissions from motor vehicles (emission performance standards and fuel or carbon performance standards).” Caltrans asserts that the state must maintain a consistent GHG reduction policy across all agencies to create a coordinated climate change program.

Executive Order #S-3-05

Executive Order #S-3-05, signed by Governor Arnold Schwarzenegger on June 1, 2005, calls for a reduction in GHG emissions to 1990 levels by 2020 and for an 80% reduction in GHG emissions to below 1990 levels by 2050. Executive Order #S-3-05 also calls for the California Environmental Protection Agency (CalEPA) to prepare biennial science reports on the potential impact of continued global warming on certain sectors of the California economy. The first of these reports, *Scenarios of Climate Change in California: An Overview* (Climate Scenarios report), was published in February 2006 (California Climate Change Center 2006).

National and State Ambient Air Quality Standards

As required by the CAA Amendments of 1970 (PL 91-064, December 31, 1970) and the CAA Amendment of 1977 (PL 95-95, August 7, 1977), EPA has established NAAQS for the following air pollutants: CO, O_3, NO_2, PM10, SO_X, and lead. CARB has also established standards for these pollutants. Recent legislation requires CARB to develop and adopt regulations to reduce GHGs (AB 1493, 2002). The federal and state governments have both adopted health-based standards for pollutants. For some pollutants, the national and state standards are very similar; for other pollutants, the state standards are more stringent. The differences in the standards are generally the result of the different health effect studies considered during the standard-setting process and how these studies were interpreted.

Table 3.3-1 lists the federal and state standards. The federal primary standards are intended to protect the public health with an adequate margin of safety. The federal secondary standards are intended to protect the nation's welfare and account for air-pollutant impacts on soil, water, visibility, vegetation, and other aspects of the general welfare. Areas that violate these standards are designated nonattainment areas. Areas that once violated the standards but now meet the standards are classified as maintenance areas. Classification of each area under the federal standards is done by EPA based on state recommendations and after an extensive review of monitored data. Classification under the state standards is done by CARB.

Table 3.3-1
State and National Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a]		Federal Standards[b]		
		Concentration[c]	Method[d]	Primary[c,e]	Secondary[c,f,g]	Method[g]
O_3	1 hour	0.09 ppm ($180\ \mu g/m^3$)	Ultraviolet photometry	N/A	Same as primary standard	Ultraviolet photometry
	8 hours	0.070 ppm ($137\ \mu g/m^3$)		0.08 ppm ($157\ \mu g/m^3$)[h]		
PM10	24 hours	$50\ \mu g/m^3$	Gravimetric or beta attenuation	$150\ \mu g/m^3$	Same as primary standard	Inertial separation and gravimetric analysis
	Annual arithmetic mean	$20\ \mu g/m^3$		N/A		
PM2.5	24 hours	No separate state standard	Gravimetric or beta attenuation	$35\ \mu g/m^3$	Same as primary standard	Inertial separation and gravimetric analysis
	Annual arithmetic mean	$12\ \mu g/m^3$		$15\ \mu g/m^3$		
CO	8 hours	9.0 ppm ($10\ mg/m^3$)	NDIR	9 ppm ($10\ mg/m^3$)	None	NDIR
	1 hour	20 ppm ($23\ mg/m^3$)		35 ppm ($40\ mg/m^3$)		
	8 hour (Lake Tahoe)	6 ppm ($7\ mg/m^3$)		N/A		
NO_2	Annual arithmetic mean	N/A	Gas phase chemilum-incescence	0.053 ppm ($100\ \mu g/m^3$)	Same as primary standard	Gas phase chemilum-incescence
	1 hour	0.25 ppm ($470\ \mu g/m^3$)		N/A		
Lead[i]	30 day average	$1.5\ \mu g/m^3$	Atomic absorption	N/A	N/A	High volume sampler and atomic absorption
	Calendar quarter	N/A		$1.5\ \mu g/m^3$	Same as primary standard	
SO_2	Annual arithmetic mean	N/A	Ultraviolet Fluorescence	0.030 ppm ($80\ \mu g/m^3$)	N/A	Spectro-photometry (Pararosoani-line method)
	24 hours	0.04 ppm ($105\ \mu g/m^3$)		0.14 ppm ($365\ \mu g/m^3$)	N/A	
	3 hours	N/A		N/A	0.5 ppm ($1300\ \mu g/m^3$)	
	1 hour	0.25 ppm ($655\ \mu g/m^3$)		N/A	N/A	
Visibility reducing particles	8 hours (10 a.m. to 6 p.m., Pacific Standard Time)	In sufficient amount to produce an extinction coefficient of 0.23 per km-visibility of 10 mi (16 km) or more (0.07–30 mi [.011–48 km] or more for Lake Tahoe) due to particles when the relative humidity is less than 70%. Method: Beta attenuation and transmittance through filter tape.		No federal standards		

Pollutant	Averaging Time	California Standards[a]		Federal Standards[b]		
		Concentration[c]	Method[d]	Primary[c,e]	Secondary[c,f,g]	Method[g]
Sulfates	24 hour	25 μg/m³				
Hydrogen sulfide	1 hour	0.03 ppm (42 μg/m³)	Ultraviolet fluorescence			
Vinyl Chloride[h]	24 hour	0.01 ppm (26 μg/m³)	Gas chroma-tography			

μg/m³ = micrograms per cubic meter.
mg/m³ = milligrams per cubic meter.
N/A = not available.
NDIR = non-dispersive infrared photometry.
ppm = parts per million.

[a] California standards for O_3, CO (except Lake Tahoe), SO_2 (1 and 24 hour), NO_2, suspended particulate matter-PM10, PM2.5, and visibility reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 CCR.

[b] National standards (other than O_3, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The O_3 standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For PM10, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m³ is equal to or less than one. For PM2.5, the 24-hour standard is attained when 98% of the daily concentrations, averaged over 3 years, are equal to or less than the standards.

[c] Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based on a reference temperature of 25°C (77°F) and a reference pressure of 760 mm (30 in) of mercury. Most measurements of air quality are to be corrected to a reference temperature of 25°C (77°F) and reference pressure measurements of 760 mm (30 in) of mercury (1,013.2 millibar [1 atmosphere]); ppm in this table refers to ppm volume, or micromoles of pollutant per mole of gas.

[d] Any equivalent procedure that can be shown to the satisfaction of CARB to give equivalent results at or near the level of the air quality standard may be used.

[e] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

[f] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[g] Reference method as described by EPA. An *equivalent method* of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by EPA.

[h] CARB has identified lead and vinyl chloride as *toxic air contaminants* with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

Source: California Air Resources Board 2006.

B. METHOD OF EVALUATION OF IMPACTS

Pollutants

Pollutants that can be traced principally to transportation sources and are thus relevant to the evaluation of the project alternatives are CO, O_3 precursors (NO_X and TOG), PM10, PM2.5, and CO_2. Because high CO levels are mostly the result of congested traffic conditions combined with adverse meteorological conditions, high CO concentrations generally occur within 300 ft (91 m) to 600 ft (183 m) of heavily traveled roadways. Concentrations of CO on a regional and localized or microscale basis can consequently be predicted appropriately.

As discussed below in the affected environment section, TOG and NO_X emissions from mobile sources are of concern primarily because of their role as precursors in the formation of O_3 and particulate matter. O_3 is formed through a series of reactions that occur in the atmosphere in the presence of sunlight over a period of hours. Because the reactions are slow and occur as the pollutants are diffusing downwind, elevated O_3 levels are often found many miles from sources of the precursor pollutants. The impacts of TOG and NO_X emissions are, therefore, generally examined on a regional level. CO_2 emission burdens, because of their global impact, are currently expressed only on the statewide level by CARB and EPA. In this analysis, therefore, CO_2 impacts are discussed on the statewide level. It is appropriate to predict concentrations of PM10 and PM2.5 on a regional and localized basis.

Pollutant Burdens

The air quality analysis for this Program EIR/EIS focuses on the potential statewide, regional, and localized impacts on air quality. The regional pollutant burdens were estimated based on changes that would occur, including the following, under each of the alternatives.

- Highway VMT.
- Number of plane operations.
- Number of train movements (proposed HST and existing LOSSAN system).
- Power requirements for the proposed HST system.

Localized air quality impacts were estimated based on level of service information and volume to capacity ratios for intercity freeway segments.

A comparison of the 2005 conditions to the 2030 No Project conditions illustrates the expected trends in air quality. Currently, CARB has not released 2030 emission inventory information. For the purposes of this analysis, emission burdens were projected to 2030, based on CARB emission burden data from 2005–2020. The potential impacts from proposed alternatives were then added to the 2030 conditions. Changes in VMT for on-road mobile sources (vehicles) and for off-road mobile sources (number of plane operations and train movements) were estimated for each of the alternatives. Changes in emissions of stationary sources (electrical power generators) were also assessed.

Highway VMT: On-road pollutant burdens were calculated as a ratio of baseline VMT to estimated VMT changes under each alternative. Although vehicular speeds affect emission rates, the potential basinwide speed changes were considered too small to affect overall emission estimates; thus, changes in future on-road mobile source emission burdens for the project were based solely on VMT changes and did not consider speed.

Number of Plane Operations: The FAA's Emission and Dispersion Modeling System (EDMS) Version 6 is used to estimate airplane emissions. The EDMS estimates the emissions generated from a specified number of landing and take-off (LTO) cycles. Along with the emissions from the planes themselves, emissions generated from associated ground maintenance requirements are also included. Average plane emissions are calculated based on a typical 737 aircraft. The pollutant burdens generated by the LTOs under each alternative were added to CARB's off-road mobile sources (planes) emission budgets for each air basin to determine the potential impacts of the alternatives.

To determine the number of plane trips potentially replaced from the No Project Alternative daily by the HST Alignment Alternatives, the following calculations were performed using a representative HST Alignment Alternatives[1]. The number of daily air trips that could be removed by the proposed HST system (77,682) was divided by an average number of passengers per flight (101.25). The resulting number (38.50) represents the number of flights per day that could potentially be removed by the proposed HST system. (See Chapter 2, "Alternatives," for definition of system alternatives.)

[1] Based on revised low-end ridership forecast developed by Cambridge Systematics June 11, 2007. Also refer to Chapter 2, "Alternatives," and Section 2.3.3.C, Travel Demand and Ridership Forecasts.

77,682 trips = 77,682 flying passengers (1 trip = 1 takeoff and 1 landing)

1 flight = 101.25 passengers (135 seats X 75% load factor, as per Table 3.2-3 in the *System Definition Report,* [Parsons Brinckerhoff 2002])

Therefore,

(77,682 passengers/day) / (101.25 passengers/flight) = 38.5 flights/day

Number of Train Movements: It has been determined that there will be no increase in feeder train service to the proposed HST service; therefore, there are expected to be no changes in train movements due to the HST Alignment Alternatives.

Power Requirements: In addition to the on-road and off-road emission burdens, emissions resulting from the power generated to run the HST system as a whole were estimated and included in the emission burden of the HST Alignment Alternatives. Emission estimates are based on British thermal unit (BTU) requirements calculated in the energy analysis for the project (Section 3.5). BTU emission factors are based on energy usage information from the *California Energy Demand 2006–2016, Staff Energy Demand Forecast* (California Energy Commission, Revised September 2005); California Air Resources Board , Emission Inventory Data, *Conserving Energy and Preserving the Environment: The Role of Public Transportation* (Shapiro et al. 2002); and the *Transportation Energy Data Book* (U.S. Department of Energy 2006).

Pollutant burdens generated by on-road (vehicles), off-road (planes, trains), and stationary (electric power generation) sources were combined and compared to the No Project Alternative and to the HST Alignment Alternatives. The HST system will be powered by the state's electricity grid. Because the grid will supply the power, and no dedicated generating facilities are proposed, no source facilities can be identified. Emission changes from power generation can therefore be predicted on a statewide level only. In addition, because of the state requirement that an increasing fraction of electricity generated for the state's power portfolio come from renewable energy sources, the emissions generated for the HST system are expected to be lower in the future as compared to emissions generated based on the state's current power portfolio.

C. CEQA SIGNIFICANCE CRITERIA / PROJECT RATING SCHEME

Under CEQA, impacts on air quality would be considered significant if the project would:

- Conflict with or obstruct implementation of the applicable air quality plan.
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors).
- Expose sensitive receptors to substantial pollutant concentrations.
- Create objectionable odors affecting a substantial number of people.

To determine if the project has significant air quality impacts as defined by CEQA, the relevance of the potential emission changes was assessed from a total pollutant burden and percentage change compared to the No Project Alternative in the affected air basins and statewide. Depending on each air basin's attainment status, the predicted differences were ranked as a high (+ or -), medium (+ or -), or low (+ or -) impact. The ranking of high, medium, or low was based on the potential magnitude of the emission changes compared to EPA's General Conformity threshold levels for nonattainment and maintenance areas and the No Project Alternative emission inventory (for on-road sources, planes, and trains) for each air basin.

This assessment is based on the total pollutant burden of an area under the No Project Alternative and the change in emissions estimated under a proposed alternative. Both positive and negative impacts were considered. A positive (+) impact indicates a potential benefit (i.e., a decrease in emissions) to an air basin for a specific pollutant; a negative (-) impact indicates a potential detriment (i.e., an increase in emissions) to an air basin.

The following factors were used to rate the potential effects of each proposed project alternative:

- The threshold values provided in EPA's Conformity Rule (Table 3.3-2) that determine when a detailed conformity analysis is required for a proposed federal project located in a nonattainment or maintenance area along with CEQA significance thresholds.
- The Conformity Rule's definition (40 CFR Part 55.852) of a regionally significant project, which is one that would increase emissions of an applicable pollutant in a nonattainment or maintenance area by 10% or more.
- CARB's emission inventories, which are the estimated amounts of pollutants emitted into the atmosphere in 2030 (from the growth projections based on 2005-2020 CARB data) in each air basin from major stationary, areawide, and natural source categories.

For the purpose of this analysis, a project alternative is considered to cause a low impact for a pollutant when it is estimated to increase or decrease the emissions of that pollutant in an air basin by an amount less than the CEQA significance threshold or the appropriate conformity threshold value. A project alternative is considered to cause a medium impact when it is estimated to increase or decrease emissions by an amount greater than the CEQA significance threshold or the appropriate conformity threshold value but less than 10% of the total emissions generated in the basin. A project alternative is considered to cause a high impact when it is estimated to increase or decrease emissions by an amount greater than 10% of the total emissions generated in the basin.

Changes in the amounts of CO_2 emitted as a result of the project alternatives were estimated on a statewide basis. These estimates were based on the estimated changes in fuel use and electrical energy production associated with the HST Alignment Alternatives. In light of the substantial GHG emission reductions goal established by the State Legislature to mitigate the significant adverse environmental effects of global climate change, the following global climate change significance threshold is used for this analysis. This threshold has been identified for the purposes of this EIS/EIR only.

- The project's incremental contribution to global climate change would be considered cumulatively significant if the GHG emissions generated by the proposed project are not consistent with California's achievement of the reductions required by AB 32.

Table 3.3-2
Threshold Values Used to Determine Impact Significance

Pollutant	Area's Attainment Status	Conformity Rule's Significant Impact Thresholds in Tons (Metric Tons)/Year	CEQA Impact Thresholds in Tons (Metric tons)/Year
O_3 (VOCs or NO_X)	Nonattainment—serious	50 (45)	10 (9)
	Nonattainment—severe	25 (23)	10 (9)
	Nonattainment—extreme	10 (9)	10 (9)
	Nonattainment—outside an O_3 transport region	100 (91)	10 (9)
	Nonattainment—moderate/marginal inside an O_3 transport region	50/100 (45/91) (VOC/NO_X)	10 (9)
	NO_X maintenance	100 (91)	10 (9)
	VOC maintenance—outside O_3 transport region	100 (91)	10 (9)
	VOC maintenance—inside O_3 transport region	50 (45)	10 (9)
CO	Nonattainment—all	100 (91)	100 (91)
	Maintenance	100 (91)	100 (91)
PM10/PM2.5	Nonattainment—moderate	100 (91) / 100 (91)	27 (25) / 10 (9)
	Nonattainment—serious	70 (64) / 100 (91)	27 (25) / 10 (9)
	Maintenance	100 (91) / 100 (91)	27 (25) / 10 (9)

To quantify a project's impact on local pollutant levels, a screening analysis was conducted based on overall traffic volumes and projected changes in V/C ratios and level of service estimates. Per state and national guidelines (California Department of Transportation 1997), baseline intersection level of service estimates of D or below that would degrade because of a project have the potential to affect local air quality. Similarly, volume increases of greater than 5% could potentially impact local air quality levels. The traffic analyses determined which roadways would experience an impact (positive or negative) under the project alternatives.

For this level of analysis, however, detailed intersection information has not been generated. Rather, traffic screenlines have been developed. *Screenlines* describe defined segments of a roadway that were selected to reasonably represent the routes affected by the proposed alternatives, as discussed in detail in Section 3.1, "Traffic, Transit, Circulation, and Parking." The estimated traffic volume generated or reduced by the HST Alignment Alternatives was added to No Project traffic volumes and expressed as overall screenline volumes (typical values based on averages over time), level of service, and V/C ratios. These factors were compared to No Project values, and locations with potentially high impacts were identified. The screenlines do not include an analysis of intersections and are therefore not detailed enough to be used for an air quality intersection screening analysis. However, the screenline numbers provide a general idea of the project's impact on the roadway network. Based on these numbers, general potential impacts on the local roadway network for each of the alternatives are discussed below.

3.3.2 Affected Environment

A. STUDY AREA DEFINED

California is divided into 15 air basins (17 CCR § 60100 *et seq.*). Each has unique terrain, meteorology, and emission sources. This analysis has been structured to estimate the potential impacts on the two air basins directly affected by the proposed alternatives, as illustrated in Figure 3.3-1 and statewide impacts. The following basins are considered in this study:

- San Francisco Bay Area.
- San Joaquin Valley.

The previous statewide program EIR/EIS studied the air basins that would be directly affected by the project. Air quality in nearby air basins could also be affected by changes in travel patterns, miles traveled, and regional pollutant transport resulting from the proposed alternatives. These effects are expected to be less than those experienced by the basins that physically contain the project. For this program-level analysis, potential impacts on air quality are described only on a statewide level and for the air basins specified.

B. GENERAL DISCUSSION OF AIR QUALITY RESOURCES

Each pollutant is briefly described below.

- CO is a colorless, odorless gas that is generated in the urban environment primarily by the incomplete combustion of fossil fuels in motor vehicles. Relatively high concentrations of CO can be found near crowded intersections and along heavily used roadways carrying slow-moving traffic. CO chemically combines with the hemoglobin in red blood cells to decrease the oxygen-carrying capacity of the blood. Prolonged exposure can cause headaches, drowsiness, or loss of equilibrium.
- SO_X constitute a class of compounds, of which SO_2 and SO_3 are of great importance in air quality. SO_X is also generated by the incomplete combustion of fossil fuels in motor vehicles. However, relatively little SO_X is emitted from motor vehicles. The health effects of SO_X include respiratory illness, damage to the respiratory tract, and bronchio-constriction.
- HC are composed of a wide variety of organic compounds, including methane (CH_4), emitted principally from the storage, handling, and combustion of fossil fuels. HC are classified according to their level of photochemical reactivity: reactive or nonreactive. Nonreactive hydrocarbons consist mostly of methane. Emissions of TOG and ROG are two classes of hydrocarbons measured for California's emission inventory. TOG include all hydrocarbons, both reactive and nonreactive. In contrast, ROG include only reactive HC. TOG is measured because nonreactive HC have enough reactivity to play an important role in photochemistry. Though TOG can cause eye irritation and breathing difficulty, their principal health effects are related to their role in the formation of O_3. TOG are also considered a GHG.
- NO_X constitute a class of compounds that include NO_2 and nitric oxide (NO), both of which are emitted by motor vehicles. Although NO_2 and NO can irritate the eyes and nose and impair the respiratory system, NO_X, like TOG, is of concern primarily because of its role in the formation of O_3. NO_X is also considered a GHG.
- O_3 is a photochemical oxidant that is a major cause of lung and eye irritation in urban environments. It is formed through a series of reactions involving HC and NO_X that take place in the atmosphere in the presence of sunlight. Relatively high concentrations of O_3 are normally found only in the summer because low wind speeds or stagnant air coupled with warm temperatures and cloudless skies provide the optimum conditions for O_3 formation. Because of

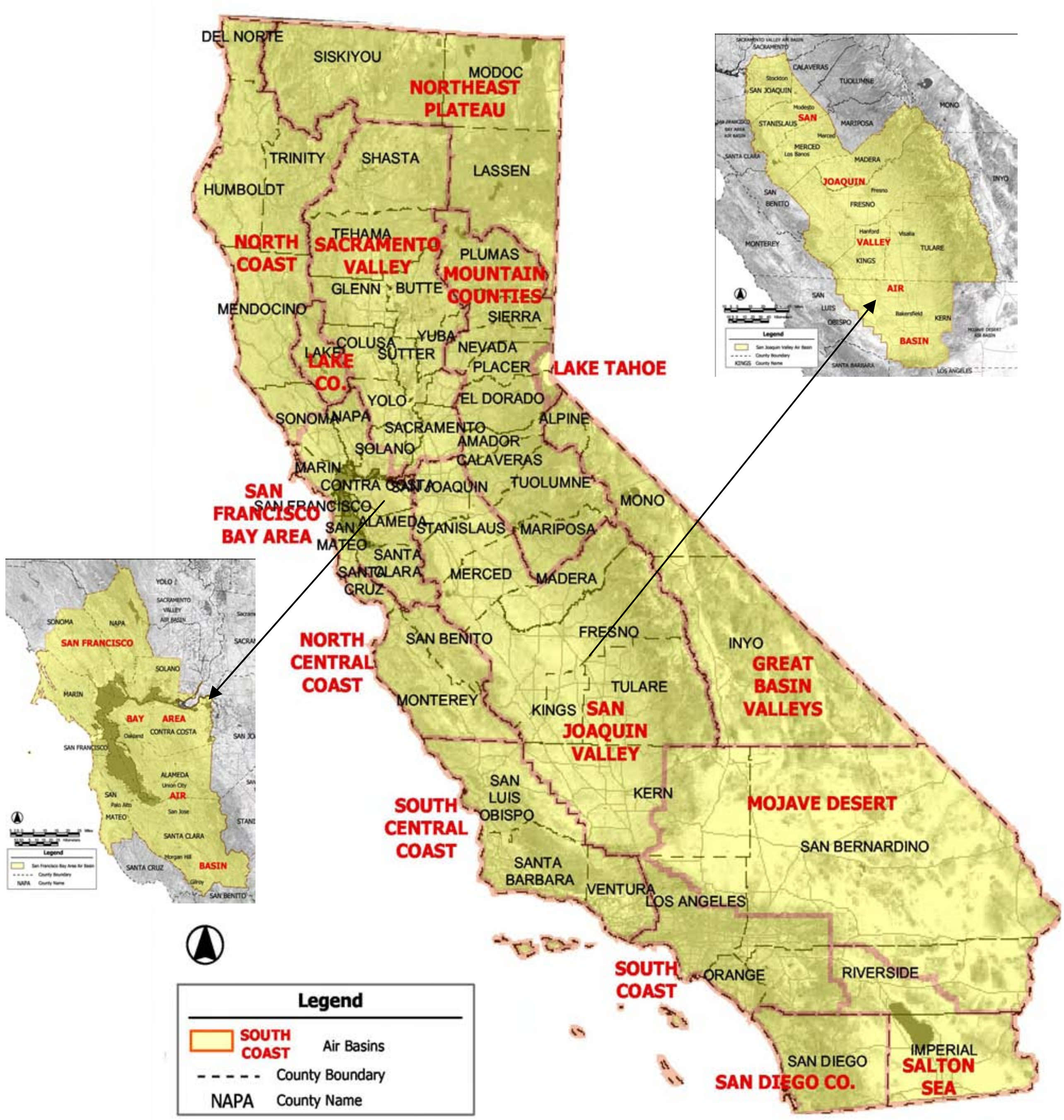


Figure 3.3-1
Air Basins in the Study Region

the long reaction time involved, peak O_3 concentrations often occur far downwind of the precursor emissions. Thus, O_3 is considered a regional pollutant rather than a localized pollutant.

- Particulate matter includes both airborne and deposited particles of a wide range of size and composition. Of particular concern for air quality are particles smaller than or equal to 10 microns and 2.5 microns in size, PM10 and PM2.5, respectively. The data collected through many nationwide studies indicate that most PM10 is the product of fugitive dust, wind erosion, and agricultural and forestry sources, while a small portion is produced by fuel combustion processes. However, combustion of fossil fuels account for a significant portion of PM2.5. Airborne particulate matter mainly affects the respiratory system.
- Lead is a stable chemical element that persists and accumulates both in the environment and in humans and animals. There are many sources of lead pollution, including mobile sources such as motor vehicles and other gasoline-powered engines and nonmobile sources such as petroleum refineries. Lead levels in the urban environment from mobile sources have significantly decreased because of the federally mandated switch to lead-free gasoline. The principal effects of lead on humans are on the blood-forming, nervous, and renal systems.
- CO_2 is a colorless, odorless gas that occurs naturally in the earth's atmosphere. Significant quantities are also emitted into the air by fossil fuel combustion. CO_2 is considered a GHG. The natural greenhouse effect allows the earth to remain warm and sustain life. GHGs trap the sun's heat in the atmosphere and help determine our climate. As atmospheric concentrations of GHGs rise, so may temperatures. Higher temperatures may result in more emissions, increased smog, and respiratory disease.

The existing (2005) baseline pollutant burden for each of the two air basins is described in the following section. The existing baseline represents the current air quality conditions in each of the air basins in the study area. The future No Project conditions are considered the estimated 2020 future baseline pollutant burden for each of the affected air basins. The existing and future baseline information was developed using the CARB pollutant burden projections for the years 2005 and 2020, available at the CARB web site. 2030 emission projections were projected based on the 2005–2020 data. CARB projections are based on future growth levels in stationary, areawide, and mobile sources. CARB projections account for emission reductions resulting from clean vehicles and clean fuel programs. There are two categories of mobile sources: on road and off road. Vehicles licensed for highway use are considered on-road mobile sources; airplanes, marine vessels, locomotives, construction and garden equipment, and recreational off-road vehicles are considered off-road mobile sources.

C. AIR RESOURCES BY AIR BASIN

The air quality attainment status based on state and federal standards for CO, PM10, PM2.5 and O_3 for each of the air basins in the study area is shown in Table 3.3-3. All air basins are assigned an attainment status for air pollutants based on meeting state and federal pollutant standards. There are some differences between state and federal standards, so a pollutant might not have the same status under each standard. A basin is considered in *attainment* for a particular pollutant if it meets the standards set for that pollutant; a basin is considered in *maintenance* for a pollutant if the standards were once violated but are now met; and a basin is considered *nonattainment* for a particular pollutant if its air quality exceeds standards for that pollutant. A basin is considered *unclassified* if the area cannot be classified based on available information as meeting or not meeting the applicable standard. The standards and status designations are discussed in more detail above in Section 3.3.1, Regulatory Requirements and Methods of Evaluation.

Table 3.3-3
Attainment Status of Affected Air Basins

Air Basin	CO		PM2.5		PM10		O_3	
	National Standard	State Standard	National Standard	State Standard	National Standard	State Standard	National Standard	State Standard
San Francisco Bay Area	Maintenance	Attainment	Attainment	Nonattain-ment	Unclassified – 24 hour/ Attainment – Annual	Nonattain-ment	Marginal nonattain-ment	Nonattain-ment – 1 hour / Unclassified – 8 hour
San Joaquin Valley	Maintenance	Attainment except for Fresno Urbanized Area, which is nonattainment	Nonattain-ment	Nonattain-ment	Maintenance (as of 10/17/06)	Nonattain-ment	Serious nonattain-ment	Nonattain-ment

San Francisco Bay Area Air Basin

The San Francisco Bay Area Air Basin covers California's second largest metropolitan area. The counties in the air basin are Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara, as well as the southern half of Sonoma County and the southwestern portion of Solano County. The unifying feature of the basin is the San Francisco Bay, which is oriented north-south and covers about 400 square miles (sq mi) (1,036 square kilometers [sq km]) of the area's total 5,545 sq mi (14,361 sq km). Approximately 20% of California's population resides in this air basin. The area is surrounded by hills, but low passes and the Sacramento–San Joaquin River Delta, which extends to the San Francisco Bay, allow some air pollutant transport to the Central Valley.

Pollution sources in the basin account for about 16% of the total statewide criteria pollutant emissions. The basin is federally classified as follows: maintenance for CO, attainment for PM2.5, unclassified/attainment for PM10, and marginal nonattainment for O_3.

Emissions of O_3 precursors (NO_X and TOG) have decreased since 1975 and are projected to continue declining through 2010. This is the result of strict motor vehicle controls. Stationary source emissions of TOG have declined over the last 20 years because of new controls on oil refinery fugitive emissions and new rules for control of TOG from various industrial coatings and solvent operations.

PM10 emissions are predicted to increase through 2010. This increase is caused by growth in emissions from areawide sources, primarily fugitive dust sources. Mobile source emissions from diesel motor vehicles have been decreasing since 1990, even though population and VMT have been growing. This is the result of stringent emission standards.

CO emissions have been declining in the basin over the last 25 years, and this trend is expected to continue. Motor vehicles and other mobile sources are the largest sources of CO emissions in the air basin. Because of stringent control measures, CO emissions from motor vehicles have been declining.

San Joaquin Valley Air Basin

The San Joaquin Valley Air Basin encompasses the southern two-thirds of California's Central Valley. The counties in this basin are Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare, and the western portion of Kern. The basin spreads across 25,000 sq mi (64,750 sq km). The basin is mostly flat and unbroken, with most of the area below 400 ft (122 m) in elevation. The San Joaquin River runs along the western side of the basin from south to north. The San Joaquin Valley has cool, wet winters and hot, dry summers. Generally, the temperature increases and rainfall decreases from north to south.

Air quality is not dominated by emissions from one large urban area in this basin. Instead, a number of moderately sized urban areas are spread along the main axis of the valley. Approximately 9% of the state's population lives in the San Joaquin Valley. Pollution sources in the region account for about 14% of the total statewide criteria pollutant emissions.

The basin is federally classified as follows: maintenance for CO, nonattainment for PM2.5 and PM10, and serious nonattainment for O_3.

The population in the San Joaquin Valley Air Basin increased by 56% from 1981 to 2000. This is a much higher rate than the statewide average of 39%. During the same time period, the daily VMT increased by 136%, again much higher than the overall statewide average of 91%. Overall, except for PM10, the emission levels in the San Joaquin Valley Air Basin have been decreasing since 1990. The rate of improvement, however, has not been the same as for other air basins. This is due mainly to the large growth rates and increased VMT this area has experienced.

Emissions of the O_3 precursors NO_X and TOG are decreasing in the air basin. NO_X emissions have decreased by approximately 24% since 1985 and are predicted to decrease another 26% by 2010. ROG emissions have decreased by approximately 48% since 1985. They are predicted to decrease another 11% by 2010. These reductions have resulted from more stringent mobile and stationary source emission controls and standards.

Direct emissions of PM10 have been increasing in the air basin and are expected to continue increasing. This increase is due to growth in emissions from areawide sources, primarily fugitive dust from vehicle travel on unpaved and paved roads, waste burning, and residential fuel combustion. These increases are a direct result of the large growth in population and VMT. Mobile sources (emissions directly emitted from motor vehicles) are predicted to decrease through 2010 because of new diesel standards.

CO emissions have been trending downward since 1985 and are expected to continue downward through 2010. Motor vehicles are the largest source of CO emissions in the air basin. Emissions from motor vehicles have been declining since 1985, despite increased VMT. This is the result of stringent emission control measures and standards.

3.3.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

Pollutant burden levels of CO, NO_X, and TOG are predicted to decrease statewide through 2030 compared to existing levels. This decrease is due to the implementation of stringent standards, control measures, and state-of-the-art emission control technologies. Emissions per vehicle are dropping significantly in California because of CARB's clean vehicle and clean fuel programs. Consequently, motor vehicle emissions are declining overall, despite an increase in VMT. The low emission vehicle (LEV) and LEVII regulations adopted in 1990 and 1998, respectively, require a declining average fleet emission rate for new cars, pickup trucks, and medium-duty vehicles (including sport utility vehicles). These regulations, which are being implemented between 1994 and 2010, are expected to result in about a 90% decline in new vehicle emissions. Similar emission reductions are occurring in the heavy-duty diesel truck fleet as progressively lower emission standards for new trucks are introduced. The next phase of tighter diesel truck standards, scheduled to be implemented between 2007 and 2010, is expected to produce an overall reduction of 98% from uncontrolled engine emissions. Newer regulations, including California's low fuel standards, which will require a 10% reduction of carbon intensity by 2020, and AB1493, which is predicted to result in a 27% reduction in grams of CO_2 per vehicle mile by 2030, are not yet reflected in the current emission burden estimates developed by CARB and are thus not reflected in this analysis.

According to CARB pollutant burden projections, emissions of PM10 are expected to increase statewide for the No Project Alternative compared to existing conditions. The upward trend in PM10 emissions is primarily the result of increased emissions from areawide sources, including dust from increased VMT on unpaved and paved roads. PM10 emissions from stationary sources are also expected to increase slightly in the future because of industrial growth.

CO_2 levels for 2005 were projected from data in the December 2006 report *Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004*, by the California Energy Commission. Year 2005 CO_2 emissions were estimated at 1.280 million tons/day.

The percentage of each pollutant source that may be affected by the HST Alignment Alternatives is shown in Figure 3.3-2. Of the four sources of concern (on-road mobile, trains, planes, electric) shown in the figure, on-road mobile is the largest single contributor for all the pollutants. For CO, on-road mobile sources would contribute 74%; for NO_X, on-road mobile sources would contribute 50%. These percentages are only based on the four sources affected by the project and do not reflect total statewide percentages. By detailing the potential overall contribution to statewide pollution levels of each of these sources, the relationship between changes in sources and overall pollution concentrations becomes clearer.

The following analysis of the Pacheco and Altamont Alternatives is based on the "low" ridership projections found in Chapter 2, Table 2.3-3. As discussed in Chapter 2, only the low ridership forecasts are used for air quality analysis for both the Pacheco and Altamont alternatives.

B. PACHECO ALTERNATIVE

<u>No Project Base Alternative Compared to Pacheco Alignment Alternative</u>

The highway component is based on potential daily VMT reductions of 73.365 million miles. The air travel component is based on potential reductions of 43,865 daily trips.

<u>Roadways</u>: The proposed Pacheco Alignment Alternative could potentially result in a daily reduction of 73.365 million VMT as compared to the No Project Alternative. Changes in VMT and estimated on-road mobile source emission reductions resulting from the use of the proposed HST have been calculated statewide and for each of the air basins (Table 3.3-4). The highest reductions in on-road mobile source emissions are predicted for the San Francisco Bay Air Basin. The Pacheco Alignment Alternative is predicted to reduce the 2030 predicted CO mobile source emission budget for San Francisco Bay Air Basin by 94.3 tons per day (85.6 metric tons per day).

<u>Air Travel</u>: The air-travel component is based on 52,876 daily trips (1 trip = 1 takeoff and 1 landing), or 433 flights statewide, being shifted from the airplane component of No Project future conditions to the proposed Pacheco Alignment Alternative. The emission burden reductions projected from the reduced number of flights, shown in Table 3.3-5, were calculated by determining the number of flights that could be accommodated by the proposed HST and multiplying that number by the emission estimates of an average flight, as described above in the discussion of methods of evaluating impacts. The emission changes by air basin resulting from the reduced number of flights range from an estimated 3.4% reduction in PM2.5 in the San Francisco Bay Air Basin to a 0.1% reduction in CO in the San Joaquin Air Basin. Statewide emission reductions range from 0.7% for PM10 and PM2.5 to 3.4% for NO_X. CO_2 plane emissions, generated based on BTUs, are predicted to decrease by approximately 44% on a statewide level under the Pacheco Alignment Alternative.

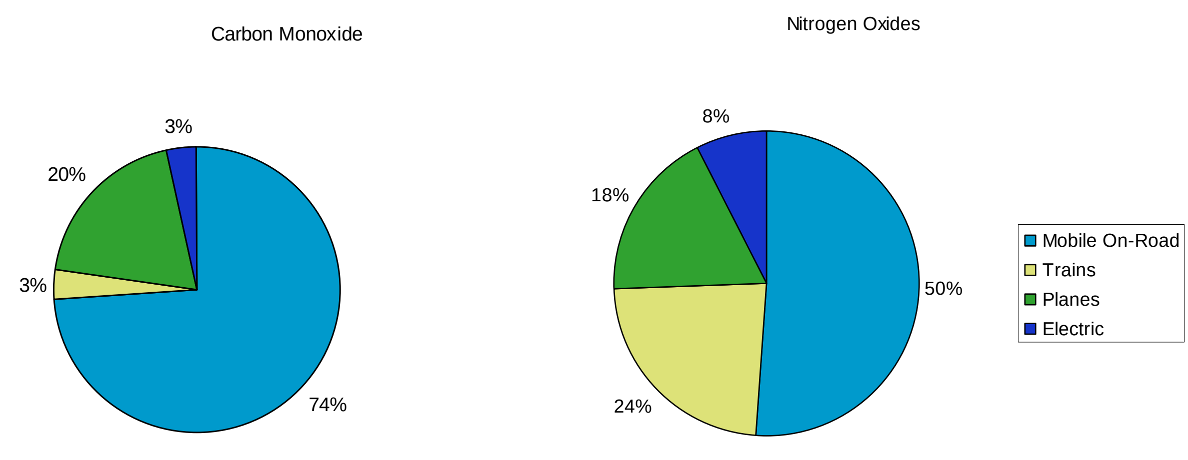


Figure 3.3-2
Pollutants That May Be Affected

Train Travel: Conventional rail service is not predicted to increase under the proposed Pacheco Alignment Alternative; therefore, no change in pollutant burdens is predicted as a result of conventional train travel.

Electrical Power: Additional electrical power would be required to operate the HST system. Because of the nature of electrical power generation and the use of a grid system to distribute electrical power, it is not yet clear which facilities would be supplying power to the HST system. Emission changes from power generation can therefore be predicted only on a statewide level for the full HST system. As shown in Table 3.3-6, CO, PM10, PM2.5, NO_X, and TOG burden levels would be predicted to increase because of the power requirements of the Pacheco Alignment Alternative. A 1.2% increase in CO, PM10, PM2.5, TOG, and NO_X is predicted in the electric utilities portion of these CARB pollutant emission burden projections. A 1.8% increase in CO_2 electrical power emission burden projections is predicted due to increased electrical requirements of the project. If it is decided that the project would be run on 100% clean, zero-carbon emissions electricity, there would be no predicted increase in CO_2 levels due to the project's increased electrical requirements.

Summary of Pollutants: Table 3.3-7 summarizes the combined source categories for existing conditions and the No Project Alternative and the Pacheco Alignment Alternative. Compared to the No Project Alternative, the proposed Pacheco Alignment Alternative is projected to result in a decrease in the amount of pollutants statewide and in all air basins analyzed. Potential air quality benefits would range from a medium to a high rating. CO_2 levels are also detailed in Table 3.3-7. CO_2 project impacts were estimated based on energy projections developed for each alignment alternative. CO_2 calculations for the alignment alternatives reflect only emissions from electrical power stations, planes, and on-road VMT. More detailed tables illustrating the analysis of the pollutant burdens predicted, can be found in the appendix to this report.

Table 3.3-4
On-Road Mobile Source Regional Emissions Analysis—No Project Alternative and Pacheco Alignment Alternative

Air Basin	2030 No Project VMT	2030 Pacheco Base VMT	2030 No Project Emission Burden (Tons/Day)						2030 Pacheco Base Emission Burden (Tons/Day)						Incremental Change from No Project					
			CO	PM 10	PM 2.5	NO_X	TOG	CO_2	CO	PM 10	PM 2.5	NO_X	TOG	CO_2	CO	PM 10	PM 2.5	NO_X	TOG	CO_2
Miles and Tons per Day*																				
San Francisco Bay	112,280,333	71,514,786	259.8	11.6	7.5	51.0	36.0	NA	165.5	7.4	4.8	32.5	22.9	NA	-94.3	-4.2	-2.7	-18.5	-13.1	NA
San Joaquin Valley	126,463,316	116,352,966	142.8	7.1	4.2	33.8	19.3	NA	131.4	6.5	3.9	31.1	17.8	NA	-11.4	-0.6	-0.3	-2.7	-1.5	NA
State Total	1,141,592,762	1,068,227,705	1,310.5	56.9	35.1	263.5	186.2	486,613	1,226.2	53.2	32.5	246.5	174.2	455,341	-84.2	-3.7	-2.6	-16.9	-12.0	-31,272
Kilometers and Metric Tons per Day*																				
San Francisco Bay	180,697,680	115,091,892	235.7	10.5	6.8	46.2	32.6	NA	150.1	6.7	4.3	29.5	20.8	NA	-85.6	-3.8	-2.5	-16.8	-11.8	NA
San Joaquin Valley	203,522,979	187,251,948	129.6	6.4	3.8	30.6	17.5	NA	119.2	5.9	3.5	28.2	16.1	NA	-10.4	-0.5	-0.3	-2.4	-1.4	NA
State Total	1,837,215,462	1,719,145,847	1,188.8	51.6	31.8	239.0	168.9	441,457	1,112.4	48.3	29.5	223.7	158.1	413,086	-76.4	-3.3	-2.3	-15.4	-10.9	-28,370

* Area emission increments are based on area specific emission factors derived from area specific VMT and emission burdens. Statewide emission increments are based on statewide average emissions rather than area specific emissions, thus the statewide totals do not represent a simple sum of all air basins but rather an average of emission increments statewide. CO_2 emissions are only calculated on a statewide level.

Air Basin	% Change from No Project					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
San Francisco Bay	-36.3	-36.3	-36.3	-36.3	-36.3	NA
San Joaquin Valley	-8.0	-8.0	-8.0	-8.0	-8.0	NA
State Total	-6.4	-6.4	-7.3	-6.4	-6.4	-6.4

Table 3.3-5
Airplane Emission Burdens—No Project Alternative and Pacheco Alignment Alternative

Air Basin	2030 Projected No Project Airplane Emission Inventory (Tons/Day)						Flights removed due to project	2030 Emission Reductions due to Flights removed under Build Alternative (Tons/Day)						2030 Total Plane Emission Burden under Build Alternative (Tons/Day)					
	CO	PM 10	PM 2.5	NO_X	TOG	CO_2		CO	PM 10	PM 2.5	NO_X	TOG	CO_2	CO	PM 10	PM 2.5	NO_X	TOG	CO_2
Tons per Day*																			
San Francisco Bay	74.75	0.67	0.64	41.45	12.72	NA	167	-1.74	-0.02	-0.02	-1.20	-0.41	NA	73.00	0.65	0.62	40.24	12.31	NA
San Joaquin Valley	81.50	0.46	0.45	4.75	10.03	NA	10	-0.10	0.00	0.00	-0.07	-0.02	NA	81.40	0.46	0.45	4.68	10.00	NA
State Total	346.74	7.76	7.67	92.44	51.05	114	433	-4.53	-0.06	-0.06	-3.13	-1.08	-50.45	342.21	7.70	7.62	89.32	49.97	63.41
Metric Tons per Day*																			
San Francisco Bay	67.81	0.61	0.58	37.60	11.54	NA	167	-1.58	-0.02	-0.02	-1.09	-0.38	NA	66.23	0.59	0.56	36.51	11.17	NA
San Joaquin Valley	73.93	0.42	0.41	4.31	9.10	NA	10	-0.09	0.00	0.00	-0.06	-0.02	NA	73.84	0.42	0.41	4.24	9.07	NA
State Total	314.56	7.04	6.96	83.87	46.31	103.30	433	-4.11	-0.05	-0.05	-2.84	-0.98	-45.77	310.45	6.99	6.91	81.03	45.33	57.52

*CO_2 emissions are only calculated on a statewide level.

Air Basin	% Change from No Project					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
San Francisco Bay	-2.3	-3.2	-3.4	-2.9	-3.3	NA
San Joaquin Valley	-0.1	-0.3	-0.3	-1.4	-0.2	NA
State Total	-1.3	-0.7	-0.7	-3.4	-2.1	-44.3

Table 3.3-6
Electrical Power Station Emissions—No Project Alternative and Pacheco Alignment Alternative

Air Basin	2030 Projected No Project Energy Emission Inventory (Tons/Day)						2030 Emission changes due to HST power demands under the Build Alternative (Tons/Day)						2030 Total Energy Emission Burden under Build Alternative (Tons/Day)					
	CO	PM10	PM2.5	NO_X	TOG	CO_2*	CO	PM10	PM2.5	NO_X	TOG	CO_2	CO	PM10	PM2.5	NO_X	TOG	CO_2
Tons per Day																		
Statewide	60.08	9.34	9.00	39.16	44.48	391,412	0.71	0.11	0.11	0.46	0.52	7,234	60.78	9.45	9.11	39.62	45.01	398,647
Metric Tons per Day																		
Statewide	54.50	8.47	8.17	35.53	40.36	355,090	0.64	0.10	0.10	0.42	0.47	6,563	55.14	8.57	8.27	35.94	40.83	361,653

* Assumes 22.2% of CO_2 inventory is a result of electrical production, as per Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004,

Air Basin	% Change from No Project					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
Statewide	1.2	1.2	1.2	1.2	1.2	1.8

Table 3.3-7
Potential Impacts on Air Quality Statewide—Existing, No Project, and Pacheco Alignment Alternative

Air Basin	2005 Existing Emission Inventory (Planes, Trains, On-Road Mobile, and Energy, CO_2 all sources) (Tons/Day)						2030 Projected No Project Emission Inventory (Planes, Trains, On-Road Mobile, and Energy, CO_2 all sources) (Tons/Day)						2030 Projected Build Emission Inventory (Planes, Trains, On-Road Mobile, and Energy, CO_2 all sources) (Tons/Day)					
	CO	PM10	PM2.5	NO_X	TOG	CO_2	CO	PM10	PM2.5	NO_X	TOG	CO_2	CO	PM10	PM2.5	NO_X	TOG	CO_2
Tons per Day																		
San Francisco Bay	1536	10	7	318	174	NA	398	22	17	144	94	NA	303	18	15	125	81	NA
San Joaquin Valley	948	7	6	224	102	NA	231	8	5	58	31	NA	220	7	5	55	30	NA
State Total	7,979	69	52	1759	932	1,280,217	1,715	69	47	478	253	1,763,118	1,627	65	44	457	239	1,739,034
Metric Tons per Day																		
San Francisco Bay	1,393	9	7	288	157	NA	361	20	16	131	86	NA	275	16	13	114	74	NA
San Joaquin Valley	860	7	5	203	93	NA	210	7	5	53	28	NA	199	7	4	50	27	NA
State Total	7,239	63	48	1,596	846	1,161,416	1,556	62	42	433	229	1,599,505	1,476	59	40	415	217	1,577,657

Air Basin	% Change from No Project					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
San Francisco Bay	-23.9	-18.9	-15.2	-13.3	-13.7	NA
San Joaquin Valley	-5.0	-7.0	-6.6	-4.8	-5.0	NA
State Total	-5.2	-5.4	-5.6	-4.2	-5.2	-1.4
Air Basin	**Benefit Rating**					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
San Francisco Bay	High	High	High	High	High	NA
San Joaquin Valley	Medium	Medium	Medium	Medium	Medium	NA
State Total	Medium	Medium	Medium	Medium	Medium	NA

Local Impacts: A total of 18 intercity freeway segments were analyzed. The general trend in screenline data shows that the LOS on these freeway segments would largely remain the same under the Pacheco Alignment Alternative compared to the No Project Alternative. Most of the freeway segments would experience less than a 5% change in V/C ratio and no change in LOS. This is with the exception of I-5 (between I-580 and SR 140), which would experience a better level of service under the Pacheco Alignment Alternative, with an approximately 20% reduction in V/C ratio. V/C ratio is the comparison of the roadway volume to roadway capacity, and a reduction in the V/C ratio signifies a better level of service and, therefore, less congestion and lower potential for air quality impacts.

As the alignment alternatives are refined, segments where V/C ratios increase (degrade) should be screened to determine whether more detailed local analyses need to be conducted. Roadways and intersections around proposed station location options should also be screened and undergo detailed modeling if necessary to ensure that the project would not cause or exacerbate a violation of applicable air quality standards.

GHGs: The air quality analysis identified a reduction of about 1.4% of CO_2 emissions statewide attributed to the Pacheco Alignment Alternative. This would be a beneficial impact due to the reduction in automobile vehicle miles traveled (mobile sources) and reduction in the number of airplane trips.

C. ALTAMONT ALTERNATIVE

No Project Base Alternative Compared to Altamont Alignment Alternative

The highway component is based on potential daily VMT reductions of 87.952 million miles. The air travel component is based on potential reductions of 41,573 daily trips.

Roadways: The proposed Altamont Alignment Alternative could potentially result in a daily reduction of 87.952 million VMT as compared to the No Project Alternative. Changes in VMT and estimated on-road mobile source emission reductions resulting from the use of the proposed HST have been calculated statewide and for each of the air basins (Table 3.3-8). The highest reductions in on-road mobile source emissions are predicted for the San Francisco Bay Air Basin. The Altamont Alignment Alternative is predicted to reduce the 2030 predicted CO mobile source emission budget for San Francisco Bay Air Basin by 101.5 tons per day (91.7 metric tons per day).

Air Travel: The air-travel component is based on 55,168 daily trips (1 trip = 1 takeoff and 1 landing), or 411 flights statewide, being shifted from the airplane component of No Project future conditions to the proposed Altamont Alignment Alternative. The emission burden reductions projected from the reduced number of flights, shown in Table 3.3-9, were calculated by determining the number of flights that could be accommodated by the proposed HST and multiplying that number by the emission estimates of an average flight, as described above in the discussion of methods of evaluating impacts. The emission changes by air basin resulting from the reduced number of flights range from an estimated 3.2% reduction in PM2.5 in the San Francisco Bay Air Basin to a 0.1% reduction in CO in the San Joaquin Air Basin. Statewide emission reductions range from 0.7% for PM10 and PM2.5 to 3.2% for NO_X. CO_2 plane emissions, generated based on BTUs, are predicted to decrease by approximately 42% on a statewide level under the Altamont Alignment Alternative.

Train Travel: Conventional rail service is not predicted to increase under the proposed Pacheco Alignment Alternative; therefore, no change in pollutant burdens is predicted as a result of conventional train travel.

Table 3.3-8
On-Road Mobile Source Regional Emissions Analysis—No Project Alternative and Altamont Alignment Alternative

Air Basin	2030 No Project VMT	2030 Altamont Base VMT	2030 No Project Emission Burden (Tons/Day)						2030 Altamont Base Emission Burden (Tons/Day)						Incremental Change from No Project					
			CO	PM 10	PM 2.5	NO_X	TOG	CO_2	CO	PM 10	PM 2.5	NO_X	TOG	CO_2	CO	PM 10	PM 2.5	NO_X	TOG	CO_2
Miles and Tons per Day*																				
San Francisco Bay	112,280,333	65,382,106	259.8	11.6	7.5	51.0	36.0	NA	158.7	7.1	4.6	31.1	22.0	NA	-101.5	-4.5	-2.9	-19.8	-14.0	NA
San Joaquin Valley	126,463,316	112,879,903	142.8	7.1	4.2	33.8	19.3	NA	131.7	6.5	3.9	31.1	17.8	NA	-11.2	-0.6	-0.3	-2.6	-1.5	NA
State Total	1,141,592,762	1,053,640,241	1,310.5	56.9	35.1	263.5	186.2	486,613	1,224.3	53.1	32.8	246.2	174.0	463,187	-86.2	-3.7	-2.3	-17.3	-12.2	-23,426
Kilometers and Metric Tons per Day*																				
San Francisco Bay	180,697,681	105,222,299	235.7	10.5	6.8	46.2	32.6	NA	144.0	6.4	4.1	28.3	19.9	NA	-91.7	-4.1	-2.6	-18.0	-12.7	NA
San Joaquin Valley	203,522,980	181,662,594	129.6	6.4	3.8	30.6	17.5	NA	119.5	5.9	3.5	28.2	16.2	NA	-10.1	-0.5	-0.3	-2.4	-1.4	NA
State Total	1,837,215,462	1,695,669,599	1,188.8	51.6	31.8	239.0	168.9	441,457	1,110.7	48.2	29.7	223.3	157.8	420,204	-78.2	-3.4	-2.1	-15.7	-11.1	-21,252

* Area emission increments are based on area specific emission factors derived from area specific VMT and emission burdens. Statewide emission increments are based on statewide average emissions rather than area specific emissions, thus the statewide totals do not represent a simple sum of all air basins but rather an average of emission increments statewide. CO_2 emissions are only calculated on a statewide level.

Air Basin	% Change from No Project					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
San Francisco Bay	-38.9	-38.9	-38.9	-38.9	-38.9	NA
San Joaquin Valley	-7.8	-7.8	-7.8	-7.8	-7.8	NA
State Total	-6.6	-6.6	-6.6	-6.6	-6.6	-4.8

Table 3.3-9
Airplane Emission Burdens—No Project Alternative and Altamont Alignment Alternative

Air Basin	2030 Projected No Project Airplane Emission Inventory (Tons/Day)						Flights removed due to project	2030 Emission Reductions due to Flights removed under Build Alternative (Tons/Day)						2030 Total Plane Emission Burden under Build Alternative (Tons/Day)					
	CO	PM 10	PM 2.5	NO_X	TOG	CO_2		CO	PM 10	PM 2.5	NO_X	TOG	CO_2	CO	PM 10	PM 2.5	NO_X	TOG	CO_2
Tons per Day*																			
San Francisco Bay	74.75	0.67	0.64	41.45	12.72	NA	-158	-1.65	-0.02	-0.02	-1.14	-0.39	NA	73.10	0.65	0.62	40.31	12.33	NA
San Joaquin Valley	81.50	0.46	0.45	4.75	10.03	NA	-9	-0.09	0.00	0.00	-0.07	-0.02	NA	81.40	0.46	0.45	4.68	10.00	NA
State Total	346.74	7.76	7.67	92.44	51.05	114	-411	-4.29	-0.05	-0.05	-2.96	-1.02	-47.83	342.44	7.70	7.62	89.48	50.03	66.03
Metric Tons per Day*																			
San Francisco Bay	67.81	0.61	0.58	37.60	11.54	NA	-158	-1.50	-0.02	-0.02	-1.03	-0.36	NA	66.31	0.59	0.56	36.57	11.19	NA
San Joaquin Valley	73.93	0.42	0.41	4.31	9.10	NA	-9	-0.09	0.00	0.00	-0.06	-0.02	NA	73.85	0.42	0.41	4.25	9.07	NA
State Total	314.56	7.04	6.96	83.87	46.31	103.30	-411	-3.90	-0.05	-0.05	-2.69	-0.93	-43.39	310.67	6.99	6.91	81.18	45.38	59.90

*CO_2 emissions are only calculated on a statewide level.

Air Basin	% Change from No Project					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
San Francisco Bay	-2.2	-3.1	-3.2	-2.8	-3.1	NA
San Joaquin Valley	-0.1	-0.3	-0.3	-1.4	-0.2	NA
State Total	-1.2	-0.7	-0.7	-3.2	-2.0	-42.0

Table 3.3-10
Electrical Power Station Emissions—No Project Alternative and Altamont Alignment Alternative

Air Basin	2030 Projected No Project Energy Emission Inventory (Tons/Day)						2030 Emission changes due to HST power demands under the Build Alternative (Tons/Day)						2030 Total Energy Emission Burden under Build Alternative (Tons/Day)					
	CO	PM10	PM2.5	NO_X	TOG	CO_2*	CO	PM10	PM2.5	NO_X	TOG	CO_2	CO	PM10	PM2.5	NO_X	TOG	CO_2
Tons per Day																		
Statewide	60.08	9.34	9.00	39.16	44.48	391,412	0.71	0.11	0.11	0.46	0.52	7,234	60.78	9.45	9.11	39.62	45.01	398,647
Metric Tons per Day																		
Statewide	54.50	8.47	8.17	35.53	40.36	355,090	0.64	0.10	0.10	0.42	0.47	6,563	55.14	8.57	8.27	35.94	40.83	361,653

* Assumes 22.2% of CO_2 inventory is a result of electrical production, as per Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004,

Air Basin	% Change from No Project					
	CO	PM 10	PM2.5	NO_X	TOG	CO_2
Statewide	1.2	1.2	1.2	1.2	1.2	1.8

Table 3.3-11
Potential Impacts on Air Quality Statewide—Existing, No Project, and Altamont Alignment Alternative

Air Basin	2005 Existing Emission Inventory (Planes, Trains, On-Road Mobile, and Energy, CO_2 all sources) (Tons/Day)						2030 Projected No Project Emission Inventory (Planes, Trains, On-Road Mobile, and Energy, CO_2 all sources) (Tons/Day)						2030 Projected Build Emission Inventory (Planes, Trains, On-Road Mobile, and Energy, CO_2 all sources) (Tons/Day)					
	CO	PM10	PM2.5	NO_X	TOG	CO_2	CO	PM 10	PM 2.5	NO_X	TOG	CO_2	CO	PM 10	PM 2.5	NO_X	TOG	CO_2
Tons per Day																		
San Francisco Bay	1,536	10	7	318	174	NA	398	22	17	144	94	NA	296	17	15	124	80	NA
San Joaquin Valley	948	7	6	224	102	NA	231	8	5	58	31	NA	220	8	5	55	30	NA
State Total	7,979	69	52	1,759	932	1,280,217	1,715	69	47	478	253	1,763,118	1,625	65	44	457	239	1,746,883
Metric Tons per Day																		
San Francisco Bay	1,393	9	7	288	157	NA	361	20	16	131	86	NA	269	16	13	112	73	NA
San Joaquin Valley	860	7	5	203	93	NA	210	7	5	53	28	NA	200	7	4	50	27	NA
State Total	7,239	63	48	1,596	846	1,161,416	1,556	62	42	433	229	1,599,505	1,474	59	40	415	217	1,584,777

Air Basin	% Change from No Project					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
San Francisco Bay	-25.6	-20.2	-16.3	-14.2	-14.7	NA
San Joaquin Valley	-4.9	-6.9	-6.4	-4.7	-4.9	NA
State Total	-5.3	-5.5	-5.1	-4.2	-5.3	-0.9
Air Basin	Benefit Rating					
	CO	PM10	PM2.5	NO_X	TOG	CO_2
San Francisco Bay	High	High	High	High	High	NA
San Joaquin Valley	Medium	Medium	Medium	Medium	Medium	NA
State Total	Medium	Medium	Medium	Medium	Medium	NA

Electrical Power: Additional electrical power would be required to operate the HST system. Because of the nature of electrical power generation and the use of a grid system to distribute electrical power, it is not yet clear which facilities would be supplying power to the HST system. Emission changes from power generation can therefore be predicted only on a statewide level for the full HST system. As shown in Table 3.3-10, CO, PM10, PM2.5, NO_X, and TOG burden levels would be predicted to increase because of the power requirements of the Altamont Alignment Alternative. A 1.2% increase in CO, PM10, PM2.5, TOG, and NO_X is predicted in the electric utilities portion of these CARB pollutant emission burden projections. A 1.8% increase in CO_2 electrical power emission burden projections is predicted due to increased electrical requirements of the project. If it is decided that the project would be run on 100% clean, zero-carbon emissions electricity, there would be no predicted increase in CO_2 levels due to the project's increased electrical requirements.

Summary of Pollutants: Table 3.3-11 summarizes the combined source categories for existing conditions and the No Project Alternative and the Altamont Alignment Alternative. Compared to the No Project Alternative, the proposed Altamont Alignment Alternative is projected to result in a decrease in the amount of pollutants statewide and in all air basins analyzed. Potential air quality benefits would range from a medium to a high rating. CO_2 levels are also detailed in Table 3.3-11. CO_2 project impacts were estimated based on energy projections developed for each alignment alternative. CO_2 calculations for the alignment alternatives reflect only emissions from electrical power stations, planes, and on-road VMT. More detailed tables illustrating the analysis of the pollutant burdens predicted can be found in the appendix to this section.

Local Impacts: A total of 18 intercity freeway segments were analyzed. The general trend in screenline data shows that the LOS on these freeway segments would largely remain the same under the Altamont Alignment Alternative compared to the No Project Alternative. Most of the freeway segments would experience less than a 5% change in V/C ratio and no change in LOS. This is with the exception of I-5 (between I-580 and SR 140), which would experience a better level of service under the Altamont Alignment Alternative, with an approximately 20% reduction in V/C ratio. V/C ratio is the comparison of the roadway volume to roadway capacity, and a reduction in the V/C ratio signifies a better level of service and, therefore, less congestion and lower potential for air quality impacts.

As the alignment alternatives are refined, segments where V/C ratios increase (degrade) should be screened to determine whether more detailed local analyses need to be conducted. Roadways and intersections around proposed station location options should also be screened and undergo detailed modeling if necessary to ensure that the project would not cause or exacerbate a violation of applicable air quality standards.

GHGs: The air quality analysis identified a reduction of about 0.9% of CO_2 emissions statewide attributed to the Altamont Alignment Alternative. This would be a beneficial impact due to the reduction in automobile vehicle miles traveled (mobile sources) and reduction in the number of airplane trips.

3.3.4 Design Practices

The HST system would use electrical propulsion to serve the forecast ridership, which is primarily diverted from highway or air travel. The HST Alignment Alternatives are estimated to have a beneficial effect on the emissions levels throughout the air basins involved. In addition, the Authority will pursue the identification and utilization of energy produced from clean/efficient sources to the extent possible, as per the California Renewables Portfolio Standard Program, which was enacted in SB 1078, ch. 516, Statutes of 2002, which added California Public Utility codes sections 387, 399.11 et seq., and 399.25.

As described in Section 3.1, "Traffic, Transit, Circulation, and Parking," using existing/planned multimodal hubs for station location options would also minimize air emission increases in and around station areas.

3.3.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, the proposed HST Alignment Alternatives would have a less than significant effect on air quality because they are predicted to result in reduced emissions of CO, PM10, PM2.5, NO_X, TOG, and CO_2 compared to the No Project Alternative. [2] Continued improvements in air pollution controls on vehicles, as new vehicles replace older vehicles, will result in an overall reduction of the average air pollutant emissions per vehicle mile of operation in the future. Use of the proposed HST system, however, would reduce vehicle miles otherwise traveled and result in an air quality benefit when viewed on a systemwide and a regional basis. Temporary, short-term (defined by EPA as less than 5 years) increases in emissions associated with construction activities will be reduced with the application of mitigation strategies. The potential for localized air pollutant increases associated with traffic near proposed HST stations will be addressed by mitigation strategies and design practices (discussed in Section 3.1.6) applied to reduce these impacts. When more detailed, area-specific analyses are conducted on the project, it is recommended that a hot spot screening analysis and if necessary a detailed microscale analysis be conducted to determine if the project causes or exacerbates a violation of the applicable standards. Construction sites lasting more than 5 years should undergo a detailed construction analysis in the area specific analyses.

The proposed HST system would result in beneficial impacts related to GHGs and global climate change. Any additional carbon entering the atmosphere, whether by emissions from the project itself or by removal of carbon sequestering plants (included agricultural crops), would be more than offset by the beneficial reduction of carbon resulting from the project due to a reduction in automobile vehicle miles traveled (mobile sources) and reduction in the number of airplane trips.

The program-level analysis in this document reviews the potential statewide air quality impacts of a proposed HST system, and the analysis would support determination of conformity for the proposed HST system. At the project level, potential mitigation strategies should be explored to address potential localized impacts. The proposed HST system could be designed to use state-of-the-art, energy-efficient equipment to minimize potential air pollution impacts associated with power used by the proposed HST system. Potential localized impacts could be addressed at the project level by promoting the following measures:

- Increase use of public transit.
- Increase use of alternative-fueled vehicles.
- Increase parking for carpools, bicycles, and other alternative transportation methods.
- Potential construction impacts, which should be analyzed once more detailed project plans are available, can be mitigated by following local and state guidelines.

Potential mitigation strategies for air quality impacts associated with the project would focus on the alleviation of traffic congestion around passenger station areas, as described in Section 3.1, "Traffic, Transit, Circulation, and Parking," and on the reduction of air emissions during the construction process. The potential strategies listed below are related to the reduction of air emissions during construction.

- Water all active construction areas at least twice daily.

[2] Both the Altamont and Pacheco Alignment Alternatives would have virtually the same air quality benefits. See Tables 3.3-7 and 3.3-11.

- Cover all trucks hauling soil, sand, and other loose materials or require that all trucks maintain at least 2 ft of freeboard.
- Pave, apply water three times daily, or apply (nontoxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites.
- Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.
- Hydroseed or apply (nontoxic) soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more).
- Enclose, cover, water twice daily, or apply (nontoxic) soil stabilizers to exposed stockpiles (dirt, sand, etc.).
- Limit traffic speeds on unpaved roads to 15 mi per hour.
- Install sandbags or other erosion-control measures to prevent silt runoff to public roadways.
- Replant vegetation in disturbed areas as quickly as possible.
- Use alternative fuels for construction equipment when feasible.
- Minimize equipment idling time.
- Maintain properly tuned equipment.

The proposed HST system is expected to result in an air quality improvement when viewed on a systemwide basis. Temporary, short-term emissions increases associated with construction activities and potential localized air pollution increases associated with traffic near proposed HST stations would be substantially reduced by the application of mitigation strategies and design practices. See Section 3.1.6 for further discussion of mitigation strategies for increased traffic near stations. At the second-tier, project-level review, applications of these mitigation strategies are expected to reduce localized air quality impacts to a less-than-significant level in most locations. Additional environmental assessment will allow more precise evaluation in the second-tier, project-level environmental analyses.

3.3.6 Subsequent Analysis

At the project level, local traffic counts would be conducted at access roads serving major station locations. These counts would provide more accurate information for determining potential local air quality hotspot locations. Hotspots are areas where the potential for elevated pollutant levels exist. Once potential hotspot locations (if any) are determined, a detailed analysis following the guidelines at the time of analysis would be conducted.

Potential construction impacts and potential mitigation measures would also be addressed in subsequent analyses. Once alignments are established, a full construction analysis should be conducted. This analysis should quantify emissions from construction vehicles, excavation, worker trips, and other related construction activities. Specific mitigation measures, if required, would be identified and a construction monitoring program, if required, would be established.

3.4 Noise and Vibration

This section identifies potential noise and vibration impacts on sensitive receptors or receivers, such as people in residential areas, schools, and hospitals, for the No Project and HST Alignment Alternatives[1]. This analysis generally describes the sensitive noise receptors in the region and the methodology for determining the potential noise and vibration impacts on those receptors for each HST Alignment Alternative. The differences in potential impacts among the HST Alignment Alternatives are compared to each other. This comparison considers the potential noise impacts from airplanes, automobiles on intercity highways, and the proposed HST system. The section also discusses the potential noise benefits of adding grade separations[2] for existing railroads in some areas and eliminating noise-generating at-grade crossings. Because this is a program-level environmental document, the analysis of potential noise and vibration impacts broadly compares the relative differences in potential impacts among the alternatives.

3.4.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Noise and vibration are environmental issues evaluated under CEQA and NEPA for a proposed HST project.

Federal Noise Emission Compliance Regulation

The FRA has a regulation governing compliance with the Noise Emission Compliance Regulation adopted by the EPA for noise emissions from interstate railroads. The FRA's Railroad Noise Emission Compliance Regulation (49 CFR Part 210) prescribes minimum compliance regulations for enforcement of the railroad noise emission standards adopted by the EPA (40 CFR Part 201).

California Noise Control Act

At the state level, the California Noise Control Act was enacted in 1973 (Health and Safety Code § 46010 *et seq.*) and provides for the Office of Noise Control in the Department of Health Services to provide assistance to local communities developing local noise control programs and work with the Office of Planning and Research to provide guidance for the preparation of the required noise elements in city and county general plans, pursuant to Government Code § 65302(f). In preparing the noise element, a city or county must identify local noise sources and analyze and quantify, to the extent practicable, current and projected noise levels for various sources, including highways and freeways, passenger and freight railroad operations, ground rapid transit systems, commercial, general, and military aviation and airport operations, and other ground stationary noise sources, these would include HST alignments. Noise-level contours must be mapped for these sources, using both community noise equivalent level (CNEL) and day-night average level (L_{dn}), and are to be used as a guide in land use decisions to minimize the exposure of community residents to excessive noise.

1 See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

2 For this analysis, a grade separation is the literal separation, using overpasses or underpasses, of the rail and roadway components of an at-grade crossing. This eliminates the need for trains to blow horns or sound warning devices at the grade separated (previous grade crossing) locations.

B. METHOD OF EVALUATION OF IMPACTS

Assessment of the HST Alignment Alternatives is based on relevant criteria adopted by the FRA (U.S. Department of Transportation 2005), FHWA (U.S. Department of Transportation 1998), and FTA (Federal Transit Administration 2006), each of which has established criteria for assessing noise impacts. The FRA has established criteria for assessment of noise and vibration impacts for high-speed ground transportation projects, with speed over 125 mph, as presented in the FRA High Speed Ground Transportation Noise and Vibration Assessment (U.S. Department of Transportation 2005). The methodology and impact criteria for noise and vibration from this FRA guidance manual have been used in the assessment of the HST Alignment Alternatives in areas with speed over 125 mph. In areas with train speeds under 125 mph, the FTA criteria for assessment of noise and vibration impacts, as found in Transit Noise and Vibration Impact Assessment (Federal Transit Administration 2006), has been used in the assessment of the HST Alignment Alternatives. As described below, each agency's criteria were used to define a screening distance for assessing the potential for noise impact from relevant sources. The FRA and FTA have also established vibration impact criteria related to rail transportation.

Two basic evaluation techniques were used for analysis of the HST: a screening analysis and a more specific analysis of typologies derived from representative HST locations. The representative typologies were used to verify screening-level assumptions and to provide a basis for comparison of HST Alignment Alternatives, including consideration of the potential effectiveness of mitigation and the potential impacts or benefits associated with grade separation of existing rail lines.

Screening Procedure

Transportation noise impacts are assessed according to the number of people and noise-sensitive land uses potentially impacted by new noise sources from a project. However, at the program level (especially before many project-level details of the proposed HST system have been defined) it is not possible to develop a specific measure of the noise impacts. Consequently, a screening method was used to develop a general estimate of the relative potential for noise and vibration impact among HST Alignment Alternatives. Screening distances were applied from the center of alignments to estimate all potentially impacted land uses in noise-sensitive environmental settings. The screening distances used are defined in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A). Based on census data, the number of people and noise-sensitive land uses were estimated within the defined screening distance. The rating methods used to determine these numbers are also described in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A). The method is conservative in that it overestimates the potential for impact. The method identifies all potentially impacted developed lands by type of use within the study area, but subsequent project-level analysis using better-defined system parameters and land use information is likely to indicate lower levels of potential impact. Because potential noise impacts decrease dramatically if a structure or land form blocks the path to the receptor, this is a conservative approach.

Noise screening analyses were performed for the HST Alignment Alternatives based on criteria established by the FRA and FTA for HST and conventional rail. The analyses were accomplished using available GIS data for land use and alignment geometry for each alignment. The number of people potentially affected and the area of noise-sensitive land uses within the screening distance were determined using GIS and census data.

The analyses were subsequently combined to develop an impact rating for each alignment alternative (see Environmental Consequences). The impact rating for each alignment alternative is described as low, medium, or high, as an indication of the potential for noise impact.

Rating the severity of impacts requires an assessment of how many people are exposed to impact-level noise and vibration. Consequently, a metric describing the relative magnitude of impact was developed.

Impact Metric = (Residential Population in the Impact Area/Mile) + 0.3 × (Mixed Use Population in the Impact Area /Mile) + (100 × Number of Hospitals in the Impact Area)/Mile + (250 × Number of Schools in the Impact Area)/ Mile

For this screening study, the impact metrics and impact ratings are defined in Table 3.4-1. The rating scheme is designed to indicate the potential for noise and vibration impacts along the alignment alternatives.

Table 3.4-1
Ratings Used for Noise and Vibration Analysis

Rating	Impact Metric	
	Noise	Vibration
Low	Less than 80	Less than 40
Medium	80–200	40–100
High	Greater than 200	Greater than 100

Application of Screening Method to Conventional Rail and High-Speed Train Modes

Railroad noise and vibration criteria developed by FTA are consistent with criteria adopted by the FRA for HSTs. Criteria for HST noise impact assessment are based on activity interference and annoyance ratings developed by EPA. These criteria, described and presented in graphical form in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A), provide the basis for the rail noise analysis procedures used in the screening and the representative typologies (U.S. Department of Transportation 2005).

The screening procedure used by the FRA takes into account the noise impact criteria, the type of corridor, and the ambient noise conditions in typical communities. Distances within which potential impacts may occur are defined based on operations of a typical HST system. These distances were developed from detailed noise models based on empirical measurements of noise emissions of existing steel-wheel/steel-rail HSTs, expected maximum operation levels and speeds, and residential land use. The width of the potential impact along the length of the HST alignment is the area in which there is potential for noise impact. The FRA screening procedure was developed for HST speeds from 125 to 210 mph (201 to 338 kph). For speeds less than 125 mph (201 kph) and for areas near stations, the FTA screening method was used in concert with the FRA method. The average speed along the HST Alignment Alternatives was used to determine the screen distance. The FRA and FTA screening distances for noise are included in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A).

The screening distances are different for the different types of developed areas along a potential alignment, according to their estimated existing ambient noise. *Urban* and *noisy suburban* areas are grouped together. These areas are assumed to have ambient noise levels greater than 60 dBA L_{dn}. Similarly, *quiet suburban*, *rural,* and *natural open-space* areas are grouped as areas where ambient noise levels are less than 55 dBA L_{dn}. For developed land with L_{dn} between 55 and 60 dBA, the classification depends on other factors, such as proximity of major transportation facilities and density of population. The screening procedure was applied to first allow for the comparison of impacts between alternatives and to identify areas of potential impacts for further consideration in project-level analysis. The screening procedure estimates the affected receptors to ensure that all potential impacts are included at the program level.

Although the screening procedure is based on the type of equipment (technology and power type), operational characteristics of the new services (speeds and frequencies), the type of support structure (aerial or at-grade), and the general ambient noise level, it does not address the horn and bell noise associated with existing passenger and freight trains because these are regarded as part of the existing environment. To develop a relative comparison of the HST Alignment Alternatives, the results of the screening analysis were adjusted to account for noise reductions from the elimination of at-grade crossings on existing rail lines, where the HST Alignment Alternatives would share the rail corridor. The degree of adjustment was based on the representative typologies for similar circumstances and is defined in the following section.

As a final step for those areas rated medium or high for potential impacts, the screening analysis assessed the potential use of noise barriers and other mitigation options to reduce noise impacts. The mitigation analysis is discussed in Section 3.4.5.

The vibration screening procedure was used to compare potential impacts among HST alignments and to provide an estimate of the length of alignments where consideration of vibration attenuation features may be appropriate.

Representative Typologies for High-Speed Trains

To better understand the potential impacts of the HST, several noise impact assessment studies were previously prepared for representative situations of noise- and vibration-sensitive land uses in the statewide program EIR/EIS (Authority and FRA, November 2005). The more detailed General Assessment Method of FTA's and FRA's guidance manuals were used to estimate the potential for noise impacts. These typological studies verified the general results from the screening procedure. Representative situations were chosen to provide a range of potential impact types and levels. This approach provided a means of considering at the program level the potential impacts on communities along any potential proposed HST alignment.

Developed land use categories consist of individual medium- and low-density residential zones, schools, hospitals, parks, and other unique institutional receptors such as museums and libraries. Residential land uses were chosen for the typologies for new and shared corridors that varied in local zoning densities, ambient noise conditions, set back distances from the alignment, and HST operational speeds. Institutional uses, as mentioned above, and parks were individually identified for each focused study. These representative typologies evaluated the topics listed below.

- Verification of screening distances (noise and vibration).
- Effectiveness of noise barriers.
- Benefits from elimination of grade crossings.
- Costs and benefits of a high-speed downtown bypass loop.

Verification of Screening Distances (Noise and Vibration)

The analyses of the representative typologies confirmed that the screening method used an appropriate upper boundary as an indicator of potential for noise impact. Impacts were found to occur in 90% of the cases identified in the screening procedure; in 75% of those studied, consideration of mitigation may be appropriate. Those that would have insignificantly low noise impact were either at outer edges of the screening distance or were shielded sufficiently by other buildings. Shielding by terrain features or buildings is not taken into account in the screening process but would be included in the subsequent project-level analyses of HST segments.

Representative typology studies were also completed that assess the range of the potential vibration impact levels that are likely to be encountered in project-level analyses. The results generally show that the closer buildings would be to a proposed alignment, the greater the likelihood of impact. Where speeds are expected to be low, the vibration potential impacts are confined to within 100 ft (30 m) of the track. At top speeds, the potential impacts extend to 200 ft (61 m). The special typologies generally validate the vibration screening distances that are included in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005, Appendix 3.4-A).

Effectiveness of Noise Barriers

Noise barriers are used extensively in Europe and Japan to mitigate noise impacts from HST systems. The representative typology studies generally indicated that mitigation by sound barrier walls can be an effective means of reducing the potential impacts by one category, for example, from severe impact (mitigation appropriate) to impact. Noise barrier mitigation is shown to be especially effective for receivers close to the tracks. Although noise barrier walls would not be the only potential mitigation strategy considered, they were used to represent mitigation potential in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005) and in this Program EIR/EIS.

Benefits from Elimination of Grade Crossings

The representative typology studies were also used to estimate the potential benefit of noise reduction resulting from grade separations. A focused noise study in the Bay Area to Central Valley region (at Charleston Road in Palo Alto) showed the potential benefit of eliminating horn blowing at a typical Caltrain grade crossing on the San Francisco Peninsula. Assessment of noise impact from horns at-grade crossings was performed with FRA's horn noise model and annoyance based criteria. The horn noise model indicated an 81% reduction in the number of people impacted within 0.25 mi (0.40 km) of that intersection by elimination of horn noise from commuter trains. Although the results vary depending on the local population density and proximity of residences and other sensitive land uses at each grade crossing, they illustrate the magnitude of the potential change to be expected if the sounding of horns and bells at existing rail crossings could be eliminated.

Removing all potential remaining horn noise would not eliminate noise impacts, however, because the sound of the trains would remain. The proposed HST would add its own noise to that of other trains using the railroad corridor. Carrying the focused study further, it was found that approximately 75% of the at-grade crossings to be eliminated with the proposed HST system are located adjacent to residential areas with a high potential noise impact rating. Although there would be a clear benefit from the elimination of the horns and warning signals, there would be additional train noise and vibration primarily from the high train speed and frequency of service.

Based on these results, the potential noise impact ratings from screening were adjusted to account for segments where at-grade crossings would be eliminated for existing passenger and freight trains as part of the implementation of HST service along that alignment. A reduction in one impact rating level (high to medium or medium to low) was made only for alignments where HST speeds would be less than 150 mph (241 kph). Where speeds were above that level, no adjustment was made because the noise created by the proposed new service at higher speeds would likely overshadow the reduction in horn and bell noise resulting from the grade separation.

This adjustment was made on the alignments listed below.

- Caltrain Corridor from San Francisco to San Jose.
- Niles subdivision line from south of Oakland to north of Warm Springs.
- UPRR line on the Altamont crossing.
- UPRR and BSNF corridors in the Central Valley.

C. CEQA SIGNIFICANCE CRITERIA

At the programmatic level, the project would cause a significant noise or vibration impact under CEQA if it would result in:

- Potential exposure of persons to or generation of noise levels in excess of standards established by the FRA for high-speed ground transportation and by the FTA for rail projects.
- Potential exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

D. METHOD OF EVALUATION OF POTENTIAL IMPACTS ON WILDLIFE

The potential for direct effects of train noise on wildlife in natural areas is not well documented. There are no established criteria relating high-speed train noise and animal behavior. However, some characteristics of high-speed train noise are similar to low overflights of aircraft, and researchers generally agree that high noise levels from aircraft overflights can have a disturbing effect on both domestic livestock and wildlife. Some animals get used to noise exposure, while some do not. Documented effects range from simply taking notice and changing body position to taking flight in panic. Whether these responses represent a threat to survival of animals remains unclear, although panic flight may result in injuries to animals in rough terrain or in predation of unprotected eggs of birds. A limited amount of quantitative noise data relating actual levels to effects provides enough information to develop a screening procedure to identify areas where noise from HST operations could affect domestic and wild animals. The basis for the screening is the interim criteria for HST noise effects on animals shown in Table 3.4-2.

Figure 3.4-1 presents the screening distances at which a train passby with a sound exposure level (SEL) of 100 dBA would occur for different operating speeds. Wildlife in natural areas would be minimally affected by train passbys at speeds of up to 180 mph at distances of 60 ft or more.

Table 3.4-2
Interim Criteria for High Speed Train Noise Effects on Animals

Animal Category	Class	Noise Metric	Noise Level
Domestic	Mammals (livestock)	Sound exposure level	100
	Birds (poultry)	Sound exposure level	100
Wild	Mammals	Sound exposure level	100
	Birds	Sound exposure level	100
Source: High Speed Ground Transportation Noise and Vibration Assessment 2005.			

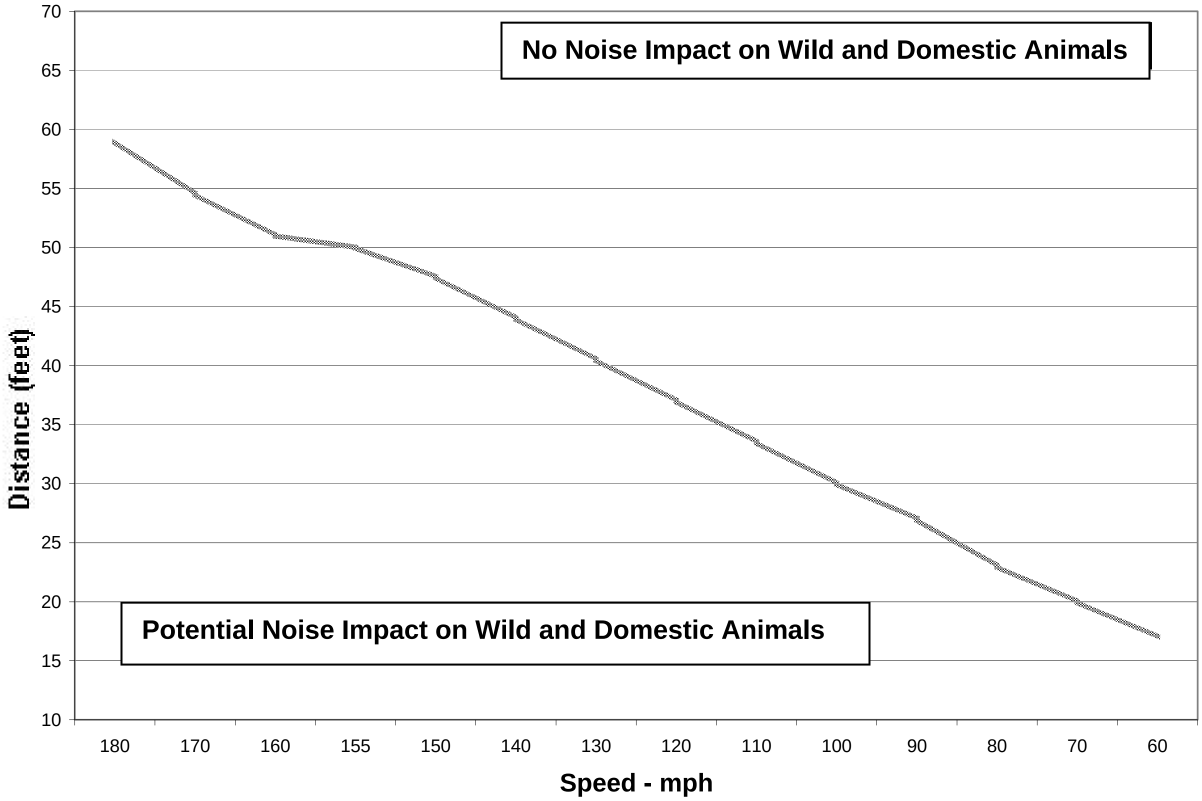


Figure 3.4-1
Wildlife Impacts at Different Setback
Distances and Train Speeds

The HST project's potential noise and vibration impacts on wildlife will be evaluated further at the project level when speed, noise, and vibration may be more precisely calculated and field surveys may be performed to identify potentially affected wildlife.

E. METHOD OF EVALUATION OF POTENTIAL IMPACTS ON PRISTINE OPEN SPACES

Noise thresholds have been selected as a means by which HST noise impacts on pristine areas with very quiet ambient sound levels can be measured. None of these thresholds are associated with a specific FRA, FTA, or other criteria or standards for rail noise; however, they are all considered useful in describing the potential for impact on pristine areas where the existing ambient noise levels are less than 50 dBA. They are based on past experience with the effects of military and civilian aircraft overflights on national parks.

Human cognitive effects of HST operations are interference and annoyance. Interference is the precursor to annoyance, which means something that prevents persons from doing what they want to do; interference is an interruption or distraction. Annoyance means having an emotional reaction to noise interference. Low levels of HST noise can result in interference but not necessarily result in annoyance. The number and frequency of HST operations must exceed a certain level or threshold before it is perceived as annoying. Interference is a short-term occurrence. Annoyance, because of the emotional component is more long lasting. Annoyance is the more appropriate criteria in evaluating the receiver experience in pristine open spaces using the metric Time Audible (TA) – the percentage of time that aircraft sound levels are audible. This metric is used to assess the potential aviation noise annoyance to quiet outdoor areas with frequent human recreation and could be adapted for use at the project level for HST noise.

The other noise metric that could be used to assess potential impacts to pristine areas would be change in exposure (ΔL)—the algebraic difference (in A-weighted decibels) between HST noise levels and baseline ambient sound levels during the daily period when the HSTs operate. Generally, a change in 5 dB is considered noticeable to humans, and an increase of 10 dB is considered twice as loud. However, because the measurement period is 12 hours or longer, the noise level of a single-event HST passby would be much higher than the ambient noise level but would last for less than 15 seconds. As an indication of potential impacts to humans, this metric is not as good as annoyance.

Studies of the effects of military aircraft overflights on recreational uses of national parks have suggested a dose response relationship between percent annoyed and percent time audible (Miller 2001). The following guidelines, taken from this study, are used to assess the different air tour alternatives for parks. The average percent annoyed represent those visitors who felt that the aircraft flyovers interfered with their appreciation of natural quiet. Table 3.4-3 shows the dose response relationship between percent time audible and average percent of visitors annoyed.

Table 3.4-3
Dose Response Relationship between Time Audible and Visitor Annoyance

Percent Time Audible	Average Percent of Visitors Annoyed
10	3–4
20	6–8
30	10–12
40	14–16
50	19–21

Source: Miller 2001

HST operation noise would be limited to the areas that adjoin track alignments. The extent of the potential impacts would be determined by the train speed, number of power units and coaches, topographical features, and the existing ambient noise levels. To quantify these impacts, project-level studies would include detailed graphic plots of noise contours of HST operations in pristine open spaces to determine the area of potential effect.

3.4.2 Affected Environment

A. STUDY AREA DEFINED

The study area for the noise and vibration assessment is defined by the screening distances that are used by the FRA (U.S. Department of Transportation 2005) and FTA (U.S. Department of Transportation 2006) to evaluate rail lines. Study areas are within 1,000 ft (305 m) of the centerline of the alignment options for each alignment.

B. GENERAL DISCUSSION OF NOISE AND VIBRATION

This section describes the characteristics and associated terms and measurements used for transportation-related noise and vibration. When noise from a highway, plane, or train reaches a receptor, whether it is a person outdoors or indoors, it combines with other sounds in the environment (the ambient noise level) and may or may not stand out in comparison. The distant sources may include traffic, aircraft, industrial activities, or sounds in nature. These distant sources create a background noise in which usually no particular source is identifiable and to which several sources may contribute but is fairly constant from moment to moment and varies slowly from hour to hour. Superimposed on this slowly varying background noise is a succession of identifiable noisy events of relatively brief duration. Examples include the passing of a train, the over flight of an airplane, the sound of a horn or siren, or the screeching of brakes. These single events may be loud enough to dominate the noise environment at a location for a short time, and, when added to everything else, can be an annoyance. The descriptors used in the measurement of noise environments are summarized below.

The fundamental measure of noise is the dB, a unit of sound level based on the ratio between two sound pressures—the sound pressure of the source of interest (e.g., the HST) and the reference pressure (the quietest sound that a human can hear). Because the range of actual sound pressures is very large (a painful sound level can be over 1 million times the sound pressure of the faintest sound), the expression of sound is compressed to a smaller range with the use of logarithms. The resulting value is expressed in terms of dB. For example, instead of a sound pressure ratio of 1 million, the same ratio is 120 dB.

The human ear does not respond equally to high- and low- pitched sounds. In the 1930s, acoustical scientists determined how humans hear various sounds and developed response characteristics to represent the sensitivity of a typical ear. One of the characteristics, called the *A-curve*, represents the sensitivity of the ear at sound levels commonly found in the environment. The A-curve has been standardized. The abbreviation dBA is intended to denote that a sound level is expressed as if a measurement has been made with filters in accordance with that standard.

- *Maximum Sound Level (L_{max})*, measured in dBA, is the highest noise level achieved during a noise event.
- *Equivalent Sound Level (L_{eq})*, measured in dBA, describes a receptor's cumulative noise exposure from all noise events that occur in a specified period of time. The hourly L_{eq} is a measure of the accumulated sound exposure over a full hour. The L_{eq} is computed from the measured sound energy averaged over an hour (nothing one would read from moment to

moment on a meter) representing the magnitude of noise energy received in that hour. FHWA uses the peak traffic hour L_{eq} as the metric for establishing highway noise impact.

- *Day-Night Sound Level (L_{dn})* describes a receptor's cumulative noise exposure from all noise events that occur in a 24-hour period, with events between 10 p.m. and 7 a.m. increased by 10 dB to account for greater nighttime sensitivity to noise. The L_{dn} is used to describe the general noise environment in a location, the so-called "noise climate." The unit is a computed number, not one to be read from moment to moment on a meter. Its magnitude is related to the general noisiness of an area. EPA developed the L_{dn} descriptor, and now most federal agencies, including the FRA, use it to evaluate potential noise impacts. Typical L_{dns} in the environment are shown in Figure 3.4-2.
- *CNEL*, a variant of L_{dn}, is used in noise assessments in California. Rather than dividing the day into two periods, daytime and nighttime, CNEL adds a third to account for increased sensitivity to noise in the evening when people are likely to be engaged in outdoor activities around the home. An evening addition of 5 dB is applied to noise events between the 7 and 10 p.m. to reflect the additional annoyance noise causes at that time. In general, the difference between L_{dn} and CNEL is slight, and the two measures will be considered interchangeable for purposes of this noise analysis.
- *Sound Exposure Level (SEL)* is the sound energy from a single event train passby. SEL is a cumulative measure of noise so (1) louder events have greater SELs than do quieter ones, and (2) events that last longer in time have greater SELs than do shorter ones.

The way people react to noise in their environment has been studied extensively by researchers throughout the world. Based on these studies, noise impact criteria have been adopted by the FRA (U.S. Department of Transportation 2005) and other federal agencies to assess the contribution of the noise from a source like the HST to the existing environment. The FRA bases noise impact criteria on the estimated increase in L_{dn} (for buildings with nighttime occupancy) or increase in L_{eq} (for institutional) buildings caused by the project for direct and indirect impacts. Criteria are discussed in Section 3.4.1.

Transportation Noise

Noise from highways, airports, and rail lines tends to dominate the noise environment in its immediate vicinity. Each mode has distinctive noise characteristics in both shape and source levels. Highway and rail noise affects an area that is linear in shape, extending to both sides of the alignment. Airport noise, in contrast, affects a closed area around the facility, with the shape of the closed loop determined by runway orientation.

Conventional and High-Speed Train Noise and Vibration

Although HSTs have some similar noise and vibration characteristics to conventional trains, they also have several unique features resulting from their reduced size and weight, the electrical power, and the higher speed of travel. The proposed HST would be a steel-wheel, steel-rail electrically powered train operating in an exclusive right-of-way. Because there would be no roadway at-grade crossings, the annoying sounds of the train horn and warning bells would be eliminated. The use of electrical power cars would eliminate the engine rumble associated with diesel-powered locomotives. The above factors allow HST to generate lower noise levels than conventional trains at comparable speeds below 100 mph (161 kph). At higher speeds above 150 mph (241 kph), however, HST noise levels would increase over conventional trains due to aerodynamic effects. A mitigating factor is that due to high speeds, HST noise would occur for a relatively short duration compared with conventional trains (a few seconds at the highest speeds versus 10–20 seconds for conventional passenger trains and over 1 minute for freight trains).

For the proposed HST system, higher operating speeds of 150–220 mph (241–354 kph) would occur in the less constrained areas, in terms of alignment (i.e., flat and straight). In contrast, much lower operating speeds (less than 125 mph [201 kph]) would be prevalent in the more developed areas. Figure 3.4-3 illustrates the maximum operating speeds for express service along each of the proposed HST Alignment Alternatives. Local and semi-express services would not necessarily reach these maximum speeds because they would stop and start for more stations.

Noise from a HST is expressed in terms of a source-path-receiver framework (Figure 3.4-4). The source of noise is the train moving on its tracks. The path describes the intervening course between the source and the receptor wherein the noise levels are reduced by distance, topographical and human-made obstacles, atmospheric effects, and other factors. Finally, at each receptor, the noise from all sources combines to make up the noise environment at that location.

The total noise generated by a train is the combination of sounds from several individual noise-generating mechanisms, each with its own characteristics, including location, intensity, frequency content, directivity, and speed dependence. The distribution of noise sources on a typical HST is shown in Figure 3.4-5. These noise sources can be grouped into three categories according to the speed of the train.

For low speeds, below about 40 mph (64 kph), noise emissions are dominated by the propulsion units, cooling fans, and under-car and top-of-car auxiliary equipment, such as compressors and air conditioning units. The HST would be electrically powered and considerable quieter at low speeds than conventional trains, which are usually diesel powered.

In the speed range from 60 mph to about 150 mph (98–241 kph), mechanical noise resulting from wheel-rail interactions and structural vibrations dominate the noise emission from trains. In the existing rail corridors in California, conventional trains seldom exceed 79 mph (127 kph), so this speed range, which represents a medium range for HST, is the top end of noise characteristics for trains with which most people are familiar. Speed has a strong influence on noise in the medium speed range.

Above approximately 170 mph (274 kph), aerodynamic noise sources tend to dominate the radiated noise from the HST. Conventional trains are not capable of attaining such speeds. HST noise in the transition speeds between each of the three foregoing ranges is a combination of the sources in each range.

Noise from HST also depends on the type and configuration of its track structure. Typical noise levels are expressed for HST at grade on ballast and tie track, the most commonly found track system. For trains on elevated structure, HST noise is increased, partially due to the loss of sound absorption by the ground and partially due to extra sound radiation from the bridge structure. Moreover, the sound from trains on elevated structures spreads about twice as far as it does from at-grade operations of the same train because of clearer paths for sound transmission.

Horns are an example of a train noise source that is a dominant noise source at any speed. Audible warnings for at-grade crossings, including train horns and warning bells, are a common feature of conventional trains and a vital safety component of railroad operations. These noise sources often prove to be a source of annoyance to people living near railroad tracks. In the case of HST, however, horn and warning bell noise are absent except in the case of emergencies because at-grade crossings are eliminated. Reduction of horn and bell noise from the elimination of existing at-grade crossings would provide a noise benefit associated with the implementation of HST for alignments along existing rail corridors, but only at locations where grade separations are built that serve both the HST system and existing rail lines.

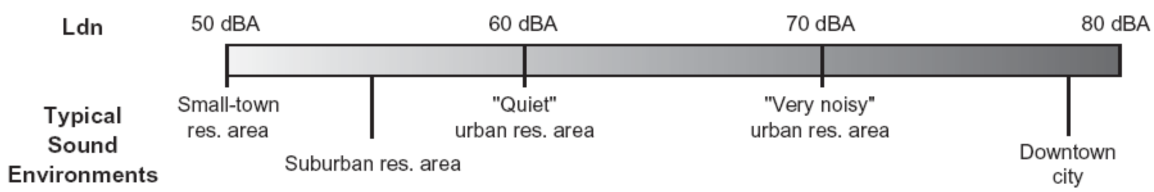


Figure 3.4-2
Typical Day-Night Sound Level Environments

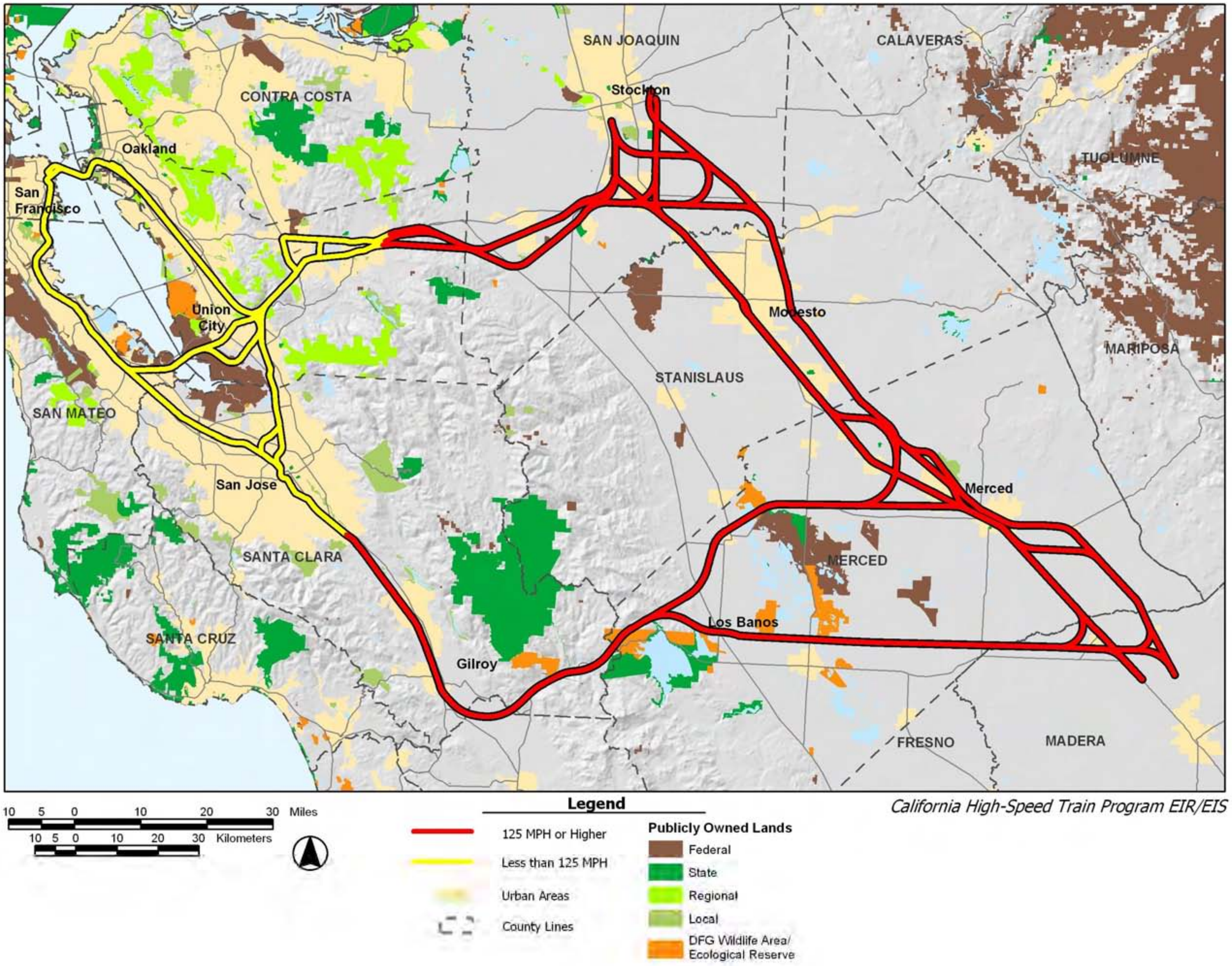


Figure 3.4-3
Potential Average Operating Speeds

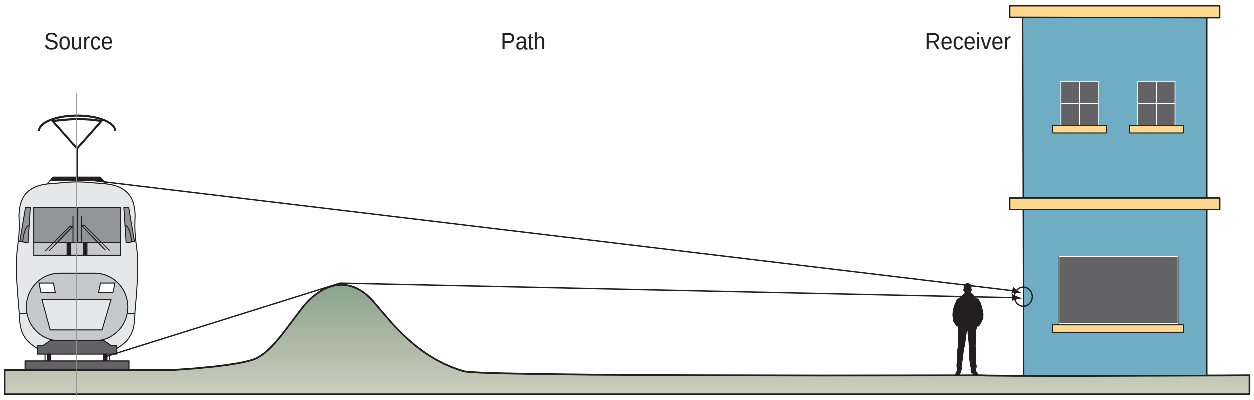


Figure 3.4-4
HST Source Path Receiver Framework

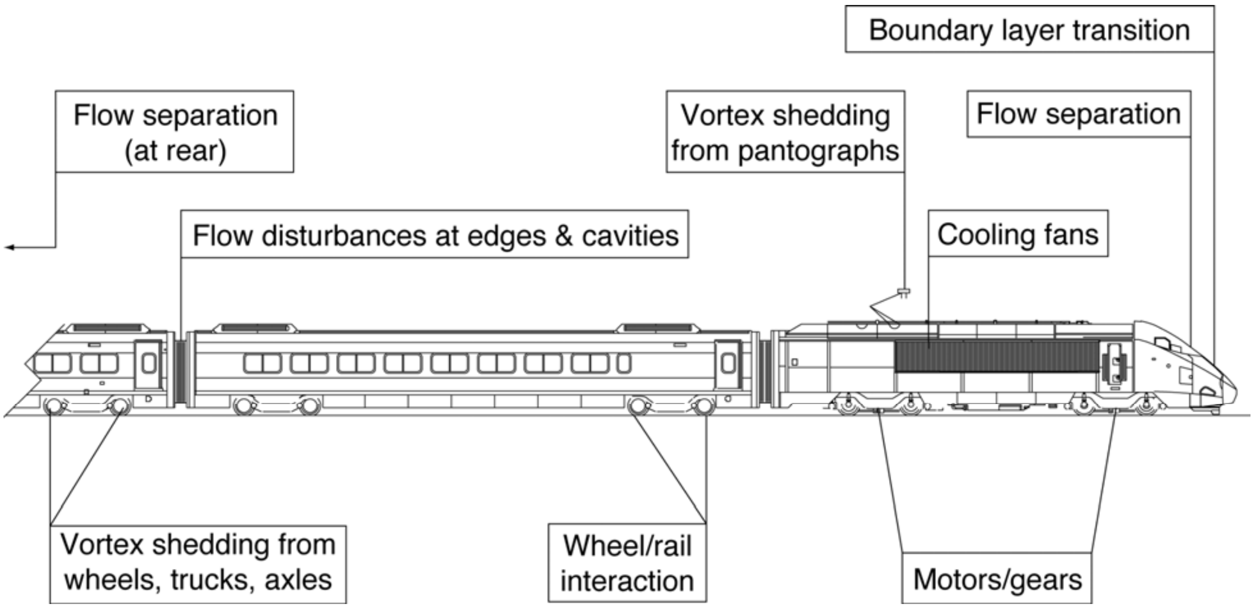


Figure 3.4-5
Noise Sources on HST

Vibration of the ground caused by the pass-by of the HST is similar to that caused by conventional steel wheel/steel rail trains. However, vibration levels associated with the HST are relatively lower than conventional passenger and freight trains due to advanced track technology, smooth track and wheel surfaces, and high maintenance standards required for high-speed operation.

Ground-borne vibration from trains refers to the fluctuating motion experienced by people on the ground and in buildings near railroad tracks. In general, people are not commonly exposed to vibration levels from outside sources that they can feel. Little concern results when a door is slammed and a wall shakes or something heavy is dropped and the floor shakes momentarily. Concern results, however, when an outside source like a train causes homes to shake. The effects of ground-borne vibration in a building located close to a rail line could at worst include perceptible movement of the floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. None of these effects are great enough to cause damage but could result in annoyance if repeated many times daily.

As with noise, ground-borne vibration can be understood as following a source-path-receptor framework (Figure 3.4-4). The source of vibration is the train wheels rolling on the rails. They create vibration energy that is transmitted through the track support system into the track bed or track structure. The path of vibration involves the ground between the source and a nearby building. The receptor of vibration is the building.

C. EXISTING NOISE ENVIRONMENT

Existing noise environments are generally dominated by transportation-related sources, including vehicle traffic on freeways, highways, and other major roads, existing passenger and freight rail operations, and aviation sources, including civilian and military. Existing noise along highway and proposed HST corridors has been estimated using data in the noise element from the general plan for cities and counties in the region, along with general methods provided by FHWA, FRA, and FTA for estimating transportation noise. Ambient noise levels are characterized for below. Ambient vibration conditions are very site-specific in nature and are not characterized as part of the program environmental process.

The study region is central California from the San Francisco Bay Area (San Francisco and Oakland) south to the Santa Clara Valley and east across the Diablo Range to the Central Valley. The ambient noise in the northern portion of the Bay Area to Central Valley region is dominated by motor vehicle traffic in densely populated areas and along freeways. All the regional freeways considered in the No Project Alternative are major contributors to the ambient noise environment. In this region, the HST Alignment Alternatives would primarily follow or parallel existing rail tracks. Along the proposed alignment alternative on the San Francisco Peninsula, the Caltrain passenger service is a major contributor to the ambient noise levels, especially at grade crossings, where horn noise dominates the noise environment within 0.25 mi (0.40 km) of the intersections. Along the proposed East Bay Crossings alignment, existing Amtrak passenger service and freight rail contribute to the ambient noise levels, with horns at grade crossings being a major factor. In southern San Jose and as far as Gilroy to the south, Caltrain, Amtrak, and freight rail are major contributors to the ambient noise levels.

In the urban areas and suburban areas of the East Bay, San Francisco Peninsula, and San Jose, the ambient noise is estimated to range from L_{dn} 57 to 66 dBA. In many of the residential areas close to the international airports at San Francisco (SFO), Oakland (OAK), and San Jose (SJC), the ambient levels exceed L_{dn} 65 dBA. In the more rural areas of the region to the southeast, the ambient noise ranges from 52 to 57 dBA. Henry Coe State Park is characterized by a low ambient noise environment, approximately L_{eq} 40 dBA, because it is in a remote location and removed from transportation noise sources, except in the southern area, which is approximately 5 miles from SR 152.

In areas away from major roadways, noise from local noise sources is estimated using a relationship determined by the EPA. EPA determined that ambient noise can be approximately related to population density in locations away from transportation corridors, such as airports, major roads, and railroad tracks, according to the following relation:

$L_{dn} = 22 + 10 \log (p)$ (in dBA)

where p = population density in people per square mile.

3.4.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

The No Project Alternative includes programmed and funded transportation improvements that will be implemented and operational by 2030, in addition to the existing conditions. These improvements are not major systemwide capacity improvements (e.g., major new highway construction or widening or additional runways) and will not result in a general improvement of intercity travel conditions across the study region.

For purposes of this analysis, it is assumed that there will be no additional noise and vibration impacts associated with the development of the No Project Alternative, as compared to existing conditions. The potential significant impacts associated with programmed projects would be addressed with mitigation measures in a manner consistent with existing conditions in accordance with the project-level environmental documents and approvals for the projects as prepared by the project sponsors. Although the implementation of the No Project Alternative may result in some increases, any estimate of such increases would be speculative.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

It is assumed that any improvements associated with the HST Alignment Alternatives and stations location options would be in addition to No Project conditions.

The existing Caltrain alignment along the San Francisco Peninsula and the East Bay railroad alignments pass through densely populated communities where there is high potential for noise impacts. The potential noise impacts of the proposed HST service through these areas would result primarily from the greater frequency of trains, since the HST service would be operating at reduced speeds and would create noise levels similar to the existing services. The HST system would be expected to result in the elimination of up to 48 grade crossings on the peninsula and up to 38 grade crossings on the East Bay. Grade separation of existing rail services would result in considerable benefits from the elimination of the warning bells at existing at-grade crossings and the horn blowing of the existing commuter/intercity services along these alignments.

All the options for mountain crossings between the Bay Area and the Central Valley pass through sparsely populated areas but would introduce new noise sources along corridors through wilderness areas where the alignment is at grade or elevated. Along the Pacheco alignment from Diridon to Gilroy, there are 42.4 miles where noise impacts are rated medium to high and vibration impacts are rated medium. Four schools are located along this alignment, with 131 ac of parkland and varying residential populations. Through the Altamont Pass, there are 1.7–9.7 mi of sparsely populated areas where noise and vibration impacts are rated medium to high.

The relative level of potential noise and vibration impact for each HST alternative segment is shown in Table 3.4-4 and Figure 3.4-6. The table includes the length of alignment alternatives, residential population, mixed use population, acreage of parkland, number of schools, and number of hospitals. At a program level of analysis, station locations will not affect the impact rating of the alternative segments, so no data was included in Table 3.4-4. A detailed data table is included in Appendix 3.4-A.

In general the noise and vibration impact ratings are based on the population densities along each of the segments and the proximity of parkland, hospitals, and schools. Segments where trains would operate at higher speeds would have a greater level of impact. The comparison of the alignment alternatives is based on the data presented in Table 3.4-4 and Figure 3.4-6. Appendix 3.4-A provides a comparison of the alternative alignments by segment.

Potential noise and vibration impacts on wildlife and pristine open space from the HST system cannot be analyzed and ranked at the programmatic level of this report. At the programmatic level, the location and density of wildlife is undetermined, as are the types of wildlife along the HST Alignment Alternatives. Areas of pristine open space need to be defined and mapped based on more precise project-specific information. The significance of noise and vibration impacts of the HST Alignment Alternatives on wildlife and on pristine open space is therefore speculative at this time. Future project-level analyses should include a detailed study of the location, type, and density of wildlife in the project area. The boundaries of pristine open space should be defined and mapped during the project level analyses, so that the amount of pristine open space affected by noise and vibration from the HST Alignment Alternatives can be calculated.

San Francisco to San Jose

Although the HST service in the San Francisco to San Jose (Caltrain) corridor would be going through densely populated communities, the alignment alternatives in this corridor were rated as having a medium level of potential noise impacts because the HST would be traveling at reduced speeds and the communities would benefit from grade separation improvements for existing services and electrification of the railroad.

The noise impacts along this corridor are rated low for those alignment alternatives that are either in a tunnel or passing through sparsely populated areas. The remaining alignment alternatives are rated medium because of the higher population density in proximity to the alignment and the existing parkland and two schools. Vibration impacts along the Transbay Transit Center to 4^{th}/Townsend segment are low. The other alignment alternatives have the potential for medium to high vibration impacts because of the proximity of residential structures to the alignment.

Table 3.4-4
Noise and Vibration Impact Summary Data Table for
Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	28.84	5,509.3	140.1	0.00	0	2	Medium	Medium
	1 of 1	Dumbarton to San Jose	21.61	9,456.3	62.1	5.27	0	0	Medium	High
Station Location Options										
Transbay Transit Center			Ratings are based on alignment alternative that station is on—San Francisco to Dumbarton						Low	Low
4th and King (Caltrain)			Ratings are based on alignment alternative that station is on—San Francisco to Dumbarton						Low	Low
Millbrae/SFO			Ratings are based on alignment alternative that station is on—San Francisco to Dumbarton						Medium	Medium
Redwood City (Caltrain)			Ratings are based on alignment alternative that station is on—San Francisco to Dumbarton						Medium	Medium
Palo Alto (Caltrain)			Ratings are based on alignment alternative that station is on—Dumbarton to San Jose						Medium	High
Oakland to San Jose: Niles/ I-880	1 of 2	West Oakland to Niles Junction	13.6	2,626.7	0.00	0.00	0	1	Medium	High
		12th Street/City Center to Niles Junction	13.56	2,636.5	0.00	0.00	0	1	Medium	High
	1 of 2	Niles Junction to San Jose via Trimble	13.09	1,949.6	87.9	67.44	0	1	Medium	Medium
		Niles Junction to San Jose via I-880	25.55	2,032.9	95.4	67.44	0	1	Medium	Medium

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
Station Location Options										
West Oakland/7th Street			Ratings are based on alignment alternative that station is on—West Oakland to Niles Junction						Medium	High
12th Street/City Center			Ratings are based on alignment alternative that station is on—12th Street/City Center to Niles Junction						Medium	High
Coliseum/Airport			Ratings are based on alignment alternative that station is on—West Oakland to Niles Junction						Medium	High
Union City (BART)			Ratings are based on alignment alternative that station is on—Niles Junction to San Jose Via Trimble						Medium	Medium
Fremont (Warm Springs)			Ratings are based on alignment alternative that station is on—Niles Junction to San Jose Via Trimble						Medium	Medium
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	70.57	8,029.2	48.4	735.96	0	4	Medium	Medium
	1 of 3	Henry Miller (UPRR Connection)	62.59	0.6	0.6	1,437.29	0	1	Low	Low
		Henry Miller (BNSF Connection)	64.89	0.6	0.6	1,437.29	0	1	Low	Low
		GEA North	51.05	1,496.5	1,361.7	825.92	0	1	Low	Low
Station Location Options										
San Jose (Diridon)			Ratings are based on alignment alternative that station is on—Pacheco						Medium	Medium
Morgan Hill (Caltrain)			Ratings are based on alignment alternative that station is on—Pacheco						Medium	Medium
Gilroy (Caltrain)			Ratings are based on alignment alternative that station is on—Pacheco						Medium	Medium
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	29.99	1,110.1	0.6	94.51	0	1	Low	Low
		I-580/ UPRR	26.54	894.4	0.6	11.61	1	2	Low	Low
		Patterson Pass/UPRR	25.62	2,407.5	0.00	20.40	0	2	Medium	Medium
		UPRR	25.15	2,208.85	0.00	20.40	0	2	Medium	Medium

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
	1 of 4	Tracy Downtown (BNSF Connection)	50.18	2,596.9	0.00	54.68	0	1	Low	Low
		Tracy ACE Station (BNSF Connection)	50.41	1,005.8	0.00	200.15	0	1	Low	Low
		Tracy ACE Station (UPRR Connection)	29.55	2,693.9	0.00	167.99	0	1	Medium	Low
		Tracy Downtown (UPRR Connection)	33.14	4,258.6	0.00	54.68	0	1	Medium	Low
	2 of 2	East Bay Connections	1.77	1,453.74	4.5	0	0	0	High	High
Station Location Options										
Pleasanton (I-680/Bernal Rd)			Ratings are based on alignment alternative that station is on—Patterson Pass/UPRR						Medium	Medium
Pleasanton (BART)			Ratings are based on alignment alternative that station is on— I-680/ 580/UPRR						Low	Low
Livermore (Downtown)			Ratings are based on alignment alternative that station is on—Patterson Pass/UPRR						Medium	Medium
Livermore (I-580)			Ratings are based on alignment alternative that station is on— I-680/ 580/UPRR						Low	Low
Livermore (Greenville Road/UPRR)			Ratings are based on alignment alternative that station is on—Patterson Pass/UPRR						Medium	Medium
Livermore (Greenville Road/I-580)			Ratings are based on alignment alternative that station is on—I-680/ 580/UPRR						Low	Low
Tracy (Downtown)			Ratings are based on alignment alternative that station is on—Tracy Downtown (UPRR Connection)						Medium	Low
Tracy (ACE)			Ratings are based on alignment alternative that station is on—Tracy ACE Station (UPRR Connection)						Medium	Low

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	6.76	0.00	0.00	0.00	0	0	Low	Low
		Trans Bay Crossing – 4th & King	6.5	0.00	0.00	0.00	0	0	Low	Low
	1 of 6	Dumbarton (High Bridge)	18.57	6,848.0	8.9	366.08	0	4	High	High
		Dumbarton (Low Bridge)	18.57	6,848.0	8.9	366.08	0	4	High	High
		Dumbarton (Tube)	18.57	5,267.5	4.5	151.66	0	2	High	High
		Fremont Central Park (High Bridge)	22.29	4,279.9	8.9	572.58	0	3	High	High
		Fremont Central Park (Low Bridge)	22.29	4,279.9	8.9	572.58	0	3	High	High
		Fremont Central Park (Tube)	22.29	3,034.3	8.9	214.42	0	2	Medium	High
Station Location Options										
Union City (Shinn)		Ratings are based on alignment alternative that station is on—Niles Junction to San Jose Via Trimble							Medium	Medium
Central Valley	1 of 6	BNSF – UPRR	86.78	4,000.2	895.5	123.93	1	4	Low	Low
		BNSF	91.29	4,587.5	1052.2	125.57	0	4	Low	Low
		UPRR N/S	87.25	7,401.8	648.7	205.27	2	2	Medium	Low
		BNSF Castle	91.48	7,598.5	1,837.1	494.33	0	7	Medium	Low
		UPRR – BNSF Castle	92.32	11,363.3	2,066.2	699.60	1	6	Medium	Low
		UPRR – BNSF	87.62	7,764.9	1,124.6	329.20	2	3	Medium	Low

Corridor	Possible Alignments	Alignment Alternative	Total Segment (Miles)	Residential Population	Mixed Use Population	Parkland (Acres)	Hospitals	Schools	Noise Impact Rating*	Vibration Impact Rating
Station Location Options										
Modesto (Downtown)			Ratings are based on alignment alternative that station is on—UPRR N/S						Medium	Low
Briggsmore (Amtrak)			Ratings are based on alignment alternative that station is on—BNSF						Low	Low
Merced (Downtown)			Ratings are based on alignment alternative that station is on—UPRR-BNSF Castle						Medium	Low
Castle AFB			Ratings are based on alignment alternative that station is on—BNSF Castle						Medium	Low

*Accounts for Grade Crossing Elimination on alignment segments on or adjacent to existing non-grade separated tracks.

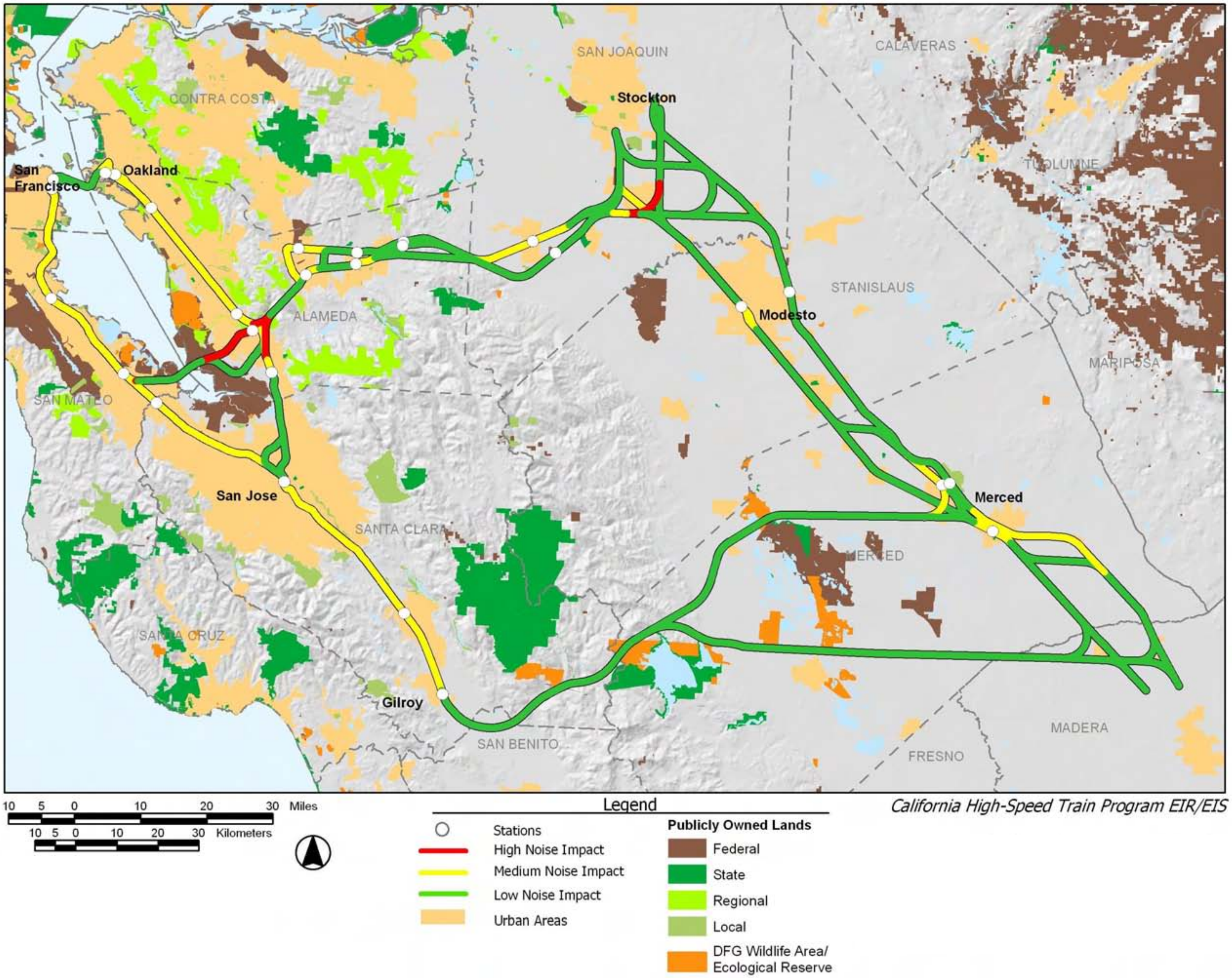


Figure 3.4-6
Potential Noise Impact Levels

Oakland to San Jose

Although the HST service in the Oakland to San Jose corridor would be going through densely populated communities, the alignment alternatives in this corridor were rated as having a medium level of potential noise impacts because the HST would be traveling at reduced speeds and the communities would benefit from grade separation improvements for existing services and electrification of the railroad.

The alignment alternatives through Oakland to Niles are rated medium for noise and high for vibration because of the higher population densities and the proximity of a school to the segments. The 12th Street/City Center to Niles Junction alignment alternative would have an additional 4.8 mi of vibration impact rated high than the West Oakland to Niles Junction alternatives because of the segment between 12th Street/City Center to Jack London Square. Noise impacts are the same for these two alternatives.

The alignment alternative from Niles Junction to San Jose via Trimble has 6 mi of noise impacts rated as medium and vibration impacts rated high; the Niles Junction to San Jose via I-880 alignment alternative is similar but has an additional 2.9 mi of medium rated vibration impact.

San Jose to Central Valley

The San Jose to Central Valley corridor is rated as having medium potential for noise impacts. Although the HST system could reach speeds as great as 186 mph (299 kph) through this area, the densities are less than on the San Francisco Peninsula or the East Bay, and the communities would receive considerable benefit from the elimination of up to 24 grade crossings.

Along the Pacheco alignment alternative from Diridon to Gilroy, there are 42.4 miles where noise impacts are rated medium to high and vibration impacts are rated medium. Four schools are located along this alignment, and there are 131 ac of parkland and varying residential populations.

All the alignment alternatives for mountain crossings between the Bay Area and the Central Valley are through sparsely populated areas but would introduce new noise sources along corridors through wilderness areas where the alignment is at grade or elevated.

From San Luis Reservoir to Henry Miller Wye, there are three alignment alternatives. The noise and vibration impacts in the UPRR Connection and BNSF Connection alignment alternatives are rated low. Both these alignment alternatives pass through areas with little to no residential population. The GEA North alignment alternative is located closer to populated areas and the noise and vibration impacts in this alignment alternative are rated medium along the 7.7 miles between GEA Atwater Wye to the BNSF.

Eastbay to Central Valley

In the Eastbay to Central Valley corridor, which extends from Niles Canyon to the County Line through the Altamont Pass, there are four alignment alternatives. The I-680/580/UPRR alignment alternative is rated a medium noise and vibration impact from Sunol to El Charo Road, which is made up of 9.7 mi of sparsely populated residents with 7 ac of parkland. The I-580/UPRR alignment alternative is rated a high impact for noise and vibration along the Pleasanton to El Charo 1.7 mi segment. The Patterson Pass/UPRR alignment alternative has 8.0 mi of noise and vibration impacts rated medium to high from Pleasanton to the Patterson Pass cut off. The UPRR alignment is the same as Patterson Pass/UPRR with similar impacts along the same 8.0 mi length.

Of the four alignments from Tracy to Escaton Wye, the segment from southeast Manteca to the BNSF connection would be ranked the highest in noise and vibration impacts.

In the East Bay alignment alternative, the Niles to Niles Wye segment is rated a high vibration impact through Fremont, and the segment through Union City is rated a low vibration impact. Noise impacts are the same along these segments.

San Francisco Bay Crossings

In the San Francisco Bay Crossings corridor, the Trans Bay Crossing alignment alternative would be through a tunnel and is rated low for noise and vibration impacts. Of the six alignment alternatives from the Dumbarton Wye to Niles Wye, the Dumbarton Tube alignment alternative is rated the highest noise and vibration impact over the greatest distance, approximately 12 mi.

Central Valley

Through the Central Valley, most of the HST Alignment Alternatives are rated as low potential noise impact due generally to the sparseness of residential land use and the extent of open space along most of the length of the options—even though the proposed HST service would be operating at maximum speeds throughout most of the Central Valley. However, there are a number of locations in the Central Valley where the various alignment alternatives pass through populated areas and have high potential noise impact ratings for short segments. Examples include portions of Modesto and Merced that could be exposed to higher noise levels from HST operations.

Through many of the cities in the Central Valley, the HST is proposed to be on aerial structure, primarily to reduce potential conflicts with freight railroad spur tracks or freight railroad yards. The vertical elevation of the aerial structure would allow potential noise impacts to extend further than they would at grade.

Through the Central Valley corridor, from North Stockton to the Henry Miller BNSF Wye, the alignment alternatives with the highest ranked noise impact are the BNSF Castle and UPRR – BNSF Castle alternatives, with 16.8 mi that are rated high noise impact and medium vibration impact.

C. SHORT-TERM CONSTRUCTION NOISE AND VIBRATION

Construction Noise Levels

Noise impacts from construction of the project will be generated by heavy equipment used during major construction periods as close as 50 ft from existing structures along the alignment. Table 3.4-5 shows the estimated maximum noise levels for the different stages of at-grade construction at 100 ft from a receiver.

Table 3.4-5
Estimated Peak Hour Construction Noise Levels

Construction Phase	Loudest Equipment	Noise Level at 100 ft Lmax (dBA)
Clearing and grubbing	Bulldozer, backhoe, haul trucks	86
Earthwork	Scraper, bulldozer	88
Foundation	Backhoe, loader	85
Structures	Crane, loader, haul truck	86
Base preparation	Trucks, bulldozer	88
Paving	Paver, pumps, haul trucks	89
Source: *Transit Noise and Vibration Impact Assessment* (U.S. Department of Transportation 2006).		

Construction Vibration Levels

Common vibration-producing equipment used during at-grade construction activities include jackhammers, pavement breakers, hoe rams, augur drills, bulldozers, and backhoes. Pavement breaking and soil compaction would probably be the activities that produce the highest level of vibration. Table 3.4-6 presents various types of construction equipment measured under a wide variety of construction activities, with an average of source levels reported in terms of velocity levels. Although the table gives one level for each piece of equipment, it should be noted that there is a considerable variation in reported ground vibration levels from construction activities. The data provide a reasonable estimate for a wide range of soil conditions.

Table 3.4-6
Vibration Source Levels for Construction Equipment

Equipment	Peak Particle Velocity at 25 Ft (inches per second)	Approximate Velocity Level at 25 Ft
Pile driver (impact)		
Upper range	1.518	112
Typical	0.644	104
Pile driver (sonic)		
Upper range	0.734	105
Typical	0.170	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill (slurry wall)		
In soil	0.008	66
In rock	0.017	75
Large bulldozer	0.089	87
Caisson drilling	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Velocity level = Root mean square velocity in decibels (VdB) relative to 1 micro-inch/second.
Source: *Transit Noise and Vibration Impact Assessment* (U.S. Department of Transportation 2006).

3.4.4 Role of Design Practices in Avoiding and Minimizing Effects

Because of the high-speed alignment requirements of the HST system, significant portions of the alignment alternatives are in a tunnel or trench section. For these portions of the system, the potential for noise impacts is mostly eliminated. The tunnel cross sections are designed (per established engineering criteria) to provide sufficient cross-sectional area to avoid potential aerodynamic effects at the tunnel portals caused by trains operating at maximum speed.

At similar speeds, HSTs generate significantly less noise than commuter and freight trains. This is primarily to the result of the use of electric power versus diesel engines, higher quality track interface, and smaller, lighter, more aerodynamic trainsets. The use of electric power units would not have the engine rumble associated with diesel-powered locomotives. Although wheel/track interface is a significant source of train noise, HST track beds and rails are designed and maintained to very high geometric tolerances and standards, which would greatly minimize track noise that is prevalent with commuter/freight tracks throughout the study region.

Another reason HST noise impacts are less than commuter or freight trains is that high speeds would result in short duration noise events compared with conventional trains (a few seconds at the highest speeds versus 10 to 20 seconds for conventional passenger trains and well over 1 minute for freight trains).

The HST system would be fully grade separated from all roadways. In the urban areas, where potential for noise impacts is typically at the highest levels, the HST system would be predominantly in or adjacent to existing rail corridors, and the HST Alignment Alternatives often include the grade separation of the existing tracks. Grade separations completed with the HST system in corridors such as these would eliminate horn sounding and bells at existing grade crossings and would result in noise benefits that would offset much of the HST noise impacts.

3.4.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the design practices described in section 3.4.4, each of the HST Alignment Alternatives would have significant noise and vibration impacts, as detailed in Table 3.4-4. The HST Alignment Alternatives would create significant long-term noise and vibration impacts from introduction of a new transportation system. At the same time, the HST Alignment Alternatives would create some long-term noise reduction benefits because noise sources would be eliminated with grade separation of existing grade crossings. It is possible that at the future project-level of analysis, refined data and information would confirm that some sections of the alignment alternatives would result in less-than-significant noise and vibration impacts (i.e., through the Transbay Tunnel); however, for purposes of the programmatic analysis, the long-term noise and vibration impacts are considered significant for all sections. In addition, the HST Alignment Alternatives would involve significant short-term noise and vibration impacts from construction.

General mitigation strategies are discussed in this program-level review of potential noise impacts associated with proposed alternatives that would reduce the impacts. General vibration mitigation strategies are less predictable at a program level of analysis because of the site-specific nature of vibration transmission through soil along the alignment. More detailed mitigation strategies for potential noise and vibration impacts would be developed in the next stage of environmental analysis. Noise and vibration mitigation measures can generally be applied to the source (train and associated structures), the path (area between train and receiver), and/or the receiver (property or building). An HST system would be designed and developed to meet state-of-the-art technology specifications for noise and vibration, based on the desire to provide the highest-quality train service possible. Trains and tracks would be maintained in accordance with all applicable standards to provide reliable operations.

Treatments, such as sound insulation or vibration controls to affected buildings, may be difficult to implement for the potentially numerous properties adjacent to the right-of-way. Such treatments require protracted implementation procedures and separate design considerations. The most feasible and effective mitigation treatments are typically those involving the path. These mitigation measures can often be applied to the path within the right-of-way, either under or adjacent to the tracks. Potential noise impacts can be reduced substantially by the installation of sound barrier walls constructed to shield receivers from train noise. For vibration mitigation, several track treatments may be considered for reducing train vibrations. Determining the most appropriate treatment would depend on the site-specific ground conditions along the corridor. This program-level analysis has identified areas where future analysis should be given to potential HST-induced vibrations. The type of vibration mitigation and expected effectiveness will be determined as part of the second-tier project-level environmental analyses.

A. NOISE BARRIERS

Noise barriers are often a practical way to reduce noise impacts from the proposed HST system. The representative typologies considered the mitigation potential of noise barriers for certain areas. In most cases the application of appropriately dimensioned noise barriers next to the tracks could reduce potential noise impacts from FRA's severe noise impact category to moderate, and to the no impact category in some locations. The design of noise barriers appropriate for the proposed HST right-of-way line would depend on the location and height of noise-sensitive buildings, as well as the speeds of the trains. Noise barriers 8–10 ft (2–3 m) tall could be installed where speeds are relatively low (i.e., wheel/rail noise dominates). Higher noise barriers of 12–16 ft (4–5 m) might be used to reduce noise to taller buildings or where speeds are high in noise-sensitive areas. In many locations, noise barriers could be installed on one side of the track only because of the location and proximity of noise-sensitive areas.

Application of mitigation to the proposed HST system would result in a considerable reduction of potential noise impacts. The estimates obtained from the results of the representative typologies showed noise barriers to be effective in reducing the potential noise impact rating by one category, for example, from high to medium or from medium to low. Consequently, HST Alignment Alternatives with high rating would be adjusted down to, at most, a medium rating.

The cost of constructing a noise barrier on one side of a rail line is estimated at approximately $1 million per mi ($625,000 per km) for a concrete wall of 12 ft (4 m) in height. Conservatively, a unit cost of $1.5 million per mi ($937,500 per km) was applied to portions of the HST Alignment Alternatives with high potential noise impact ratings. The procedure was repeated for all segments with a medium rating, thereby reducing these HST noise impact ratings to low. This approach was intended to show that mitigation is possible and to provide a rough estimate of potential mitigation costs, recognizing that specific mitigation would be developed as a part of project-level review.

The results in Table 3.4-7 show the potential mitigation costs for the HST Alignment Alternatives. This analysis included noise mitigation (barrier walls) for 1.7 to 42.4 route miles (2.7 to 68.2 route km) of the proposed HST alignments with medium to high noise impacts.

Table 3.4-7
Potential Length and Cost of Noise Mitigation by Alignment

	Noise Mitigation Length in Miles (Km)	Noise Barrier Cost (in millions of dollars)
San Francisco to San Jose: Caltrain		
San Francisco to Dumbarton	26.9 (43.2)	40.3
Dumbarton to San Jose	18.7 (30.1)	28.0
Oakland to San Jose: Niles/I-880		
West Oakland to Niles Junction (1 of 2)	13.6 (21.9)	20.4
12th Street/City Center to Niles Junction (2 of 2)	13.6 (21.9)	20.4
Niles Junction To San Jose via Trimble (1 of 2)	6.0 (9.6)	9.0
Niles Junction to San Jose via I-880 (2 of 2)	6.0 (9.6)	9.0
San Jose to Central Valley: Pacheco Pass		
Pacheco	42.4 (68.2)	63.6
Henry Miller (UPRR Connection) (1 of 3)	0	0
Henry Miller (BNSF Connection) (2 of 3)	0	0
GEA North (3 of 3)	7.7 (12.4)	11.6
East Bay to Central Valley: Altamont Pass		
I-680/I-590/UPRR	9.7 (15.6)	14.6
I-580/UPRR	1.7 (2.8)	2.6

	Noise Mitigation Length in Miles (Km)	Noise Barrier Cost (in millions of dollars)
Patterson Pass/UPRR	8.0 (12.9)	12.0
UPRR	14.8 (23.7)	22.1
Tracy Downtown (BNSF Connection)	3.0 (4.8)	4.4
Tracy ACE Station (BNSF Connection)	8.2 (13.2)	12.3
Tracy ACE Station (UPRR Connection)	20.0 (32.2)	30.0
East Bay Connections	1.8 (2.8)	2.7
San Francisco Bay Crossings		
Trans Bay Crossing – Transbay Transit Center	0 (0)	0
Trans Bay Crossing – 4th & King	0 (0)	0
Dumbarton (High Bridge)	18.6 (29.9)	27.9
Dumbarton (Low Bridge)	18.6 (29.9)	27.9
Dumbarton (Tube)	11.0 (17.6)	16.4
Freemont Central Park (High Bridge)	22.3 (35.6)	33.4
Freemont Central Park (Low Bridge)	22.3 (35.6)	33.4
Freemont Central Park (Tube)	22.3 (35.6)	33.4
Central Valley		
BNSF-UPRR	10.7 (17.2)	16.1
BNSF	10.9 (17.6)	16.4
UPRR N/S	13.1 (21.0)	19.6
BNSF Castle	16.8 (27.0)	25.2
UPRR – BNSF Castle	25.5 (41.1)	38.3
UPRR – BNSF	19.4 (31.3)	29.1

B. VIBRATION MITIGATION

The following mitigation strategies can be refined and applied at the project-specific level and will reduce the vibration impact:

- Specify the use of train and track technologies that minimize ground vibration, such as state-of-the-art suspensions, resilient track pads, tie pads, ballast mats, or floating slabs.
- Phase construction activity, use low impact construction techniques, and avoid use of vibrating construction equipment where possible to avoid vibration construction impacts.

Vibration mitigation is less predictable at a program level of analysis because of the site-specific nature of vibration transmission through soil along the alignment. However, an estimate can be made of the length of corridor where vibration mitigation may need to be considered by totaling the segments with potential vibration impact rating of high. The results are shown in Table 3.4-8 and Figure 3.4-7. The range is 1.7–42.4 mi (2.7 to 68.2 km) to be considered for mitigation, depending on which option is chosen. Although the mitigation measures will reduce vibration impact levels, at the programmatic level it is uncertain whether the reduced vibration levels will be below a significant impact. The type of vibration mitigation and expected effectiveness to reduce the vibration impacts of

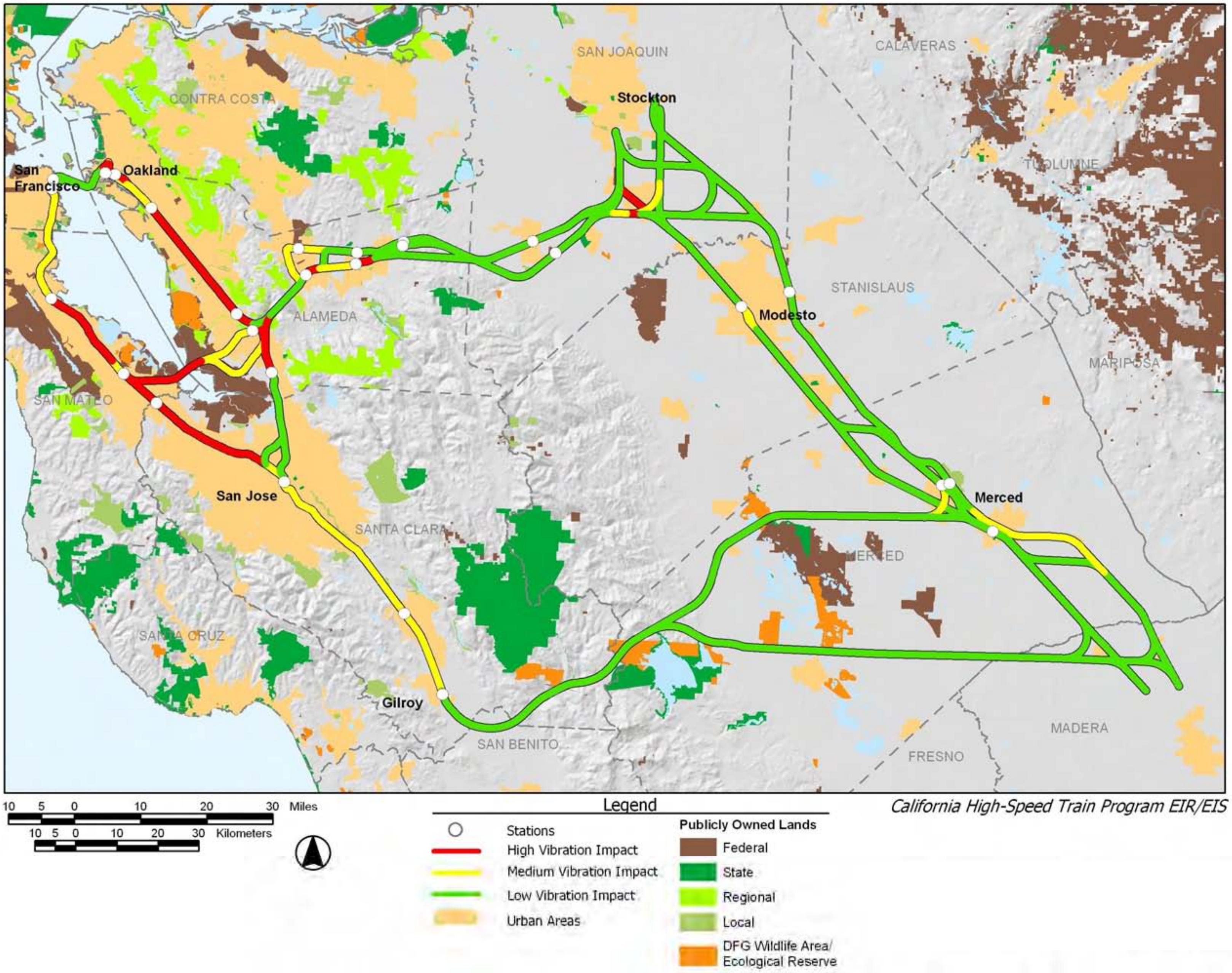


Figure 3.4-7
Potential Vibration Impact Levels

the HST Alignment Alternatives to a less-than-significant level will be determined as part of the second-tier project-level environmental analyses.

C. CONSTRUCTION MITIGATION

Potential mitigation strategies for construction noise impacts associated with the HST system are listed below.

- Construction noise could be reduced by using enclosures or walls to surround noisy equipment, installing mufflers on engines, substituting quieter equipment or construction methods, minimizing time of operation, and locating equipment farther from sensitive receptors.
- Construction operations could be suspended between 7:00 p.m. and 7:00 a.m. and/or on weekends and holidays in residential areas.
- Contractors could be required to comply with all local sound control and noise-level rules, regulations, and ordinances.
- Equip each internal combustion engine with a muffler of a type recommended by the manufacturer.

Table 3.4-8
Length of Potential Vibration Impact by Alignment

	Length of Medium Impact in Miles (km)	Length of High Impact in Miles (km)
San Francisco to San Jose		
San Francisco to Dumbarton	16.3 (26.2)	10.6 (17.0)
Dumbarton to San Jose	2.9 (4.7)	18.7 (30.1)
Oakland to San Jose		
West Oakland to Niles Junction (1 of 2)	8.4 (13.6)	5.2 (8.2)
12th Street/City Center to Niles Junction (2 of 2)	3.6 (5.8)	10.0 (16.1)
Niles Junction To San Jose via Trimble (1 of 2)	0 (0)	6.0 (9.6)
Niles Junction to San Jose via I-880 (2 of 2)	2.9 (4.7)	6.0 (9.6)
San Jose to Central Valley: Pacheco Pass		
Pacheco	42.4(68.2)	0 (0)
Henry Miller (UPRR Connection) (1 of 3)	0 (0)	0 (0)
Henry Miller (BNSF Connection) (2 of 3)	0 (0)	0 (0)
GEA North (3 of 3)	7.7 (12.4)	0 (0)
East Bay to Central Valley: Altamont Pass		
I-680/I-590/UPRR	9.7 (15.6)	0 (0)
I-580/UPRR	0 (0)	1.7 (2.8)
Patterson Pass/UPRR	4.1 (6.5)	4.0 (6.4)
UPRR	4.1 (6.5)	4.0 (6.4)
Tracy Downtown (BNSF Connection)	0 (0)	1.1 (1.7)
Tracy ACE Station (BNSF Connection)	0 (0)	1.1 (1.7)
Tracy ACE Station (UPRR Connection)	5.3 (8.5)	1.1 (1.7)
East Bay Connections	0 (0)	0.6 (1.0)

	Length of Medium Impact in Miles (km)	Length of High Impact in Miles (km)
San Francisco Bay Crossings		
Trans Bay Crossing – Transbay Transit Center	0 (0)	0 (0)
Trans Bay Crossing – 4th & King	0 (0)	0 (0)
Dumbarton (High Bridge)	6.8 (11.0)	11.8 (18.9)
Dumbarton (Low Bridge)	6.8 (11.0)	11.8 (18.9)
Dumbarton (Tube)	6.8 (11.0)	11.8 (18.9)
Freemont Central Park (High Bridge)	12.9 (20.8)	9.4 (15.1)
Freemont Central Park (Low Bridge)	12.9 (20.8)	9.4 (15.1)
Freemont Central Park (Tube)	12.9 (20.8)	9.4 (15.1)
Central Valley		
BNSF-UPRR	0 (0)	0 (0)
BNSF	0 (0)	0 (0)
UPRR N/S	0 (0)	6.1 (9.8)
BNSF Castle	16.8 (27.0)	0 (0)
UPRR – BNSF Castle	16.8 (27.0)	6.1 (9.8)
UPRR – BNSF	0 (0)	6.1 (9.8)

Other measures that should be considered include the following:

- Specifying the quietest equipment available would reduce noise by 5–10 dBA.
- Turning off construction equipment during prolonged periods of nonuse would eliminate noise from construction equipment during those periods.
- Requiring contractors to maintain all equipment and train their equipment operators would reduce noise levels and increase efficiency of operation.
- Locating stationary equipment away from noise-sensitive receptors would decrease noise impact from that equipment in proportion to the increased distance.

The above mitigation strategies are expected to reduce the short-term and long-term noise impacts of the HST Alignment Alternatives to a less-than-significant level. Additional environmental assessment would allow a more precise evaluation in the second-tier project-level environmental analyses.

3.4.6 Subsequent Analysis

A. NOISE ANALYSIS

FRA provides guidance for two levels of analysis in project environmental review, a general assessment method to further quantify the potential noise impacts in locations identified by the screening procedure and a detailed analysis procedure for evaluating suggested noise mitigation at locations where further studies show there is potential for significant impacts. The process is designed to focus on problem areas as more detail becomes available during project development. Subsequent analysis would proceed along the following lines.

Ambient noise conditions

The existing ambient noise environment is described by assumptions in the screening procedure. However ambient noise values would be estimated at the project-level analysis based on limited measurements in the general assessment and would be thoroughly measured in the detailed analysis. A measurement program involving both long-term and short-term noise monitoring would be performed at selected locations to document the existing noise environment. Because it would be impractical to measure noise everywhere, the monitoring would be supplemented by estimates of noise environments at locations considered to be typical of others. Guidelines for characterizing the existing conditions are provided by the FRA manual.

Project Noise Conditions

A generic HST is used in the screening procedure, but a more specific train type, speed profile, and operation plan would be available for more refined projections of noise levels in the next stage of environmental analysis.

Noise Propagation Characteristics

The screening procedure assumes flat terrain with noise emanating from a source unhindered by landforms and human-made structures. The next stage of analysis would incorporate topography as well as consideration of shielding by buildings, vegetation, and other natural features in a particular corridor.

Impact Criteria

The screening procedure accounts for all noise-sensitive land use categories that may be exposed to noise levels exceeding the threshold of impact. In the next stage of analysis, assessments using the full, three-level FRA impact criteria would be performed (U.S. Department of Transportation 2005). This more detailed assessment would more specifically identify locations where potential impacts may occur and locations where potentially high impact may occur and would provide for consideration of specific mitigation measures where appropriate.

Mitigation

Noise abatement is discussed generally in the screening procedure, and areas are identified where more detailed analysis should be focused in the future to integrate a proposed HST system into the existing environment. As more detail becomes available in the general assessment phase, there may be many areas that were identified as potentially impacted during screening analysis for which further analysis would not be needed, because they would not be impacted. The detailed analysis would provide information useful for the engineering design of mitigation measures. These measures would be considered in the project-level environmental review, and potential visual and shadow impacts of noise barriers would also be considered.

B. VIBRATION ANALYSIS

The steps involved in the more detailed analysis of ground-borne vibration would be similar to those for noise. The major difference would be the need for study of site-specific ground-borne vibration characteristics. Considerable variation of soil conditions may occur along the corridor, resulting in some locations with significant levels of vibration from the HST and other locations at the same distance from the track with almost imperceptible vibration levels. Determining the potential vibration characteristics in the detailed analysis would involve a measurement program performed according to the method described in the FRA guidance manual (U.S. Department of Transportation 2005). This method would allow for the prediction of vibration levels and frequency spectrum information, which is valuable not only in the assessment of impact but also in the consideration of mitigation measures.

3.5 Energy

3.5.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Federal Regulations

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) is an independent agency that regulates the interstate transmission of natural gas, oil, and electricity. FERC also regulates natural gas and hydropower projects. As part of that responsibility, FERC regulates the transmission and sale of natural gas for resale in interstate commerce, the transmission of oil by pipeline in interstate commerce, and the transmission and wholesale sales of electricity in interstate commerce. FERC also licenses and inspects private, municipal, and state hydroelectric projects; approves the siting of and abandonment of interstate natural gas facilities, including pipelines, storage, and liquefied natural gas; oversees environmental matters related to natural gas and hydroelectricity projects and major electricity policy initiatives; and administers accounting and financial reporting regulations and conduct of regulated companies.

Corporate Average Fuel Economy Standards

Corporate Average Fuel Economy (CAFE) standards are federal regulations that are set to reduce energy consumed by on-road motor vehicles. The standards specify minimum fuel consumption efficiency standards for new automobiles sold in the United States. The current standard for passenger cars is 27.5 mpg (11.69 kilometers per liter [kpl]). The 1998 standard for light trucks was 20.7 mpg (8.8 kpl). On March 31, 2003, the National Highway Traffic Safety Administration, part of the U.S. DOT, issued new light truck standards for model-year 2005 of 21.0 mpg (8.93 kpl), 21.6 mpg (9.18 kpl) for model-year 2006, and 22.2 mpg (9.44 kpl) for model-year 2007 (National Highway Traffic Safety Administration 2006).

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users

On August 10, 2005, the President signed into law SAFETEA-LU. SAFETEA-LU represents the largest surface transportation investment in history. The two acts that preceded this—the ISTEA and TEA-21—shaped the highway program to meet the country's changing transportation needs. SAFETEA-LU builds on these, supplying the funds and refining the programmatic framework for investments needed to maintain and grow the transportation infrastructure.

SAFETEA-LU addresses challenges such as improving safety, reducing traffic congestion, improving efficiency in freight movement, increasing intermodal connectivity, and protecting the environment. SAFETEA-LU promotes more efficient and effective transportation programs by focusing on transportation issues of national significance, while giving state and local transportation decision makers more flexibility for solving transportation problems in their communities (National Highway Traffic Safety Administration 2004).

Section 403(b) of the Power Plant and Industrial Fuel Use Act of 1978 (P.L. 95-620)

This section of the Power Plant and Industrial Fuel Use Act encourages conservation of petroleum and natural gas by recipients of federal financial assistance.

Executive Order 12185, Conservation of Petroleum and Natural Gas (December 17, 1979, 44 F.R. § 75093)

This executive order encourages additional conservation of petroleum and natural gas by recipients of federal financial assistance.

State Regulations

Public Resources Code Section 21100(b)(3) provides that an EIR shall include a statement setting forth the mitigation measures proposed to minimize the significant effects on the environment, including measures to reduce the wasteful, inefficient, and unnecessary consumption of energy. Appendix F to the CEQA Guidelines addresses energy conservation goals, notes that potentially significant energy implications of a project should be considered in an EIR, and contains general examples of mitigation measures for a project's potentially significant energy impacts.

CEQA Guidelines Section 15126.2 discusses requirements for an EIR to address potentially significant effects, and, although it does not include energy specifically, it mentions use of nonrenewable resources. CEQA Guidelines Section 15126.4(a)(1)(C) requires an EIR to discuss energy conservation measures, if relevant.

California Code of Regulations, Title 24, Part 6, Energy Efficiency Standards

Title 24, Part 6 of the California Code of Regulations, Energy Efficiency Standards, promotes efficient energy use in new buildings constructed in California. The standards regulate energy consumed for heating, cooling, ventilation, water heating, and lighting. The standards are enforced through the local building permit process. These standards may apply to any buildings (e.g., stations) constructed as part of or in association with the No Project and HST Alignment Alternatives[1].

B. METHOD OF EVALUATION OF IMPACTS

This evaluation of energy supply and demand compares potential energy use for intercity travel related to the HST and No Project Alternatives. This section explains the methodology used to evaluate the potential energy impacts and benefits attributable to operation (direct energy) and construction (indirect energy) of the alternatives under study. This section also explains the criteria used to determine whether a potential impact on energy consumption would be significant. The evaluation is based on available data and forecasts.

Direct Energy

The analysis of transportation energy focuses on the overall energy consumption differences between the No Project Alternative and a representative HST Alternative[2]. This approach captures the major transportation fuel inputs: petroleum oil and natural gas (a large component of electricity production). Electricity consumption as a specific item is also analyzed because of the special nature of electricity, specifically its nonstorability and its lack of suitability for trading in futures markets. The HST system would directly consume electricity, which the energy analysis focuses on, although natural gas is also addressed as one variable in the overall ability of the state's electricity-generating infrastructure to deliver adequate power to users. Moreover, total reserves of in-the-ground natural gas is relatively certain; while it is the market conditions and production capacity trends that principally determine the price and supply of this commodity, just as is the case for the other major transportation fuel, petroleum oil.

The energy analysis was performed as described below to determine the operational impact of the alternatives on overall regional transportation-related energy supply[3] and regional electricity supply during peak demand.

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

[2] Based on revised low-end ridership forecast developed by Cambridge Systematics June 11, 2007. Also refer to Chapter 2, "Alternatives," and Section 2.3.3.C, Travel Demand and Ridership Forecasts.

[3] *Overall energy* refers to the combination of energy derived from petroleum fuels and electrical energy.

Overall Statewide Transportation-Related Energy Supply

Overall direct energy consumption by the alternatives involves potential energy use for vehicle (automobiles, airplanes, and HSTs) operation and related infrastructure in the region. The potential direct impacts on overall transportation-related energy supply were evaluated both quantitatively and qualitatively.

The quantitative analysis focused on the direct relationship between projected vehicle miles traveled (VMT) (vehicle kilometers traveled [VKT]) and energy consumption to estimate the potential change in total energy consumption between the No Project Alternative and the HST Alternative. The quantitative assessment of direct energy impacts considered the VMT (VKT) for automobiles and HST, as described below (consistent with the analysis conducted for air quality).

Variation of Fuel Consumption Rates by Vehicle Type

For this analysis, the design demand was established based on the ridership studies conducted by the MTC, as discussed in Chapter 2, "Alternatives." Automobile VMT (VKT) modeling for the proposed HST system was developed as part of this Program EIS/EIR and used to develop VMT (VKT) values for existing conditions and the No Project Alternative.

The VMT (VKT) fuel consumption method used herein is outlined in *Technical Guidance*, Section 5309 New Starts Criteria (Federal Transit Authority, Office of Planning 1999). Energy consumption factors for the first two modes identified in Table 3.5-1 were developed by Oak Ridge Laboratory and published in the 2006 *Transportation Energy Book* (edition 25) (U.S. Department of Energy, Office of Planning, Budget Formulation and Analysis, Energy Efficiency and Renewable Energy 2006). These results are based on national averages for road, traffic, and weather conditions and are intended for general comparisons. The energy consumption factor for the HST mode is based on energy used by similarly designed trains, such as the Trains à Grande Vitesse in France and the Intercity Express in Germany (DE Consult 2000). This report assumes a 16-car trainset (engines and cars) with a 1,200-passenger carrying capacity.

Table 3.5-1
Direct Energy Consumption Factors

Mode	Factor (Btus/VMT)
Passenger vehicles (auto, van, light truck)[a]	5,572
Airplanes[a]	326,894
High-speed trains[b]	924,384

Btus = British thermal units.

Sources:
[a] U.S. Department of Energy, Office of Planning, Budget Formulation and Analysis, Energy Efficiency and Renewable Energy 2006; based on nationally averaged conditions and fleet composition.
[b] DE Consult 2000, based on a 16-vehicle trainset.

Overall direct energy, measured in Btus, was converted to equivalent barrels of crude oil to represent potential energy impacts and/or savings. (Btus are the standard units used by industry and government literature for such comparisons. Metric units for energy [i.e., Joules] are not used in this report.) Annual direct-energy consumption values for intercity travel was calculated and compared for existing conditions, the No Project Alternative, and the HST Alternative. The potential change in direct energy consumption from the future No Project condition (in Btus) was calculated for the HST Alternative.

U.S. Department of Transportation Federal Railroad Administration

The qualitative analysis of overall direct energy consumption considers the estimated or assumed levels of service for each of the alternatives and the effect that each would have on congestion and travel speeds, which would have a substantial impact on fuel efficiency and, therefore, energy use.

In addition to the overall direct energy analysis, average energy consumption per passenger mile (kilometer) was calculated for the HST Alternative.

Statewide Electricity Supply during Period of Peak Demand

For the HST Alternative, peak-period electricity demand was determined using an energy consumption factor for HSTs obtained from the *DE Consult Peer Review Report* (DE Consult 2000) and the operation plan developed as part of this Program EIR/EIS process. The demand was calculated in terms of megawatts (MW) and compared to current estimates of peak demand and supply capacity in the grid controlled by the California Independent System Operator (Cal-ISO). Peak demand for electricity for the future No Project Alternative is discussed qualitatively because it is not possible to measure at the program level. This approach is reasonable because the possible increase in transportation-related electricity use associated with these alternatives would likely be small and considered insignificant.

Indirect Energy

The energy that would be used to construct the proposed project is called indirect energy. Projected construction-related energy consumption refers to energy used for the construction of HST trackway and support facilities and transportation of materials and equipment to and from the work site. To the extent that construction energy information was available from other sources or existing HST systems, it was used in this analysis. However, some other countries have developed HST systems incrementally over extended periods of time (e.g., France) and have only limited relevant information available. Construction-related energy consumption factors identified for the proposed HST system included data gathered for typical heavy rail systems and a heavy rail commuter system, San Francisco Bay Area Rapid Transit District (BART). These data were used to estimate the projected construction-related energy consumption of the proposed HST system. Projected construction-related energy consumption is presented in Table 3.5-2. These estimates are appropriate for comparison purposes.

The construction energy payback period measures the number of years that would be required to pay back the energy used in construction with operational energy consumption savings. The payback period is calculated for this section by dividing the estimate of each alternative's construction energy by the amount of energy that would later be saved by the HST Alternative compared to the No Project condition. It is assumed that the amount of energy saved in the study year (2030) would remain constant throughout the payback period.

Table 3.5-2
Construction-Related Energy Consumption Factors for the Proposed HST System

Facility	Rural Compared to Urban[d]	Factor (billions of Btus)
At grade	Rural[b]	12.29/one-way guideway mi
	Urban[c]	19.11/one-way guideway mi
Elevated	Rural[b]	55.46/one-way guideway mi
	Urban[c]	55.63/one-way guideway mi
Below grade (cut)	Rural[b]	117.07/one-way guideway mi
	Urban[c]	163.14/one-way guideway mi
Below grade (tunnel)	Rural[b]	117.07/one-way guideway mi

Facility	Rural Compared to Urban[d]	Factor (billions of Btus)
	Urban[c]	328.33/one-way guideway mi
Station	N/A[e]	78[a]/station

[a] Value for construction of freight terminal. Used as proxy for HST station consumption factors.
[b] Estimates reflect typical rail system construction energy consumption.
[c] Estimates reflect energy consumption for BART system construction as surrogate for HST construction through urban area.
[d] Differences between the construction-related energy consumption factors for urban and rural settings reflect differences in construction methods, demolition requirements, utility accommodation, etc.
[e] Discreet (i.e., non-alignment-related facilities) are not differentiated between rural or urban because the data used to develop the respective values were not differentiated as such. Some difference between the actual values might be expected.

Sources: U.S. Congress, Budget Office 1977; U.S. Congress, Budget Office 1982; and California State Department of Transportation 1983; based on construction for air freight services.

C. CEQA SIGNIFICANCE CRITERIA

According to Appendix F of the CEQA Guidelines, the means to achieve the goal of conserving energy include decreasing overall per capita energy consumption, decreasing reliance on natural gas and oil, and increasing reliance on renewable energy sources. The significance criteria discussed herein are used to determine whether the alternatives would have a potentially significant effect on energy use, including energy conservation.

Significant long-term operational or direct energy impacts would occur if the HST Alternative would place a substantial demand on regional energy supply or require significant additional capacity, or significantly increase peak and base period electricity demand.

Significant short-term construction energy impacts would occur if construction of the HST Alternative were judged likely to consume nonrenewable energy resources in a wasteful, inefficient, or unnecessary manner.

A significant adverse cumulative effect would occur if implementation of the HST Alternative, together with regional growth, would contribute to a collectively significant shortage of regional or statewide energy (see Section 3.17, “Cumulative Impacts,” and Chapter 5, “Economic Growth and Related Impacts”).

By contrast, if the proposed project resulted in energy savings, alleviated demand on energy resources, or encouraged the use of efficient transportation alternatives, it would have a beneficial effect.

3.5.2 Affected Environment

A. STUDY AREA DEFINED

The study area for energy use was identified to be the state of California, the same as the travel demand forecasts prepared by Cambridge Systematics for the MTC. This differs from the statewide program EIR/EIS (California High Speed Rail Authority and Federal Railroad Administration 2005), where the study area was six of the air quality basins traversed by the statewide HST preferred alternative (the air basins used were identified because the majority of intercity trips taken in California occur within them).

At this program level of analysis, the area studied to determine the potential impacts of the proposed HST system on electricity generation and transmission was the entire state of California because most of this infrastructure in the state contributes to the statewide grid. Therefore this analysis cannot apportion to the study area the use of any particular generation facilities. In general, any potential impacts on electrical production that may result from the proposed HST system would affect statewide electricity reserves and, to a lesser degree, transmission capacity. Some general discussion of potential effects on regional electricity production and transmission is included.

B. GENERAL DISCUSSION OF ENERGY RESOURCES

California is the tenth largest worldwide energy consumer and is ranked second in consumption in the United States, behind Texas. Of the overall energy consumed in the state, the transportation sector represents the largest proportion at 46%. The industrial sector follows at 31%, residential at 13%, and commercial at 10%. Petroleum satisfies 54% of California's energy demand, natural gas 33%, and electricity 13%. Coal fuel accounts for less than 1% of total energy demand in California. Electric power and natural gas in California are generally consumed by stationary users, whereas petroleum consumption is generally accounted for by transportation-related energy use (California Energy Commission 2002). A description of the existing energy resources and market conditions that could be potentially affected by the proposed alternatives is provided below.

Petroleum

Demand for transportation services (and, therefore, petroleum/gasoline) in California mirrors the growth of the state's population and economic output. The California Energy Commission (CEC) records of historical trends coupled with current population and economic growth and gasoline price projections were used to estimate that on-road miles traveled are anticipated to increase by 41% between 2003 and 2025—from 314 billion to 446 billion[4]. Notwithstanding this large increase, the CEC predicts that instate road transportation fuel will remain steady at about 15 billion gallons per year. Although on-road gasoline demand is projected to be flat over the next 20 years, on-road diesel demand is projected to increase by 78%, from 2.7 billion gallons in 2003 to 4.8 billion gallons in 2025. Jet fuel usage is projected to increase 100%, from about 3 billion gallons in 2003 to just less than 6 billion gallons in 2025. (California Energy Commission 2005a.)

Electricity

Electricity as energy is given detailed consideration in this analysis because of the projected use of electric energy to power the proposed HST system. Meeting electricity demand is primarily an operational issue for system operators—it is important in evaluating system reliability, determining congestion points on the electrical grid, and identifying potential areas where additional generation, transmission, and distribution facilities might be needed. This analysis is concerned with the adequacy of the generation and transmission infrastructure to accommodate the inclusion of the HST system in the state's electricity grid; distribution issues are not considered at this program level of analysis.

Electricity used to power the proposed HST system would be generated from within the entire state (i.e., not just by PG&E) and could be imported from outside the state. Therefore this analysis cannot apportion to the study area the use of any particular generation facilities. Issues related to electricity transmission are discussed below.

Existing Electricity Demand

Electricity demand is measured in two ways: consumption and peak demand. Electricity consumption is the amount of electricity—measured in gigawatt-hours[5] (GWh)—that consumers in the state use.

[4] These projections use the California Air Resource Board's 2004 California Greenhouse Gas standards, which require automakers to begin selling vehicles with reduced greenhouse gas emissions by model year 2009 (California Air Resources Board 2004).

[5] Electric energy is measured in watts (W): 1,000 watts is a kilowatt (kW), 1,000 kilowatts is a megawatt (MW), and 1,000 megawatts is a gigawatt (GW). Electric consumption over time is measured in kilowatt-hours (kWh), megawatt-hours (MWh), and gigawatt-hours (GWh).

According to the CEC, total statewide electricity consumption grew from 166,979 GWh in 1980 to 228,038 GWh in 1990, at an estimated annual growth rate of 3.2%. The 1990s saw a slowdown in demand growth because of an economic recession that lasted until the middle of the decade. The statewide electricity consumption in 1998 was 244,599 GWh, reflecting an annual growth rate of 0.9% between 1990 and 1998 (California Energy Commission 2006a). In 2005, statewide consumption was about 272,000 GWh.

In contrast to the concept of energy consumption, peak demand—measured in megawatts—is the amount of generation needed to keep electrons flowing in the electricity system at any given moment of peak demand, usually integrated over 1 hour. A single MW is enough power to meet the expected electricity needs of 1,000 typical California homes (California Energy Commission 2003). For comparison, 1 GW would be enough power for 1,000,000 typical homes. California's peak demand typically occurs on a day in August between 3 and 5 p.m. High temperatures lead to increased use of air conditioning, which in combination with industrial loads, commercial lighting, office equipment, and residential refrigeration, comprise the major consumers of electricity consumption in the peak-demand period in California (California Energy Commission 2000). In August 2006, according to CEC, peak electricity demand for California was expected to be 59,498 MW[6].

Existing Electricity Generation Capacity

In-state electricity generation, which accounted for 78% of the 2005 total electrical supply, is fueled by natural gas (38%); nuclear sources (14%); coal[7] (20%); large hydroelectric resources (20%); and renewable resources (11%), including wind, solar, and geothermal. Electricity imports in 2005 accounted for 22% of total production. (California Energy Commission 2006c.)

In-state generation capacity was expected to be about 56,697 MW in 2006, for a total net generation capacity of 71,095 MW, with the inclusion of 13,118 MW of imports. As noted above, peak demand in August 2006 was estimated to be 59,498 MW, indicating an operating reserve[8] margin of 18.5%[9] in an average temperature year. If 2006 had been a year of adverse conditions (i.e., one that had higher than average temperatures[10], high zonal transmission limitations, and high numbers of forced outages), the operating reserve margin would have been 7.4% without the advantage of demand response programs and interruptibles.[11] (California Energy Commission 2006d.)

For comparison's sake, Cal-ISO) declares a Stage 1 emergency when operating reserve margins fall below 7%; Stage 2 and 3 emergencies are declared when shortfalls of more than 5% and 1.5%, respectively, are imminent[12] (California Energy Commission 2004a).

Existing Transmission Capacity

Electricity transmission capacity refers to the maximum amount of power that can be carried from the generating source to the utility provider and is a key component in the electrical power delivery system. Transmission capacity affects the:

[6] Estimated. Based on average summer temperatures.

[7] Intermontane and Mohave coal plants are considered to be in-state facilities because they are in Cal-ISO-controlled areas.

[8] Operating Reserve - That capability above firm system demand required to provide for regulation, load forecasting error, equipment-forced and scheduled outages, and local area protection. It consists of spinning reserve and nonspinning reserve.

[9] (Operating Generation - Imports with Reserves)/(Demand - Imports with Reserves)

[10] In this case, high temperatures that have a 10% chance of occurring in any one year.

[11] Customers reducing their electricity consumption in response to either price or system reliability events, and customers being paid for performance based on wholesale market prices.

[12] A Stage 1 declaration serves as a warning; a Stage 2 emergency requires service interruptions for some or all of selected customers, many of whom receive reduced rates as compensation for their agreement to be curtailed; a Stage 3 emergency requires involuntary curtailment of service—also referred to as rotating outages—to keep the system from collapsing.

- Reliability of the electric power system.
- Flexibility to diversify the mix of fuels that produces electricity by giving consumers access to an array of electricity sources.
- Cost structure of the entire industry by giving low-cost power plants access to high-cost power markets.
- Competition among electricity sources by giving more sources access to more markets, both near and far. (National Council on Electricity Policy 2004.)

California's electricity transmission system comprises more than 31,000 miles (50,251 kilometers) of bulk electric transmission lines and their supporting towers and substations. It links generation to load in a complex electrical network that balances supply and demand on a nearly instantaneous basis. In addition to the in-state transmission connections, California has a system of transmission interconnections that connect its electricity grid with out-of-state electricity generation; specifically, California is part of the Western Interconnection. With a total importing capacity of 18,170 MW[13], California's interconnections serve a critical role in satisfying California's electricity consumption. Figure 3.5-1 depicts the state's major transmission paths.

Transmission lines statewide are frequently running to their capacity limits, forcing system operators to reduce the output from less costly generation units, while keeping less efficient generators running to prevent the system from overloading. In other instances, transmission lines have had outages causing rolling blackouts. For example, a rolling blackout occurred in southern California in August 2005 when roughly one-half million customers had their power interrupted. The CEC has recommended a number of probable near-term transmission system upgrades[14] that mostly affect transmission interconnection for transmission-strapped southern California. (California Energy Commission 2005c.)

Mimicking the statewide transmission capacity limits, the Bay Area has consistently experienced transmission congestion for several years, with the peninsula having experienced a number of rolling blackouts. To alleviate the Bay Area's congestion problems, PG&E has recently completed the Jefferson–Martin 230- kV) Cable Project, a regional transmission line that imports electricity from near San Mateo into San Francisco, and the intracity (i.e., San Francisco) Potrero–Hunters Point 115-kV Cable. The utility also expects a second regional transmission cable (the Trans-Bay DC Cable, 400 MW— from Strategic Transmission Plan) and a second intracity transmission project (Hunters Point–Martin 115 kV Cable) to be completed in 2007. These projects would improve reliability and allow PG&E to retire older generation units, which would improve immediate transmission capacity limits in the Bay Area. (California Energy Commission 2005c.)

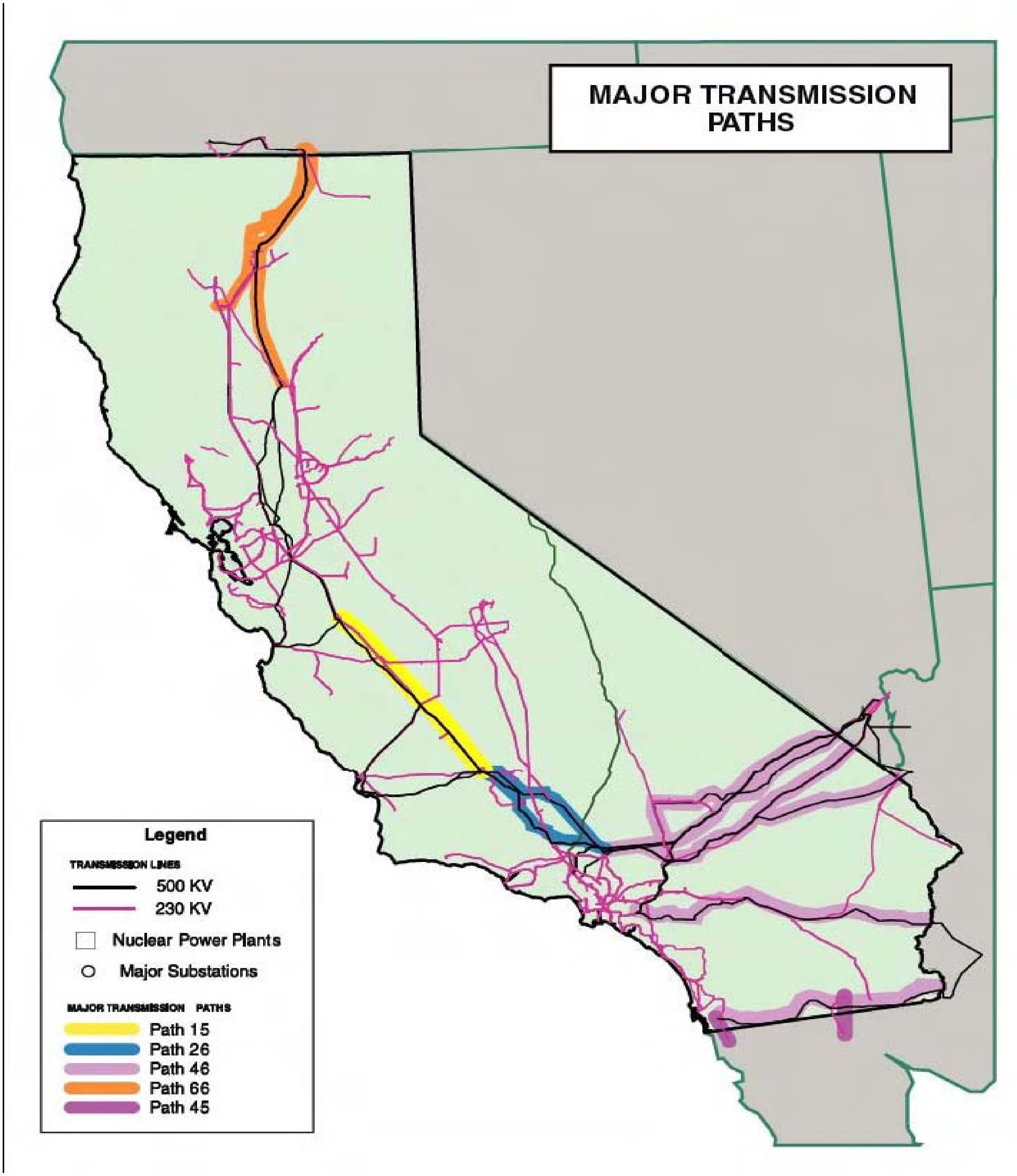
Electricity Demand and Generation Capacity Outlook

Extrapolating from the CEC's baseline prediction for statewide peak electricity demand in 2016, 2030's peak demand would be 82,880 MW[15] (California Energy Commission 2005d). Projections about generation capacity in 2030 are not possible because generation infrastructure decisions are

[13] Equivalent to approximately one-third of California's annual peak electricity demand

[14] Includes the Palo Verde -Devers No. 2 500 kV transmission project between Arizona and California and the Sunrise Powerlink 500 kV transmission project between the SDG&E and SCE service territories, both of which would reduce congestion on lines connecting, provide access to lower-cost generation, provide insurance against abnormal system conditions and power outages, and increase operating flexibility for California grid operators, reducing market power for generators and reducing the need for additional generation infrastructure. The latter would also provide interconnection to renewable resources located in the Imperial Valley. Two other near term projects, the Antelope Transmission Project and the Imperial Valley Transmission Project, would provide significant interconnection with wind projects in the Tahachapi Mountains and Imperial Valley, respectively.

[15] Based on the CEC's 2016 predictions and using the CEC's electricity demand growth estimates to extrapolate the 2016 prediction out to 2030. The low and high limits of the range of the forecasts are 70,486 and 74,465 MW, respectively.



Source: CEC, Systems Assessment & Facilities Siting Division, August 2005.

Figure 3.5-1
Major Transmission Paths
(230 to 500 kilovolt)

not generally made more than 2–3 years in advance of construction. Projections that are available run through 2010; recalling that the 2006 operating reserve during peak demand was 18.5%, the CEC projects that operating reserve margins in average-temperature years are projected to fall in the short term, reaching 16.5% by 2010, based on total net generation capacity of 71,263 MW and an average-temperature year demand of 62,995 MW. The CEC projections also include 2010 operating reserve margins of just 4.3%[16] in the case of adverse conditions, where demand response is realized and interruptible programs are used, or 0.4% where demand response is not realized and interruptible programs are not used, which would trigger a Stage 2 emergency in the former case and a Stage 3 in the latter. The CEC's finding about the reliability of California's electricity-generating resources is that generation is not keeping up with demand. The CEC states, "[c]onstruction of new power plants is not proceeding as planned, and the flow of new permit applications has noticeably decreased. California has more than 7,000 MW of permitted power plants that have not moved into construction. Adding to this, investor-owned utility (IOU) procurement focuses primarily upon near- and mid-term contracts, which perpetuates reliance upon the existing fleet of aging power plants." (California Energy Commission 2005b.)

Electricity Transmission Capacity Outlook

Historically, high-voltage transmission projects were planned and constructed to maintain reliability, connect a remote power plant to load centers, or provide access to a region with surplus generation. Future transmission projects would provide other strategic benefits, including insurance against contingencies, market power mitigation, fuel diversity, environmental benefits, and the meeting of state policy objectives, such as developing renewable resources and replacing or retiring power plants. Before the deregulation of the electricity industry in 1996, vertically integrated utilities made planning decisions on both generation and transmission projects. The utilities shared information about their generation plants and forecasts of power plant additions planned to meet their future loads. The utility would set a reliability objective and then select a combination of generation and transmission projects to achieve the reliability objective with minimum revenue requirement. Under a vertically integrated utility structure, integrated planning of generation and transmission was feasible. (California Energy Commission 2004b.)

Under the restructured electricity market, the integration between generation and transmission planning has changed. A lack of coordination between planning and decision-making for generation and transmission has resulted in transmission congestion because transmission infrastructure is not keeping pace with new generation facilities. As a result, as congestion and its associated costs go up, the expansion of transmission lines becomes economically justified. However, the price of power and the profit opportunities for generators are also affected by inefficient transmission expansion. (California Energy Commission 2004b.)

Natural Gas

California is the second largest consumer of natural gas in the nation, with consumption at more than 5.7 billion cubic feet (Bcf) (161 million cubic meters [Mcm]) per day in 2005. Approximately 42% of this total daily consumption was for electricity generation. Residential consumption accounts for 22%, followed by industrial, resource extraction, and commercial consumption. CEC's gas demand forecast projects continued growth at 0.07% annually through 2016, with volumes exceeding 6.1 Bcf (173 Mcm) daily by 2016, based on the 0.07% annual growth rate. (California Energy Commission 2006b.)

The total resource base (gas recoverable with today's technology) for the lower 48 states is estimated to be about 975 trillion cubic feet (Tcf) (28 trillion cubic meters [Tcm]), enough to continue current production levels for more than 50 years. Technology enhancements would continue to

[16] Based on high-temperature scenario demand of 66,797 MW.

enlarge this resource base; however, increases to production capacity are less certain (California Energy Commission 1999). Production in the continental United States is expected to increase from about 17 Tcf (0.48 Tcm) in 2005 base year to about 21 Tcf (0.59 Tcm) in 2030 (U.S. Department of Energy 2007). As of 2001, in-state natural gas production accounted for 15% of total consumption. Out-of-state production areas include the Southwest (38%), the Rocky Mountains (24%), and Canada (23%) (California Energy Commission 2006c).

California's Natural Gas Market Outlook

Although California's natural gas market is affected by nationwide price conditions, it has taken steps to insulate itself from the full magnitude of the price swing amplitudes. Since the height of the 2000-2001 energy crisis, California has built 2.2 Bcf (62.3 Mcm) of daily capacity to deliver natural gas supplies from Canada, the Rocky Mountains, and the Southwest, in addition to adding almost 1 Bcf (28 Mcm) of daily intrastate pipeline capacity. Utilities in California have also invested in underground storage capacity, an effective mechanism for controlling annual costs that will allow them to dampen the effect of future severe price increases by drawing on stored gas instead of buying high-priced natural gas on the open market. Since 2000-2001, California has added 38 Bcf (1.1 Bcm) of storage capacity, and, starting in 2003, users of those storage facilities have been placing natural gas into storage at record rates, and the state's inventory is at the high end of the 5-year average. Additional storage capacity additions are on-going. (California Energy Commission 2005b.)

The state of California has also provided utilities with the flexibility and tools to manage gas costs by purchasing natural gas supplies under different contract lengths and pricing terms and from a variety of supply sources. In addition, California is in the process of increasing its supplies of electricity from renewable power sources, such as wind, geothermal, and solar energy. California legislation enacted in 2002 (Senate Bill 1078) created the Renewable Portfolio Standard (RPS) Program, which requires retail sellers of electricity to increase their purchases of electricity generated by renewable sources, and establishes a goal of having 20% of California's electricity generated by renewable sources by 2017. Increasing California's renewable supplies will diminish the state's heavy dependence on natural gas as a fuel for electric power generation (California Energy Commission/California Public Utilities Commission 2003).

Relationship between Natural Gas and Electricity Resources in California

Increases in gas prices directly affect the price of electricity because of the large role that natural gas plays in electricity production throughout the Southwest—and in California in particular, where natural gas fueled 42.7% of electricity production in 2001. This percentage is likely to grow as the trend toward building natural gas power plants continues. During the spot-market price spike of February 2003, regional electricity prices rose 45% between early February 2003 and February 24, 2003, and an additional 150% between February 24 and February 26, 2003 (California Energy Commission/California Public Utilities Commission 2003). Such a dramatic price spike has not occurred since.

The functioning of the natural gas market, as well as the consequences of price changes in the natural gas market, is different from that of the electricity market. Unlike electricity, natural gas has the property of storability, which gives natural gas an advantage as a commodity over electricity. The storability of natural gas allows utilities to buy natural gas when prices are low and store it until prices rise, as well as price hedge in the futures markets, which mitigates short-term shortages. Long-term price increases are corrected by increases in production capacity, which are expected to bring prices down. Since the projected national in-the-ground natural gas reserves are expected to last for at least the next 50 years, actual supplies are not considered to be limiting, and short- and long-term prices are mostly a function of market conditions, assuming the trend toward improvements in natural gas production and transmission capacity continues (California Energy Commission/California Public Utilities Commission 2003).

Transportation Energy Consumption

Transportation accounts for a large portion of the California energy budget, with approximately 46% of the state's energy consumption resulting from the transport of goods and people. The population in California is projected to increase 28% by the year 2030. That growth equates to almost 10 million people (Cambridge Systematics 2007). Because of trends in travel demand, congestion, and other adverse travel conditions, the market for intercity travel in California that the proposed HST system could serve is projected to grow by up to 46% over the next 30 years.

Although travelers in, or who are visiting or leaving, the study area have several options for intercity travel—automobiles on interstate and state highways, commercial airlines, conventional passenger trains (Amtrak) on freight and/or commuter rail tracks, and long-distance commercial bus transit—the automobile is the predominant mode for intercity trips.

Transportation Energy Outlook

The recent fuel price increases have generated renewed interest in more fuel-efficient cars and in living closer to the workplace. Although it is a slow process to transform an automobile fleet, drivers are increasingly making automobile purchasing decisions based on fuel consumption concerns. Automobiles powered by diesel engines and engines that are hybrids composed of both electrical and gasoline components offer substantial fuel-efficiency upgrades over traditional gasoline engines.

Automobiles are most efficient when operating at steady speeds of 35–45 mph (56–72 kph) with no stops (U.S. Department of Energy 2006). Fuel consumption increases by about 30% when average speeds drop from 30 to 20 mph (48 to 32 kph), while a drop from 30 to 10 mph (48 to 16 kph) results in a 100% increase in fuel use with conventional automobile engines. Studies estimate that approximately 10% of all on-road fuel consumed is a result of congestion (California Energy Commission 1990).

As of 2005, 26 million automobiles were registered to drivers in California, which equated to the state being the second largest consumer of petroleum fuel in the world; only the United States consumes more. Because of this dependence on petroleum fuels, world geopolitical events can immediately and adversely affect the price and adequacy of California's fuel supply (California Energy Commission 2006e).

3.5.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

In 2000, passenger trips taken in California resulted in 354.9 billion automobile VMT (571.2 billion automobile VKT) and 75.8 million airplane VMT (122.8 million airplane VKT). By 2030, under the No Project Alternative, the total number of passenger trips estimated to be taken in California would result in about 416.7 billion automobile VMT (670.6 billion automobile VKT) and 131.9 million airplane VMT (213.9 million airplane VKT). The increase in passenger trips for is reflective of population growth expected over the same period.

Operational (Direct) Energy

As indicated in Table 3.5-3, the existing (Year 2000) energy used to power intrastate transportation was 2,002,140,708 million Btus (MMBtus), or 345 million barrels of oil. The 3.49 billion passenger trips estimated under the No Project Alternative would consume the equivalent of about 408 million barrels of oil. This is an increase of 63 million barrels of oil over existing conditions. On the one hand, this is a conservative estimate because, as noted in Section 3.5.3, automobile fuel efficiency decreases considerably as travel speed decreases below 30 mph (48 kph) and stop-and-go traffic increases. Because congestion levels under the No Project Alternative would likely be higher than they are under existing conditions, the increase in direct energy used in 2030 would have congestion-related cause to be higher than the estimated 63 million barrels. To illustrate this point, if the direct energy consumption factor for automobiles under a more congested No Project condition (increased by 5%, from 5,572 Btus/VMT to 5,851 Btus/VMT, and all other factors remained the same, the total direct energy consumption under the No Project Alternative would increase to 83 million barrels of oil, as opposed to 63 million barrels.

Key Findings

The No Project Alternative conditions would potentially place additional demand on statewide energy supplies compared to existing conditions as a result of increased passenger trips, higher levels of congestion, and slower speeds on intercity highways. There is some level of uncertainty because it is not clear how the energy intensity of the state's automobile fleet would change in the next 20 years.

Table 3.5-3
Annual Intercity Operational Energy Consumption in the Study Area

	2000 Existing[f]	2030 No Project Alternative[f]
Annual VMT (VKT) (millions)		
Auto[b]	354,878 (571,121)	416,681 (670,585)
Airplane[c]	76 (123)	132 (214)
HST[d]	0	0
Annual Energy Consumption (MMBtus)		
Auto	1,977,377,605	2,321,748,527
Airplane	24,763,102	43,128,553
HST	0	0
Total Energy Consumption (MMBtus[a])	2,002,140,708	2,364,877,081
Change in Total Energy from Existing (MMBtus[a])	—	362,736,373
Total Energy Consumption (Barrels of Oil[e]) (millions)	345	408
Change in Total Energy from Existing (Barrels of Oil[e]) (millions)	—	63

Notes:

[a] One Btu is the quantity of energy necessary to raise 1 pound of water 1° F.

[b] Based on 6/11/07 VMT/VHT data (Cambridge Systematics 2007).

[c] Based on airplane passengers flights (Cambridge Systematics 2007). Airplane VMT based on average number of passengers per flight: 101.25 (using 70% load factor per Business Plan).

[d] No HST is included in the existing conditions (2000) or No Project Alternative.

[e] One barrel of crude oil is equal to 5.8 MMBtus.

[f] Rounded.

Peak-Period Electricity Demand

The No Project Alternative electricity consumption would increase slightly over existing conditions resulting from programmed and funded projects and growth anticipated under the No Project Alternative. The possible future electrification of Caltrain, commuter rail systems, and/or Amtrak would also increase electricity use. While these projects would be regionally significant, they are small in scale compared to overall electricity usage and would be captured by routine electricity consumption forecasts by CEC, allowing electricity generation and transmission planning to account for and accommodate their additions.

Key Findings
CEC electricity supply capacity and demand projections account for the projected routine expansion increases of in the state's electricity requirements. Potential electricity demand under the No Project Alternative would be satisfied by expected expansion in generating capacity. No significant potential impacts on electricity generating capacity have been identified. *(Less than significant.)*

B. HIGH-SPEED TRAIN ALTERNATIVE

The HST Alternative would increase the transportation energy use in California with respect to existing conditions. However, compared to the No Project Alternative the HST Alternative would use less energy. As indicated in Table 3.5-4, energy use would decline by the equivalent of about 22 million barrels of oil when compared to the No Project Alternative. Additional energy savings over the No Project Alternative would be realized with implementation of the HST system because it would also ease congestion. The magnitude of the expected annual operational energy savings resulting from the HST system could also be lower than shown in Table 3.5-4 given the possibility of automobile fuel efficiency improvements.

Table 3.5-4
Annual Operational Energy Consumption in Study Area

	2000	2030 Alternatives	
	Existing	No Project Alternative[e]	HST Alternative
Annual VMT[b, c, g] (VKT) (millions)			
Auto[f]	354,878 (575,256)	416,681 (675,440)	389,903 (632,033)
Airplane[c]	76 (123)	132 (214)	73 (119)
HST	0	0	43 (70)
Annual Energy Consumption (MMBtus[a])			
Auto	1,977,377,605	2,321,748,527	2,172,540,142
Airplane	24,763,102	43,128,553	24,008,005
HST	0	0	39,707,950
Total Energy Consumption (MMBtus)	2,002,140,707	2,364,877,081	2,236,266,097
Change in Total Energy from Existing (MMBtus)		362,736,373	234,125,389
Change in Total Energy from No Project (MMBtus)	—	—	-128,610,984
Total Energy Consumption (Barrels of Oil[d]) (millions)	345	408	386
Change in Total Energy from Existing (Barrels of Oil[d]) (millions)	—	63	40
Change in Total Energy from No Project (Barrels of Oil[d]) (millions)	—	—	-22

	2000	2030 Alternatives	
	Existing	No Project Alternative[e]	HST Alternative

Notes:

[a] One Btu is the quantity of energy necessary to raise 1 pound of water 1°F.
[b] Based on airplane passengers flights (Cambridge Systematics 2007). Airplane VMT based on average number of passengers per flight: 101.25 (using 70% load factor per business plan HST VMT (California High-Speed Rail Authority 2000)
[c] Does not include airplane VMT resulting from passengers making connections to other flights to continue or complete their journey because these are a minor portion of the HST-served market.
[d] One barrel of crude oil is equal to 5.8 MMBtus.
[e] Fuel consumption for No Project would increase beyond the figures presented here as speeds drop below 30 mph on congested highways.
[f] Based on 6/11/07 VMT/VHT data (Cambridge Systematics 2007).

Energy intensities were calculated using passenger miles traveled (PMT)/passenger kilometers traveled (PKT) for each of the modes. Table 3.5-5 lists the energy intensity consumption factors of each of the modes. HST service would offer a sharp reduction in energy consumption per passenger mile (kilometer), compared to other modes, if actual ridership were to fall within the range of current projections and the planned operating plan were implemented. Specifically, whereas intercity trips taken in automobiles would average about 2,320 Btus/PMT (1,438 Btus/PKT) and those trips taken in airplanes would require 3,230 Btus/PMT (2,003 Btus/PKT), the HST system would require 975 Btus/PMT (605 Btus/PKT).

Table 3.5-5
Energy Consumption per Passenger Mile Traveled by Mode (PMT)

Mode	Energy Consumption[d]
Intercity Passenger Vehicles (auto, van, light truck)[a]	2,320 Btus/PMT (1,438 Btus/PKT)
Airplanes[b]	3,230 Btus/PMT (2,003 Btus/PKT)
High-Speed Train[c]	975 Btus/PMT (605 Btus/PKT)

Notes:
[a] Based on 2.4 passengers per vehicle.
[b] Based on 101.25 passengers per vehicle (70% load factor).
[c] Based on 994 passengers per 16-car trainset.
[d] Rounded.

Regional

In addition to the statewide direct automobile VMT savings that would result from travelers choosing HST travel, the proposed HST system would potentially provide additional regional VMT reductions, compared to the No Project Alternative conditions. Proposed HST station location options would be more numerous than airports, which would result in a lessening of the average distance required for passengers to travel from their points of origin to the mode transfer point (and vice versa) because of the likelihood that one or more of the stations would be closer to their point of origin than would their respective regional airport.

Key Findings

The comparison of the HST Alternative to the No Project Alternative shows that the proposed project would decrease energy use statewide by 22 million barrels of oil per year. (*Beneficial impact.*)

Peak-Period Electricity Demand

The electricity requirement of the HST Alternative operating schedule would be about 794 MW[17] during peak electricity demand periods in 2030. It is difficult to analyze how such potential load additions would affect the statewide electricity generation and transmission system. With respect to electricity surplus, as noted above, such a long time horizon has uncertainty, especially on the supply side, and capacity additions are difficult to predict more than 2 to 3 years into the future. The furthest out that the CEC currently provides generation and surplus projections is 2010. Whereas the operating reserve in 2006 was 18.5%, the projected 2010 operating reserve is 16.5% during average temperature conditions[18]. To illustrate how the addition of the HST Alternative would affect the state's electricity grid in 2010, were it hypothetically completely operational by then, the HST operating plans would add enough load to bring the operating reserve down to 9.0%, all else being equal. This is only hypothetical, and it is expected that by the time the HST system were to become operational, the entire system would be larger and the amount by which the HST load would cause the operating reserve to decline would be smaller.

Another way to understand how the additional load would affect the statewide electricity system is to compare the expected load caused by the addition of the HST system to the projected demand in the build year (2030) because prediction horizons for demand estimates are longer than for capacity additions, as noted. The additional 794-MW load that would be placed on statewide electricity generating resources by the HST system would represent approximately 0.96% of the 2016 CEC-predicted statewide electricity demand extrapolated to 2030.[19] When viewed in the context of California's entire electricity system, with the percentage of demand acting as a conceptual surrogate for supply capacity, the additional load that the HST system would place on the system is not significant. Moreover, the HST system would be built and become operational in stages, which would allow the system to gradually increase its electricity consumption rate to 794 MW instead of placing the entire load on the state's production and transmission resources abruptly. The gradual increase would allow the in-state and out-of-state electricity generation and transmission industries and planners to anticipate and respond to the effects of the proposed HST system on generating and transmitting resources.

Regional

Regional impacts on the electricity grid could occur if the proposed HST system contributed to electricity transmission deficiencies, or bottlenecks, which were described in Section 3.5.2. If bottlenecks were to be aggravated by the HST system, a potentially significant impact could result. Through careful electrification design (i.e., design the system so that it draws power from the electricity grid at several places throughout the state), it would be possible to minimize or eliminate such potential problems. Also, bottlenecks in the current grid system are being addressed. If planning transmission line capacity continues to grow to anticipate statewide needs, the HST system would not have the potential to cause a significant impact on transmission.

Key Findings

The HST Alternative could cause potentially significant impacts on the state's electricity grid if the generation and transmission capacity were not equipped to handle the additional load. However, the HST system would represent a small percentage of the generating and transmission capacity required to satisfy projected overall demand. Staggering the completion of construction and the start of major

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17 Based on an average electricity use of 74.2 kW/train mi, which equates to an average electricity use rate of the order of 12 MW per trainset when integrated over 1 hour. These are averages and do not reflect acceleration or changes in grade; they are for planning purposes only.

18 So-called adverse conditions would result in a 4.3% during higher than average temperature conditions if demand response and interruptibles are realized and implemented, respectively.

19 This is consistent with the results identified in the Statewide Program EIR/EIS, which was estimated for 2020. The analysis for this Program EIR/EIS was for 2030.

operations would make the load additions less abrupt than would be the case if the start of the full planned operations were to occur simultaneously.

C. HST CONSTRUCTION (INDIRECT) ENERGY

Construction of the programmed and funded transportation improvements under the No Project Alternative would require less energy than construction of the HST system.

Project Construction

The HST system construction-related energy consumption would result in a one-time, non-recoverable energy cost, which would occur during construction of on-the-ground, underground, and aerial facilities such as trackwork, guideways, structures, maintenance yards, stations, and support facilities. Details regarding energy conservation practices have not been specified for the HST system, which has not been designed in detail, nor have construction methods and staging been planned at this time. Given the scope and scale of the improvements proposed as part of the HST system, however, it is anticipated that the construction-related energy requirement would be substantial. Table 3.5-6 shows estimates of potential construction-related indirect energy consumption for the statewide HST system.

Table 3.5-6
Non-Recoverable Construction-Related Energy Consumption

Structure	Rural vs. Urban[a]	Facility Quantity[b]	Energy Consumption[c] (MMBtus)
HST guideway (at grade)	Rural	2,074 guideway mi (3,361 km)	25,485,000
	Urban	619 (1,003 km)	11,829,000
HST guideway (elevated)	Rural	271 guideway mi (439 km)	15,026,000
	Urban	153 (249 km)	8,529,000
HST guideway (below grade, cut)	Rural	30 guideway mi (497 km)	3,557,000
	Urban	70 (114 km)	11,469,000
HST guideway (below grade, tunnel)	Rural	128 guideway mi (208 km)	15,034,000
	Urban	110 (178 km)	35,966,000
HST station	N/A	23 stations	1,794,000
HST Total			128,688,000

[a] Assumes the HST would be constructed in rural and urban areas at the following proportions:
- Bay Area to Central Valley: Rural (40%), Urban (60%)
- Sacramento to Bakersfield: Rural (95%), Urban (5%)
- Bakersfield to Los Angeles: Rural (70%), Urban (30%)
- LOSSAN: Rural (30%), Urban (70%)
- Los Angeles to San Diego via Inland Empire: Rural (60%), Urban (40%)

[b] Measured in guideway miles for non-discrete structures (e.g., highways and HST guideways), and in structure quantities for discrete structures (e.g., HST stations).

[c] Rounded.

As shown in the table, the construction of the proposed HST Alternative (statewide) would consume 128,688,000 Btus, or about 22 million barrels of oil. Energy savings resulting from operation of the HST Alternative would repay the construction energy consumption in about 1 year.

Secondary Facilities

It is reasonable to assume that secondary facilities, such as those used in the production of cement, steel, and so on, would employ all reasonable energy conservation practices in the interest of minimizing the cost of doing business. Therefore, it can reasonably be assumed that construction-related energy consumption by secondary facilities would not consume nonrenewable energy resources in a wasteful, inefficient, or unnecessary manner under either HST Alternative.

Construction of the HST Alternative is anticipated to take a number of years. Construction would occur in stages, and some segments would be open for operation while others are still under construction. Given the scope and scale of the HST system, it is anticipated that secondary construction-related energy requirements would be substantial.

Due to the scope and scale of the improvements proposed as part of the HST system, construction-related energy impacts, both project and secondary, would be potentially significant. Construction of the HST Alternative would potentially represent a significant use of nonrenewable resources.

3.5.4 Role of Design Practices in Avoiding and Minimizing Effects

The selected electrically powered HST technology is energy efficient, requiring substantially less energy than other modes of intercity travel. Implementation of the HST Alternative throughout the state is anticipated to reduce energy use over the No Project Alternative.

This is a broad program-level analysis reviewing potential statewide energy use and impacts related to the proposed HST Alternative. The HST system would be designed to minimize electricity consumption. The design particulars would be developed at the project level of analysis, but would include the following:

- Use regenerative braking to reduce energy consumption of the system.
- Minimize grade changes in steep terrain areas to reduce the use of electricity during peak periods.
- Use energy-saving equipment and facilities to reduce electricity demand.
- Maximize intermodal transit connections to reduce automobile VMT (VKT) related to the HST system.
- Develop and implement a construction energy conservation plan.
- Develop potential measures to reduce energy consumption during operation and maintenance activities.

3.5.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the discussion in CEQA Appendix F on energy conservation, the HST Alternative would have a potentially significant impact related to long-term electric power consumption when viewed on a systemwide basis. It is calculated that the statewide HST system would increase the projected statewide electricity demand by approximately 0.96% in 2030. The electricity demand is consistent with what was identified for the statewide HST system in the Statewide Program EIR/EIS. Although the HST system would result in an increase in electricity demand, it also represents a mode of transportation that is more energy efficient than travel by automobile. The HST system would result in an overall reduction in total energy consumption (combined electric power demand and oil consumption). The following mitigation strategy as well as the design practices discussed in Section 3.5.4 would be applied to further reduce operational energy consumption and can be refined and applied at the project-level.

- Locate HST maintenance and storage facilities within proximity to major stations/termini.

Construction of the HST Alternative would result in one-time non-recoverable energy consumption costs in addition to energy consumed by the planned transportation improvements included in the No Project Alternative. The result of the construction of the HST Alternative would be a new transportation mode that would reduce fuel consumption as compared to the 2030 No Project Alternative. At the program level this impact is considered significant due to the uncertainty of future projections of energy demand and generation capacity to 2030. The following mitigation strategies can be refined and applied at the project-level to reduce this impact:

- Develop and implement a construction energy conservation plan.
- Use energy efficient construction equipment and vehicles.
- Locate construction material production facilities on-site or in proximity to project construction sites.
- Develop and implement a program encouraging construction workers to carpool or use public transportation for travel to and from construction sites.

The above mitigation strategies are expected to reduce the short-term and long-term electric power consumption impacts of the HST system to a less-than-significant level. Additional environmental assessment would allow a more precise evaluation in the second-tier, project-level environmental analyses.

3.5.6 Subsequent Analysis

Subsequent energy analysis would be required in a project-level environmental document. Detailed analysis of base and peak-period electricity requirements and transmission infrastructure would be required to more precisely assess the adequacy of electricity generation and transmission capacity relative to demand for each alignment alternative to be pursued. Comprehensive traffic analysis for future conditions would be required to assess regional energy impacts in more detail for each segment.

Subsequent energy analysis at the project level would follow the methodology applied in this evaluation but would employ more detailed traffic and electrical input data for the energy consumption analysis. Energy consumption factors would be updated using the latest available published information. Detailed construction staging, sequencing, methods, and practices would be necessary to support a quantitative analysis of construction energy consumption.

3.6 Electromagnetic Fields and Electromagnetic Interference

This section describes the potential impacts of electromagnetic fields (EMFs) associated with operation of the No Project and the HST Alignment Alternatives[1]. The principal topics discussed in this section are potential impacts on personal health and potential impacts on electronic and electrical devices as a result of electromagnetic interference (EMI).

3.6.1 Regulatory Requirements

Neither the federal government nor the State of California has established regulatory limits for EMF exposure. The Federal Communications Commission (FCC) regulates sources of radiofrequency (RF) fields to maintain the quality of wireless communications across the spectrum. The FCC, which does not regulate for health and safety, has adopted regulations applicable to EMF exposure that were derived from health and safety evaluations made by the American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) and the National Council on Radiation Protection (NCRP). FCC regulations apply to devices that produce RF radiation, such as the proposed HST wireless systems, for both operational and amenity purposes. FCC regulations otherwise apply only if HST operations (RF interference) interfere with legitimate spectral uses.

Voluntary standards for EMF exposure have been developed by the International Committee on Electromagnetic Safety (ICES), which is sponsored by the IEEE. The federal and state governments do not enforce these voluntary standards. The standards are based on studies of electrostimulation (i.e., nerve and muscle responses to the internal electric field [EF] in the body). ICES standards recommend maximum permissible 60-Hz magnetic field (MF) exposure levels that are a few thousand times higher than 0.3 to 0.4 microtesla (μT) (3 to 4 milligauss [mG]). Magnetic fields greater than 0.3 to 0.4 μT are relatively uncommon exposures that are found in a small percentage of homes that have been shown to have a possible association with childhood leukemia based on inconclusive evidence (National Institute of Environmental Health Sciences 1998, 1999; International Agency for Research on Cancer 2002). Unresolved scientific issues concerning health effects of power frequency related extremely low frequency (ELF) MFs were examined extensively by the California Department of Health Services (Neutra et al. 2002) in response to a request from the California Public Utilities Commission. No evidence substantiates a relationship between ELF EFs and cancer (International Agency for Research on Cancer 2002), and the low-level EFs typically found in homes have not been associated with other diseases (National Institute of Environmental Health Sciences 1998; Institute of Electrical and Electronic Engineers 2002). The ANSI/IEEE standards; NCRP recommendations, International Commission on Non-Ionizing Radiation protection (ICNIRP) guidelines, American Conference of Governmental Industrial Hygienists, Inc. (ACGIH) guidelines suggest maximum permissible 60-hertz (Hz) EF levels for public exposure for electric transmission from 4.2 to 10 kV per meter.

3.6.2 Characteristics of Electromagnetic Fields

EMFs occur both naturally and as a result of human activity. Naturally occurring EMFs include those caused by weather and the earth's MF. EMFs also are generated by technological application of the electromagnetic spectrum for uses such as the generation, transmission, and local distribution of electricity; electric appliances; communication systems; marine and aeronautical navigation; ranging and detection equipment; industrial processes; and scientific research.

EMFs are described in terms of their frequency, or the number of times the EMF changes direction in space each second. Natural and human-generated EMFs encompass a broad frequency spectrum. In the United States, the electric power system operates at 60 Hz, or cycles per second, meaning that the field

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

reverses its direction 60 times per second. In Europe, some parts of Japan, and many other regions, the frequency of electric power is 50 Hz. Radio and other communications operate at much higher frequencies; many are in the range of 500,000 Hz (500 kilohertz) to 3 billion Hz (3 gigahertz). In areas not immediately adjacent to transmission lines, 60-Hz EMFs exist because of electric power systems and uses such as building wiring and electrical equipment or appliances.

The strength of MFs often is measured in µT or mG. As a baseline for comparison, the geomagnetic field ranges from 50 to 70 µT (500 to 700 mG) at the surface of the earth. Research on ambient MFs in homes and buildings in several western states has found average MF levels within rooms to be approximately 0.1 µT (1 mG), and measured values range from 0.9 to 2.0 µT (9 to 20 mG) in the immediate area of appliances (Severson et al. 1988, Silva et al. 1988).

Depending on the configuration of the source, the strength of an EMF decreases in proportion to distance or distance squared, or even more rapidly. Because the rate of decrease and the distance at which impacts become insignificant depend on technical specifications, such as the source's geometric shape, size, height above the ground, and operating frequency, it is not possible to define a characteristic distance for the extent of field effects that applies in general for all sources. Because of their rapid decrease in strength with distance, EMFs in excess of background levels are likely to be experienced only comparatively near sources. Consequently, only persons on or close to the proposed HST system would be likely to experience such increases, and although HST operations could introduce some very low but measurable changes in 60-Hz MFs up to 1,000 ft or more from the right-of-way, these low-level changes are not known to be harmful or hazardous. ELF is variously defined as having a lower limit of greater than zero (3 or 30 Hz) and an upper limit of 30, 100, 300, or 3,000 Hz. The HST catenary and distribution systems would have primarily 60-Hz fields.

In addition to the 60-Hz EMFs generated by the power supply system, the HST Alignment Alternatives would generate incidental RF fields and also would use RF fields for wireless communications. The 60-Hz electric and MFs from power-supply systems would occur everywhere near the energized conductors, but only the MFs would vary in strength, depending on load. Load would depend on the number of trains in the segment and their operating conditions (acceleration, speed, weight of vehicles, passengers and freight, grade). Hence, in time, the MFs are variable, whereas the EFs are constant. Similarly, EFs along the route would be similar for a given distribution and transmission voltage, whereas MFs along the route would depend on nearby loads. Therefore, daily MF averages would differ for different locales because of different local HST traffic. The information presented in this document concerns primarily EMFs at power frequencies of 50 or 60 Hz and RFs produced intentionally by HST communications or unintentionally by electric discharges (arcing) between the catenary wire and the train's power pickup and other sources of corona discharge typical of high-voltage systems. EMI occurs when the EMFs produced by a source adversely affect operation of an electrical, a magnetic, or an electromagnetic device. EMI may be caused by a source that intentionally radiates EMFs (e.g., a broadcast station) or one that does so incidentally (e.g., an electric motor).

3.6.2.1 CEQA Significance Criteria

For purposes of this discussion, an HST alignment alternative would be considered to result in a significant effect on the environment if it would expose people to a documented health risk associated with EMFs or interfere with implanted biomedical devices.

3.6.3 Environmental Consequences: Past Findings

In the statewide program EIR/EIS (California High Speed Rail Authority and Federal Railroad Administration 2005) EMF/EMI related to the HST Alternative was considered by conducting a search of existing literature and expert opinion (volunteer scientists and engineers from academia and industry working in accordance with IEEE rules) based on that literature. Issues concerning EMF[2] biological and health effects for the HST alternative are the subject of the scientific discipline known as bioelectromagnetics, which is served by the Bioelectromagnetics Society, other scientific organizations, and extensive scientific literature that has been critically reviewed by scientific expert committees convened by a number of national and international bodies. This body of information was used in the statewide program EIR/EIS to describe the potential effects of each of the system alternatives. The medical and scientific communities have been unable to determine whether usual residential exposures to EMFs cause health effects or to establish any standard or level of exposure that is known to be either safe or harmful.

There is no scientific consensus that there are adverse effects of low-level EMFs. Numerous studies have addressed but failed to establish any significant adverse health effects, and various industry, government and scientific organizations with expertise in EMF technology have produced a range of voluntary standards that represent their best judgment of what levels are considered safe. The ELF EMF that would result from the operation of the HST system is substantially below any standards examined by these experts. Consequently, the Authority and the FRA found that, based on review of the scientific evidence and considering the CEQA Appendix G thresholds of significance for effects on human beings, the increased level of EMF as a result of the HST system operation would be less than significant at a programmatic level under CEQA and are not significant under NEPA.

Likewise, the HST system would introduce additional EMI at levels for which there are no established adverse impacts. Extensive studies have failed to establish any specific levels of additional EMI/EMF exposures that result in adverse health effects. The Authority and FRA found, considering the Appendix G thresholds of significance for effects on human beings, that EMI/EMF exposures are not significant at the programmatic level under CEQA or NEPA.

The FRA also has concluded an extensive study of EMF/EMI related to the conversion of a section of Amtrak's Northeast Corridor to electric traction (Federal Railroad Administration 2006) The study quantified the levels of ELF (3–3,000 Hz) EMFs and RF (300 kHz to 50 GHz) electric fields near electric facilities along Amtrak's Northeast Corridor (NEC) between New Haven, Connecticut, and Boston, Massachusetts.

Measurements were taken close to traction power stations and the electric conductors that make up the overhead catenary system on railroad rights-of-way and showed typical increases of one to two orders of magnitude for EMFs from pre-electrification measurements. Other measurements showed that away from the power equipment or the overhead catenary system, very little difference existed between pre- and post-electrification measurements, indicating that the impact on surrounding areas was minimal.

At locations above or under an electrified rail line (overpasses or underpasses), no significant (greater than 1 mG) very low frequency (VLF) (3–30 kHz) or low frequency (LF) (30–300 kHz) MFs were measured. Measured broadband RF electric fields were relatively low, with a maximum measurement of 2% of the FCC occupational standard at 5 m from the track centerline. Also, measured broadband RF electric fields at the overpass and underpass were near zero.

The study characterized the ELF and RF field levels in the passenger compartment and operator's cab of an Acela Express train for comparison with earlier data (1993 Amtrak EMF survey).

> The ELF MF measurements showed significant temporal variability because of operation of the train. This variability is common to all electric transportation systems. The measured ELF electric fields in the passenger compartment were a maximum of 52 volts

[2] EMF covers ELF and RF forms of electric and magnetic fields, and electromagnetic fields.

> per meter (V/m) and average less than 4 V/m. (Federal Railroad Administration 2006, page 3)

The study concluded by comparing the maximum ELF electric and MF readings with exposure limits in the ACGIH and IEEE C95.6 standards.

> None of the limits were exceeded. All RF readings were logged directly as a percentage of the occupational FCC standard. None of the readings were greater than 3% of this standard. Thus, all readings were also less than 3 percent of the IEEE C95.1 and ACGIH occupational limits. Because the general public limits are lower than the occupational by factor of 2.2, the electric field limits for the general public were similarly never exceeded. (U.S. Department of Transportation, Federal Railroad Administration. 2006, page 3)

This study reinforces the conclusion that minimal EMI/EMF exposures at levels for which there are no documented health risks are anticipated and that EMI/EMF concerns are less than significant at the programmatic level under CEQA and not significant under NEPA. Furthermore, the Authority in the CEQA findings and the FRA in the ROD for the statewide program EIR/EIS adopted design practices and mitigation strategies to address potential EMI/EMF issues for the HST system to be applied and refined at the project-level in the future. It is anticipated that the use of the design practices and mitigation strategies will reduce exposure to EMFs and reduce the potential for EMI with biomedical devices to the lowest practical level. These design practices and mitigation strategies are summarized in the following sections.

The prior analysis of alignment alternatives for the HST system considered the diverse geography, communities, and land uses that would be traversed by the system, including the diversity of potential EMF exposures, although very low, in widely varied urban, suburban, rural, agricultural, and industrial areas, and concluded that at the program-level of analysis potential EMI/EMF impacts were not distinguishable among the alignment alternatives. The same is true for this program level analysis of potential alignment alternatives to connect the San Francisco Bay Area and the Central Valley portions of the HST system.

3.6.4 Design Practices

Standard design practices for overhead catenary power supply system substations, transmission lines, and vehicles of the approved HST system include the use of appropriate materials, spacing, and, if necessary, shielding to avoid potential EMF/EMI impacts and to reduce the EMFs and EMI to a practical minimum.

3.6.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the incorporation of design practices, each HST alignment alternative would result in some increase in exposure to EMFs but at levels for which there are no documented health risks. The impact therefore is considered less than significant at the programmatic level. The HST alignment alternatives would have similar extremely low potential for ELF EMFs to interfere with biomedical devices. The impact is considered less than significant at the programmatic level. While EMF impacts are considered less than significant at the programmatic level, in addition to the design strategies described above and out of an abundance of caution, the mitigation strategies described below for avoiding and reducing EMF exposures to a practical minimum will be carried forward for consideration in project-level analyses for the HST system.

- Reduce EMI with catenary components that minimize arcing and radiation of RF energy.
- Reduce potential EMI by selecting RF devices designed for a high degree of electromagnetic capability.

- Reduce EMI with electronic filters.
- Reduce EMI by relocating receiving antennas or by changing antenna design to antennas with greater directional gain.
- Establish safety criteria and procedures and personnel practices to avoid exposing employees with implanted medical devices to EMF levels that may cause interference with such devices.

3.6.6 Subsequent Analysis

The following issues would be evaluated as part of the project-level analysis of an HST system.

- Proximity of occupied structures to new high-voltage transmission lines serving HST substations.
- EMFs at passenger stations.
- EMFs in the vehicle compartment.
- EMFs at specific locations used by the train crew.
- Earth-return currents or power flows in circuits along the rails, where some fraction of the current finds its way back to substation or generating station through the earth for various regions and soil conditions, and the effects of different design and construction practices on these currents. The substations and generating stations themselves would be soundly connected to ground, allowing the earth currents to return there.
- Identification of specific structures (e.g., pipelines, cables, fences) that are particularly susceptible to induced ELF currents and methods for mitigation.
- Identification of receptors (e.g., telecommunications and research facilities) at specific locations with possibly greater sensitivity to EMI impacts.
- Spectral composition of RF generated by the pantograph-catenary contact under operating conditions.
- Technical features (e.g., frequency, field strengths, modulation system) of the right-of-way-to-train wireless communications system.
- Possible development of an electromagnetic compatibility control plan (as described in APTA SS-E-010-98) to characterize EMI sources, reduction techniques, and susceptibility control procedures (shielding, surge protection, fail-safe circuit redesign, changed location of antennas or susceptible equipment, redesign of equipment, enclosures for equipment); inclusion of a safety analysis and failure analysis; and addressing of grounding or shorting hazards.

3.7 Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice

This section evaluates the potential impacts of the No Project and HST Alignment Alternatives on land use compatibility, communities and neighborhoods, and property.[1] This section also addresses environmental justice in accordance with the provisions of Executive Order (EO) 12898. This evaluation describes how existing conditions compare with the No Project Alternative and how the No Project Alternative compares with the potential impacts of the HST Alignment Alternatives and station location options in the region being studied.

3.7.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY PROVISIONS

Land Use, Communities and Neighborhoods, and Property

These sections address the potential effects of each of the alignment alternatives on existing and planned land uses. These sections include a discussion of the existing uses in and adjacent to areas where property acquisition may be needed for an alignment alternative, an analysis of the changes to these uses that may occur with an alignment alternative, a discussion of potential inconsistencies with land use plans, and identification of general mitigation strategies. The discussion of potential inconsistencies with planned land uses does not imply that the Authority, a state agency, would be subject to such plans or local ordinances, either directly or through the NEPA or CEQA process. The information is provided to indicate potential land use changes that could result in environmental impacts.

Environmental Justice

EO 12898, known as the federal environmental justice policy, requires federal agencies to address to the greatest extent practicable and permitted by law the disproportionately high adverse human health and environmental effects of their programs, policies, and activities, on minority and low-income populations in the United States. Federal agency responsibilities under this EO also apply to Native American programs. Department of Transportation (DOT) Order 5610.2 on environmental justice defines "disproportionately high and adverse effect on minority and low-income populations" to mean an adverse effect that is predominately borne by a minority population and/or a low-income population or that would be suffered by the minority population and/or low-income population and that is appreciably more severe or greater in magnitude than the adverse effect that would be suffered by the nonminority population and/or non-low-income population (Department of Transportation Order 5610.2, Appendix Definitions, sub.[g]).

The California Government Code defines environmental justice as the "fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (California Government Code § 65040.12[e]). There are no specific state procedures prescribed for consideration of environmental justice issues related to the proposed HST Alignment Alternatives.

B. METHODS OF EVALUATION OF IMPACTS

The analysis was conducted using U.S. Census 2000 block group information/data compiled in a geographic information systems (GIS) format, local community general plans or regional plans, and land use information provided by the planning agencies in each of the regions. Existing and future conditions were described for the No Project Alternative by documenting existing information for

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

existing and planned future land use policy near HST Alignment Alternatives and potential station location options, development patterns for employment and population growth, demographics, communities and neighborhoods, housing, and economics. The No Project Alternative was compared to the planned uses reflected in general plans and regional plans to see if it may result in potential effects on future development. The general and regional plans consulted for this section are listed in Chapter 14, "Sources Used in Document Preparation."

The ranking systems described below were used to evaluate potential impacts for the HST Alignment Alternatives for land use changes, land use compatibility, and property. Potential impacts on communities and neighborhoods were also considered. The presence of minority populations and low-income populations in the study area for an alignment alternative was identified to consider potential environmental justice issues. Because this is a programmatic environmental review, the analysis of these potential impacts was performed on a broad scale to permit a comparison of relative differences among the alignment alternatives. Further evaluation of potential impacts would occur at the project-level environmental review.

Land Use Compatibility

Future land use compatibility is based on information from general plans and other regional and local transportation planning documents. These documents were examined to assess an alignment alternative's potential consistency with the goals and objectives defined therein. An alignment alternative is considered highly compatible if it would be located in areas planned for transportation multi-modal centers or corridor development, redevelopment, economic revitalization, transit-oriented development, or high-intensity employment. Compatibility would be considered low if an alignment alternative would be potentially inconsistent with local or regional planning documents. For example, homes and schools are more sensitive to changes that may result in increased noise and vibration (see Section 3.4, "Noise and Vibration") or increased levels of traffic congestion (see Section 3.1, "Traffic, Transit, Circulation, and Parking"). Industrial uses, however, are typically less sensitive to these types of changes because they interfere less with normal industrial activities. Because in this analysis an area's sensitivity or compatibility is based on the presence of residential properties, low, medium, and high levels of potential compatibility are identified based on the percentage of residential area affected, the proximity of the residential area to facilities included in an alignment alternative, and the presence of local or regional uses (such as parks, schools, and employment centers). For highway corridors (under the No Project Alternative) and for proposed alignment alternatives, land use compatibility was assessed using GIS layers (or aerial photographs where available) to identify proximity to housing and population and to determine whether the alignment alternatives would be within or outside an existing right-of-way in the study area. Potential impacts are considered low if existing land uses within a potential alignment, station, or maintenance facility area are found to be compatible with the land use changes that may result from the alignment alternative. The type of improvement that would be associated with the alignment alternative would also affect the level of potential impact. Improvements such as potential widening of an existing right-of-way or the need for new right-of-way were considered to have a low compatibility with agricultural land. Conversely, if the improvement would be contained within the existing right-of-way or within a tunnel, the alignment alternative was considered compatible with agricultural land.

Table 3.7-1 summarizes the potential compatibility rating of existing and planned land use types with the potential HST Alignment Alternatives and station location options. Therefore, where potential compatibility would be rated low, the potential for adverse impacts would be higher, and where potential compatibility would be rated high, the potential for adverse impacts would be lower.

Table 3.7-1
Compatibility of Land Use Types

Low Compatibility	Medium Compatibility	High Compatibility
Single-family residential, neighborhood and community parks, habitat conservation area, elementary/middle school, agricultural (widened or new right-of-way needed)	Multifamily residential, high schools, low-intensity industrial, hospitals	Business park/regional commercial, multifamily residential, existing or planned transit center, high intensity industrial park, service commercial, commercial recreation, college, transportation/utilities, high-intensity government facilities, airport or train station, agricultural (tunnel or no new right-of-way needed)

Communities and Neighborhoods

A potential impact on a community or neighborhood was identified if an alignment alternative would create a new physical barrier, isolating one part of an established community from another and potentially resulting in a physical disruption to community cohesion. Improvements to existing transportation corridors, including grade separations, would not generally result in new barriers.

Property

Assessment of potential property impacts is based on the types of land uses adjacent to the particular proposed alignment alternative, the amount of right-of-way potentially needed due to the construction type, and the land use sensitivity to potential impacts. Impacts include potential acquisition, displacement and relocation of existing uses, or demolition of properties.

In some instances, relatively minor strips of property would be needed for temporary construction easements or permanent right-of-way for the proposed HST Alignment Alternatives. In other instances, development of proposed facilities could result in acquisition, displacement, and/or relocation of existing structures. The types of property impacts that could occur include displacement of a residence or business or division of a farm or other land use in a way that makes it harder to use. Mitigation may also be required to maintain property access. Potential property impacts were ranked high, medium, or low, as summarized below in Table 3.7-2 (see Table 3.7-A-1 in Appendix 3.7-A for more detail).

Table 3.7-2
Rankings of Potential Property Impacts

Facility Requirements	Type of Development						
	Residential			Nonresidential			
	Rural/ Suburban	Suburban/ Urban	Urban	Rural Developed	Suburban Industrial/ Commercial	Urban Business Parks/ Regional Commercial	Rural Undeveloped
No additional right-of-way needed (also applies to tunnel segments for HST Alignment Alternatives)	Low	Low	Low	Low	Low	Low	Low
Widening of existing right-of-way required	Medium	Medium	High	Low	Medium	High	Low
New corridor (new right-of-way required; includes aerial and at-grade arrangements)	High	High	High	Medium	Medium	High	Low to medium

To determine potential property impacts, the land uses within 50 ft (15 m) of either side of the existing corridor or within 50 ft (15 m) of both sides of the centerline for new HST alignments were characterized by type and density of development. Densities of structures, buildings, and other elements of the built environment were generally higher in urbanized areas. *Rural/suburban residential* refers to low-density, single-family homes. *Suburban/urban residential* refers to medium density, multifamily housing, such as townhouses, duplexes, and mobile homes. *Urban residential* refers to high-density multifamily housing, such as apartment buildings. *Rural developed nonresidential* uses typically occur in nonurbanized areas and often include developed agricultural land, such as vineyards and orchards. *Suburban industrial/commercial* refers to medium density nonresidential uses and includes some industrial uses, as well as transportation, utilities, and communication facilities. *Urban business parks/regional commercial* refers to nonresidential uses that occur in urbanized areas and includes such uses as business parks, regional commercial facilities, and other mixed use/built-up uses. *Nonrural undeveloped land* includes cropland, pasture, rangeland, and few structures. The classification of development type was based on land use information provided by the planning agencies in each of the regions.

Environmental Justice

This analysis is based on identifying the presence of minority populations and low-income populations in the study area (0.25 mi [0.40 km] from a potential alignment), and generally in the counties crossed by the alignment alternatives. The assessment was done using U.S. Census 2000 information and alignment information to determine if minority or low-income populations exist within the study areas, and if they do, whether the alignments would be within or adjacent to an existing transportation right-of-way (lower potential for impacts) or a new alignments (higher potential for impacts).

The analysis was used to determine whether:

- At least 50% of the population in the study area may be minority or low income.
- The percentage of minority or low-income population in the study area is at least 10% greater than the average generally in the county or community.

The assessment of potential for impacts on minority and low-income populations considered the size and type of right-of-way needed for the alignment alternatives. For example, if an alignment alternative would be within an existing right-of-way, the potential for adverse impacts would be lower. If the alignment alternative would be on new right-of-way, the potential for adverse impacts may be higher. The potential alignment alternatives, however, have been identified and described to largely use or be adjacent to existing transportation rights-of-way to avoid or reduce potential impacts on natural resources and existing communities to the extent feasible and practicable (see Chapter 2, "Alternatives"). In some cases, the minority and low-income thresholds identified above were met or exceeded, but the geographic area (of the block group) was large and sparsely populated. In these areas, the minority and/or low income populations are distant from the proposed alignment alternative. For these areas, the environmental justice impacts were considered as low, given the distance between the environmental justice populations and the HST line.

Because this is a program-level document, the analysis considers the alternatives on a broad scale. The Statewide Program EIR/EIS concluded that the overall system would not result in a disproportionate impact on minority or low-income populations. Additional analysis would take place during project-level analysis to consider potential localized impacts.

C. CRITERIA FOR DETERMINING CEQA SIGNIFICANCE

Under CEQA, two types of potential impacts are considered in the determination of significance for the land use evaluation; namely, the potential for the project to:

- Physically divide an established community or be incompatible with adjacent land uses in the short or long term.
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

The evaluation methods described above provide for the review of these types of potential impacts.

3.7.2 Affected Environment

A. STUDY AREA DEFINED

The study area for land use compatibility, communities and neighborhoods, and environmental justice is 0.25 mi (0.40 km) on either side of the centerline of the rail and highway corridors included in the alignment alternatives and the same distance around station location options and other potential HST-related facilities. This is the extent of area where the alignment alternative might result in changes to land use; the type, density, or patterns of development; or socioeconomic conditions. For the property impacts analysis, the study area is narrower—50 ft (15 m) on either side of the alignment centerlines—to better represent the properties most likely to be affected by the improvements in the alignment alternatives. Land uses in the project area are shown in Figure 3.7-1.

The planned land use for all alignment alternatives is generally described by city and county general plans in the area of the alignment alternatives. Several regulatory agencies and special districts also have future development plans that are considered in this analysis for lands the alignment alternatives would cross. Communities have typically recognized and incorporated the existing rail and highway corridors in their general land use plans, and most communities encourage transit-oriented development and transit facilities to relieve highway congestion and improve mobility.

Other resources, such as U.S. Census 2000 data, California Department of Finance data, aerial photos, and field observations, were used to document existing and future (Year 2030) conditions for demographics, communities, and neighborhoods.

B. DISCUSSION OF RESOURCES BY CORRIDOR

This section briefly discusses the land use–related resources by corridor along HST Alignment Alternatives in the study area and vicinity. The following five land use-related resources are addressed: (1) existing and planned land use, (2) population characteristics, (3) income, (4) neighborhood and community characteristics, and (5) housing.

For this discussion, the source of the land use data was local governments and regional agencies, such as metropolitan planning organizations. The source of demographic information (existing population and projects, ethnicity, and income) was primarily U.S. Census 2000 data and the California Department of Finance.

According to the 2000 U.S. Census, minority persons are defined as being nonwhite persons, including those of Hispanic origin. Low-income populations are defined as having a median household income at or below Department of Health and Human Service poverty guidelines.

San Francisco to San Jose Corridor

This corridor extends from the areas on the west side of the San Francisco Bay along the Caltrain rail line from the City of San Francisco to the City of San Jose.

Existing Land Use

San Francisco to Dumbarton: The San Francisco to Dumbarton alignment alternative begins at the Transbay Transit Center located in the San Francisco Financial District and continues along the existing Caltrain rail line to Redwood City. The primary land use in the immediate vicinity of this alignment alternative is the rail right-of-way. Land uses in the downtown San Francisco area of the Caltrain rail line are primarily urban, industrial, and transportation uses, with some retail, live/work loft, residential, and commercial uses. In south San Francisco, land uses are primarily light industrial, with some commercial and residential uses, with mostly open space through the Brisbane lagoon area. The San Bruno area presents a mixture of park/open space and very low-density residential housing with some commercial and light industrial uses.

In Millbrae, the area is designated as “unclassified” and contains low-density central business, planned unit development, with some vacant, underutilized, and industrial uses adjacent to the right-of-way. The San Francisco International Airport is located to the east. In the Burlingame portion of the corridor, land uses include commercial, residential, and light industrial. The tracks pass directly adjacent to Burlingame High School and Washington Park. Land uses adjacent to the Caltrain rail line within the City of San Mateo are commercial, office, a central business district, and single- and multifamily residential, including the San Mateo County Exposition Building and fairgrounds and the Hillsdale Shopping Mall. Within the City of Belmont, the primary land uses are transportation and service commercial with some high-density residential areas. Single-family residential, transportation, and commercial uses are within the City of San Carlos. Land uses in Redwood City are predominately research-oriented and industrial, with some residential.

Dumbarton to San Jose: The Dumbarton to San Jose alignment alternative begins in Atherton and continues along the existing Caltrain rail line to the San Jose/Diridon Station. The primary use in the Town of Atherton is low-density single-family residential. The land use in Menlo Park is general

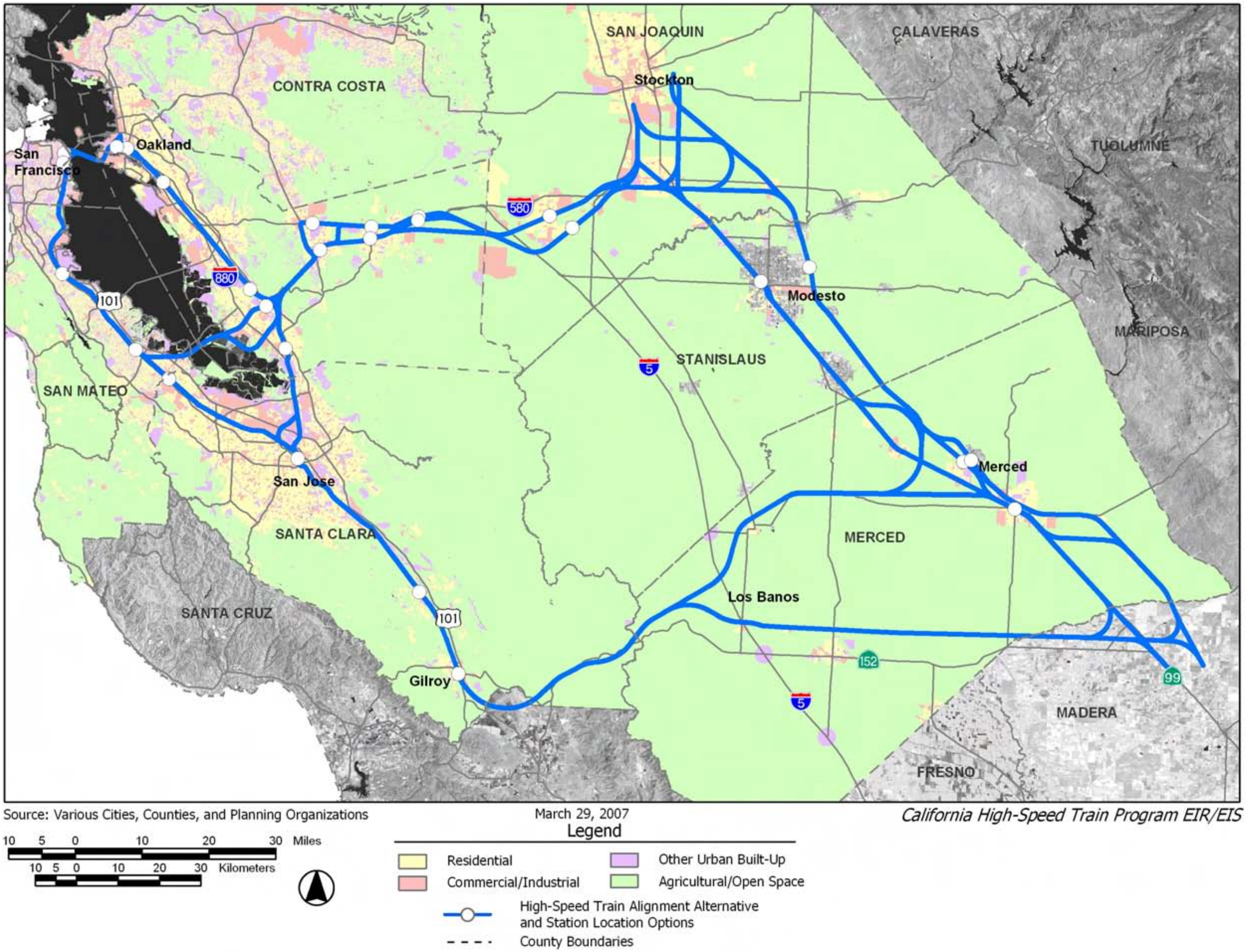


Figure 3.7-1
Existing Land Use
Bay Area to Merced, and Sacramento

commercial and varying types of residential uses, from medium density apartment to single family suburban. Land uses along the alignment alternative in Palo Alto are primarily single-family residential on the east and commercial/services on the west where the station is located. Palo Alto High School is adjacent to the rail line just south of the Palo Alto Station, beyond which is Stanford University. The City of Mountain View has various land uses adjacent to the rail line, including general industrial, residential, public facility, limited industrial, and arterial commercial. Rengstorff Park is located adjacent to the railroad right-of-way. The northern section of the corridor within the City of Sunnyvale is primarily industrial, high-density residential, general business, and neighborhood shopping, with industrial with low- to medium-density residential uses interspersed to the north. Through the City of Santa Clara, the adjacent uses consist of mixed use, moderate-density residential, office/research and development, and medium density residential.

Population Characteristics

The San Francisco to San Jose corridor crosses three counties: San Francisco, San Mateo, and Santa Clara. Population in this area grew from 2.9 million people in 1990 to 3.2 million in 2000, an increase of 10%. By 2030, the area population is expected to reach 4.0 million, an increase of 28% over 2000 levels. Santa Clara County is expected to have the highest expected growth in this area, with 35% over the same time period.

According to U.S. Census 2000 data, minority persons accounted for the following percentages of the total population in the counties in the area (lowest to highest): San Mateo, 50%; Santa Clara, 56%; and San Francisco, 56%. Approximately 52% of the population along the San Francisco to San Jose corridor is part of an ethnic minority group.

Income

According to U.S. Census 2000, the percentages per county of households identified as below federal poverty level (as defined by the Department of Health and Human Services) along the San Francisco to San Jose corridor are (lowest to highest) San Mateo, 5%; Santa Clara, 6%; and San Francisco, 10%. The study area for the San Francisco to San Jose corridor has a low-income population of approximately 7%.

Neighborhood and Community Characteristics

San Francisco to Dumbarton: The San Francisco to Dumbarton alignment alternative begins in downtown San Francisco and continues within the existing Caltrain right-of-way to Redwood City. In San Francisco, the alignment alternative passes through the Potrero, Bay View, and Bayshore districts and south into a single-family residential neighborhood in Brisbane. As it continues into south San Francisco, it passes through less dense residential neighborhoods in Tanforan and Lomita Park and along the eastern edge of Millbrae. Multifamily and single-family neighborhoods are denser where the corridor passes through Burlingame and the Hayward Park section of San Mateo. The corridor continues through the cities of Belmont and San Carlos, south into Redwood City.

Dumbarton to San Jose: The Dumbarton to San Jose alignment alternative begins in Atherton and continues to San Jose within the existing Caltrain right-of-way. The alignment alternative passes through the suburban communities of Atherton and Menlo Park until reaching Palo Alto and Stanford University. The alignment alternative then passes southeast through the City of Mountain View, the City of Sunnyvale, and the suburban neighborhoods of Lawrence and Santa Clara and the Downtown and Willow Glen neighborhoods of the City of San Jose. It terminates in the dense City of San Jose.

Oakland to San Jose Corridor

This corridor extends from the areas on the east side of the San Francisco Bay along I-880 from the City of Oakland to the City of San Jose.

Existing Land Use

West Oakland to Niles Junction: The West Oakland to Niles Junction alignment alternative begins just north of the West Oakland BART Station near a residential area with adjacent commercial uses. Land use to the southeast and southwest is primarily transportation related, including the UPRR yard and the Joint Intermodal Rail Terminal.

Between 18th and 66th Avenues, the predominant uses are industrial and commercial complexes on both sides of the UPRR tracks. Land uses west of the Coliseum Station are predominately commercial and service oriented, including the McAfee Coliseum and ORACLE Arena. Industrial and commercial complexes and residential uses are located to the east. Land uses are initially residential and then primarily industrial between the Oakland Airport/Coliseum BART Station and 98th Avenue. Adjacent land uses in the cities of San Lorenzo and Hayward are primarily single-family residential with some commercial/service oriented uses. Existing land uses in the vicinity of the Union City BART Station include residential to the east and industrial and commercial complexes to the west.

12th Street/City Center to Niles Junction: Within the 12th Street/City Center to Niles Junction alignment alternative, land uses in the vicinity of the 12th Street/City Center station location option are primarily related to the Downtown Civic Center and other commercial and service oriented uses. The alignment alternative would proceed in a tunnel under 12th Street from Downtown Oakland past Lake Merritt to 18th Avenue.

South of 18th Avenue in Oakland, the 12th Street/City Center to Niles Junction alignment alternative follows the same alignment as the West Oakland to Niles Junction alignment alternative.

Niles Junction to San Jose via Trimble: The Niles Junction to San Jose via Trimble alignment alternative begins at Niles Junction in Fremont and continues south to the east of Fremont Central Park and Lake Elizabeth, commercial and service oriented uses, and the Alameda Flood Control Channel. Near Washington Boulevard, single-family residential uses are predominant on the west and mixed urban uses on the east. Adjacent land uses are almost exclusively industrial on both sides of the UPRR tracks between Mission Boulevard and Auto Mall Parkway with some commercial complexes in Fremont. Between SR 237 and the Alameda County Line, residential and industrial uses are located to the east including the Elmwood Rehabilitation Center and County Jail Farm. Industrial and commercial complexes including service uses are located to the west.

Along Trimble Road, between I-880 and Highway 101, industrial land uses are predominant. South of Highway 101, north of the existing Caltrain alignment, land uses are industrial to the west, and the Norman Y. Mineta San Jose International Airport is to the east. This alignment alternative would continue to the San Jose (Diridon) station location option through commercial and industrial land uses.

Niles Junction to San Jose via I-880: Between Niles Junction and Trimble Road, the Niles Junction to San Jose via I-880 alignment alternative would be the same as the Niles Junction to San Jose via Trimble alignment alternative. South of Trimble Road, residential areas are located in the northeast and southeast quadrants of the I-880/Montague Expressway interchange. Between Highway 101 and the Montague Expressway, adjacent land uses are primarily industrial and commercial complexes. This alignment alternative would continue to the San Jose (Diridon) station location option through commercial and industrial land uses.

Population Characteristics

The Oakland to San Jose corridor includes Alameda and Santa Clara counties. Population for this area grew from 2.8 million people in 1990 to 3.1 million in 2000, an increase of nearly 13%, and is expected to reach 4.2 million by 2030, increasing by 33% over 2000 levels. Over the same time period, population in Santa Clara County is expected to grow by over 35%, the highest growth in this region.

Minority persons in this corridor account for 59% of the population in Alameda County and 56% in Santa Clara County, according to 2000 U.S. Census data. The study area for this corridor has an ethnic minority population of 73%.

Income

According to 2000 U.S. Census data, nearly 10% of Alameda County households and 6% of households in Santa Clara County were below the poverty threshold (as defined by the Department of Health and Human Services) in 1999. According to U.S. Census 2000, low-income households within the Oakland to San Jose corridor study area represent nearly 14%.

Neighborhood and Community Characteristics

West Oakland to Niles Junction: This alignment alternative begins in the City of Oakland and travels its entire length along either existing rail or roadway right-of-way or via tunnel. The West Oakland to Niles Junction alignment alternative travels south through single-family residential neighborhoods in west Oakland, San Leandro, San Lorenzo, and west of Ashland, continuing through the multifamily residential neighborhoods of Cherryland and Hayward. The alignment continues through the residential neighborhoods of Union City, Pabrico, and Eberly.

12th Street/City Center to Niles Junction: The 12th Street/City Center to Niles Junction alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative except that the alignment alternative would begin in Downtown Oakland.

Niles Junction to San Jose via Trimble: Within the Niles Junction to San Jose via Trimble alignment alternative, neighborhoods become denser as it enters Fremont and travels next to Lake Elizabeth. Just north of Milpitas, the alignment alternative traverses the Warm Springs District, through the City of Milpitas to its terminus in San Jose via Trimble Road.

Niles Junction to San Jose via I-880: The Niles Junction to San Jose via I-880 alignment alternative would be the same as the Niles Junction to San Jose via Trimble alignment alternative except that south of Trimble Road, the alignment alternative would travel through single-family neighborhoods in San Jose.

San Jose to Central Valley

This corridor includes the areas from the City of San Jose south to the City of Gilroy and east across the Diablo Range to the Central Valley. Three alignments are in this corridor: Pacheco, Henry Miller (UPRR), Henry Miller (BNSF), and GEA North.

Existing Land Use

Pacheco: The Pacheco alignment alternative begins at the Diridon Station in San Jose following an existing rail corridor past commercial, transportation, and single-family and multifamily residential uses. The alignment alternative continues through commercial, light industrial, and single-family residential uses as it parallels SR 87. The land uses become more industrial as the alignment alternative crosses the Almaden Expressway and Curtner Avenue. South of Coyote, rangeland and agricultural uses prevail with scattered single-family residential uses. The City of Gilroy is denser with single-family residential, commercial, and light industrial uses; however, as the alignment crosses Highway 101 to the east, land uses become agricultural again. When the alignment crosses over

Bloomfield Avenue, it no longer follows the existing rail corridor as it proceeds through agricultural land and the Diablo Mountain Range, continuing north of Pacheco State Park, Cottonwood Creek Wildlife Area, O'Neill Forebay Wildlife Area, and the San Luis Reservoir.

Henry Miller (UPRR Connection): The Henry Miller (UPRR Connection) alignment alternative would be the same as the Henry Miller (BNSF Connection) alignment alternative except that the UPRR connections would be west of Chowchilla and would only run through agricultural land.

Henry Miller (BNSF Connection): The Henry Miller (BNSF Connection) alignment alternative parallels Henry Miller Avenue beginning near the O'Neill Forebay Wildlife Area in Santa Nella just east of I-5. The alignment alternative is in a predominantly agricultural area and runs south of the Volta Wildlife Area. After crossing SR 165, the alignment crosses the southern tip of the Los Banos Wildlife Area before continuing across the San Joaquin Fresno River and SR 59 parallel to Jefferson Road/Avenue 24. The alignment alternative runs just south of Chowchilla where the agricultural uses become denser. The Henry Miller (BNSF) alignment alternative continues southeast from Chowchilla north of the Valley State Prison for Women until it merges with Santa Fe Drive. The Henry Miller (BNSF) alignment alternative continues northeast from Chowchilla, further north of the Valley State Prison for Women where it also merges with Santa Fe Drive northeast of the Brenda Reservoir.

GEA North: The GEA North alignment alternative begins at the San Luis Reservoir near Cottonwood Creek and continues through agricultural land, crossing I-5 north of Gustine. The alignment alternative continues through the northern portion of the San Luis National Wildlife Refuge and through agricultural land between Atwater and Merced. The GEA Atwater Wye South to Merced UP segment crosses SR 99 and runs east of Atwater, crossing agricultural land uses. The GEA Atwater Wye North to BNSF segment crosses SR 99 further north of the GEA Atwater Wye South to Merced UP segment west of Atwater through agricultural uses. The GEA Atwater Wye North to BNSF segment also merges with Santa Fe Drive.

The primary land use in proximity to the San Jose/Diridon station location option is industrial. Other nearby land uses within the City of San Jose include combined industrial/commercial, public park, medium-low density and medium-density residential, light industrial, private recreation, agriculture, and campus industrial. The HP Pavilion at San Jose is located adjacent to the Caltrain alignment just north of the San Jose/Diridon station location option.

Population Characteristics

The San Jose to Central Valley corridor includes four counties: Santa Clara, San Benito, Merced, and Madera. Between 1990 and 2000, this area's population increased by 15% from 1.8 million people to 2.1 million. Population in these counties is expected to grow approximately 44% by 2030, reaching over 3.0 million people. Madera and Merced Counties are expected to have the greatest population increases with an expected growth of 79 and 93%, respectively.

According to the 2000 U.S. Census, minority persons accounted for the following percentages of total population in the counties in the area (lowest to highest): Merced, 56%; Santa Clara, 59%; Madera, 62%; and San Benito, 65%. The ethnic minority population in this area for the San Jose to Central Valley corridor is 61%. The Pacheco and GEA North alignment alternatives have similar ethnic minority populations. The Henry Miller alignment alternatives have a minority population of 73%.

Income

According to 2000 U.S. Census data, the percentages per county of households identified as below federal poverty level (as defined by the Department of Health and Human Services) for this corridor are (lowest to highest): Santa Clara, 6%; San Benito, 8%; Madera, 16%; and Merced, 18%. Low-income households within this corridor represent approximately 11%, according to U.S. Census 2000. The Henry Miller alignment alternatives and the GEA North alignment alternative have the highest percentage of low-income households with 17 and 16%, respectively. The Pacheco alignment alternative has a low-income percentage of approximately 8%.

Neighborhood and Community Characteristics

Pacheco: The Pacheco alignment alternative begins at the Diridon Station in San Jose following an existing rail corridor through dense residential areas in central and southern San Jose. It proceeds along the existing rail corridor through Coyote, a small community consisting of single-family residences and some commercial/service and industrial land uses. The alignment alternative continues to follow the existing rail corridor through the suburban communities of Morgan Hill and Gilroy and the agricultural community of Old Gilroy. West of the small agricultural town of San Felipe, the alignment alternative departs from the existing rail corridor and passes through the northern portion of San Felipe. The alignment then traverses the Diablo Mountain Range, and meets the GEA North and Henry Miller alignment alternative just west of Santa Nella Village.

Henry Miller (UPRR Connection): The Henry Miller (UPRR Connection) alignment alternative would be the same as the Henry Miller (BNSF Connection) alignment alternative except that the connections with the UPRR are east of Chowchilla.

Henry Miller (BNSF Connection): The Henry Miller (BNSF Connection) alignment alternative begins just east of the community of Santa Nella. This alignment alternative is adjacent to an existing transportation right-of-way and passes through agricultural communities northwest of Los Banos and through southern Chowchilla.

GEA North: The GEA North alignment alternative begins just east of Santa Nella and continues northeast until passing just north of Gustine. Northwest of Gustine, the alignment alternative crosses one farm but does not traverse the community itself. After crossing miles of agricultural land, this alignment alternative reaches the town of Atwater. Although this alignment alternative follows existing roadways, it passes through agricultural uses in the southwestern portion of Atwater (GEA North XS). The GEA North XN alignment alternative travels through agricultural uses in central Atwater.

East Bay to Central Valley Corridor

This corridor includes the areas from the City of Fremont east through Niles Canyon and into the cities of Pleasanton, Dublin, and Livermore. East of the City of Livermore, the alignment alternatives in this corridor continue through the Altamont Pass and into the Central Valley via the cities of Tracy and Manteca.

Existing Land Use

There are eight alignment alternatives within the East Bay to Central Valley Corridor: I-680/580/UPRR, I-580/UPRR, Patterson Pass/UPRR, UPRR, Tracy Downtown (BNSF and UPRR Connections), Tracy ACE Station (BNSF and UPRR Connections).

I-680/580/UPRR: The I-680/580/UPRR alignment alternative splits from the existing UPRR alignment in south Pleasanton as it exits the Diablo Mountain Range. As the alignment alternative exits the tunnel, it crosses through the Castlewood Country Club and merges with I-680, where it continues north through single-family residential areas. As I-680 meets I-580, the alignment alternative continues along eastbound I-580 through Dublin. This area is predominantly commercial and industrial with scattered vacant land and single-family residential uses. East of Tassajara Road, land uses are generally vacant or recreational, with some industrial and transportation uses. As the alignment alternative continues east into Livermore, single-family residential uses are predominant with some vacant land on the northern side. As the alignment alternative approaches North Vasco Road, industrial buildings are the dominant land use with single-family residences on the north side of the alignment. The alignment alternative passes through the Altamont Pass via cut and tunnel, where it merges with the existing UPRR alignment before exiting on the eastern side.

I-580/UPRR: The I-580/UPRR alignment alternative continues from the Dumbarton alignment alternative at its intersection with the Niles/I-880 alignment alternative. The alignment alternative continues northwest from the Dumbarton alignment alternative, via cut and tunnel, through the Diablo Mountain Range. West of I-680, the alignment alternative connects with the existing UPRR and continues east through industrial and residential land uses. East of Pleasanton, the alignment alternative splits from the existing UPRR alignment and continues north to I-580, east of Tassajara Road, passing through mostly vacant land with some industrial uses. Continuing east along I-580, land uses are generally vacant or recreational, with some industrial, residential, and transportation uses. East of Livermore, the alignment alternative passes through the Altamont Pass via cut and tunnel, where it merges with the existing UPRR alignment before exiting on the eastern side to the county line.

Patterson Pass/UPRR: The Patterson Pass/UPRR alignment alternative continues from the Dumbarton alignment alternative at its intersection with the Niles/I-880 alignment alternative. The alignment alternative continues northwest from the Dumbarton alignment alternative, via cut and tunnel, through the Diablo Mountain Range. As it exits the tunnel and traverses west of I-680, the alignment alternative connects with the existing UPRR right-of-way and continues east through industrial and residential land uses in Pleasanton and Livermore. The alignment alternative departs from the existing UPRR alignment in east Livermore where it is flanked by both light industrial and single-family residential uses. The alignment alternative proceeds via a cut through the Altamont Pass where it merges with the UPRR alignment on the eastern side.

UPRR: The UPRR alignment alternative continues from the Dumbarton alignment alternative at its intersection with the Niles/I-880 alignment alternative. The alignment alternative continues northwest from the Dumbarton alignment alternative, via cut and tunnel, through the Diablo Mountain Range. As it exits the tunnel and traverses west of I-680, the alignment alternative connects with the existing UPRR alignment and continues east through industrial and residential land uses in Pleasanton and Livermore. East of Livermore, the alignment alternative passes through the Altamont Pass via cut and tunnel, where it merges with the existing UPRR alignment before exiting on the eastern side into open space land uses to the county line.

Tracy Downtown (BNSF Connection): The Tracy Downtown (BNSF Connection) alignment alternative begins at the western San Joaquin county border, continuing from the I-580/UPRR and UPRR alignment alternatives. The alignment alternative crosses I-580, the Edward G. Brown Aqueduct, and the Delta Mendota Canal, continuing east through the City of Tracy past single-family residences and scattered community parks. On the eastern edge of Tracy, land uses become agricultural and rural residential. After the alignment alternative crosses I-205, it continues through agricultural land west of Escalon.

Tracy ACE Station (BNSF Connection): The Tracy ACE Station (BNSF Connection) alignment alternative begins at the western San Joaquin county border, continuing from the I-580/UPRR and UPRR alignment alternatives. After crossing I-580, the alignment alternative continues just south of Tracy Municipal Airport and continues north through vacant, agricultural, and single-family land uses. At Ahern Road, land uses become predominantly agricultural with some open space and recreational uses east of I-5. As the alignment alternative continues through the City of Manteca, single-family residences with scattered community parks dominate the landscape. Once the alignment alternative crosses SR 120, it would continue through agricultural land west of Escalon.

Tracy ACE Station (UPRR Connection): The Tracy ACE Station (UPRR Connection) alignment alternative would be the same as the Tracy ACE Station (BNSF Connection) except that the alignment alternative would continue through agricultural land uses south of Manteca.

Tracy Downtown (UPRR Connection): The Tracy Downtown (UPRR Connection) alignment alternative would be the same as the Tracy Downtown (BNSF Connection) except that the alignment alternative would continue through agricultural land uses south of Manteca.

Population Characteristics

The East Bay to Central Valley corridor includes Alameda and Stanislaus counties. Population in this area grew from 1.6 million people in 1990 to 1.9 million in 2000, an increase of nearly 15%. By 2030, population in the corridor is expected to grow 39% from 2000, reaching 2.6 million people. Stanislaus County is expecting the highest percentage of growth during the same period with an increase of nearly 65%.

Minority persons in this area accounted for 56% of the population in Alameda County and 69% of the population in Stanislaus County, according to 2000 U.S. Census data. Ethnic minority persons accounted for the following percentages of the total population for each of the alignment segments (lowest to highest): Patterson Pass/UPRR, 23%; I-680/580/UPRR, 30%; Pleasanton, 30%; UPRR, 35%; and I-580/UPRR, 41%.

Income

According to 2000 U.S. Census data, nearly 10% of Alameda County households and 14% of households in Stanislaus County were below the poverty threshold in 1999 as defined by the Department of Health and Human Services.

Neighborhoods and Communities

I-680/580/UPRR: The I-680/580/UPRR alignment alternative splits from the existing UPRR alignment in south Pleasanton as it exits the Diablo Mountain Range, crossing through the Castlewood Country Club and merging with I-680. As it parallels I-680 along the western edge of Pleasanton, it continues north through a single-family residential area. At the interchange of I-680 and I-580, the alignment alternative continues on eastbound I-580 through Dublin. This area is predominantly commercial and industrial interspersed with single-family residential uses. Single-family residential neighborhoods are predominant along the southern side of the alignment alternative as it continues east into the City of Livermore.

I-580/UPRR: West of I-680, south of Pleasanton, the I-580/UPRR alignment alternative connects with existing UPRR right-of-way and continues through single-family neighborhoods. The alignment alternative splits from the existing UPRR right-of-way east of Pleasanton and continues north through unincorporated Alameda County to connect with I-580. Along I-580 and traversing east, single-family residential neighborhoods are predominant along the southern side of the alignment alternative as it continues east into the City of Livermore. Beyond Livermore, the alignment alternative does not pass through any communities or neighborhoods.

Patterson Pass/UPRR: The Patterson Pass/UPRR alignment alternative begins in east Livermore where it follows existing UPRR right-of-way before splitting from the existing UPRR alignment in unincorporated Alameda County. This alignment alternative does not pass through any communities or neighborhoods.

UPRR: As the UPRR alignment alternative exits the tunnel through the Diablo Mountain Range, it continues east through Pleasanton and Livermore on existing rail right-of-way through various neighborhoods.

Tracy Downtown (BNSF Connection): The Tracy Downtown (BNSF Connection) alignment alternative exits the Altamont Pass south of Tracy Municipal Airport, reconnecting with existing UPRR right-of-way along the edge of a single-family residential neighborhood. In southern Manteca, the Tracy Downtown (BNSF Connection) alignment alternative continues along SR 120 through a residential community.

Tracy ACE Station (BNSF Connection): The Tracy ACE Station (BNSF Connection) alignment alternative comes into San Joaquin County and continues into Tracy north of Tracy Municipal Airport along existing freight and commuter rail right-of-way. Near the airport, the alignment alternative passes through a single-family neighborhood to the north. In southern Manteca, the Tracy ACE Station (BNSF Connection) alignment alternative continues along SR 120 through a residential community.

Tracy ACE Station (UPRR Connection): The Tracy ACE Station (UPRR Connection) alignment alternative would be the same as the Tracy ACE Station (BNSF Connection) alignment alternative except that it would not pass through any communities or neighborhoods.

Tracy Downtown (UPRR Connection): The Tracy Downtown (UPRR Connection) alignment alternative would be the same as the Tracy Downtown (BNSF Connection) alignment alternative except that it does not pass through any communities or neighborhoods.

<u>San Francisco Bay Crossings</u>

These crossing alignment alternatives include the San Francisco Bay crossings between the cities of San Francisco and Oakland near the San Francisco/Oakland Bay Bridge and between the cities of East Palo Alto and Newark south of the Dumbarton Bridge and into the City of Fremont.

Existing Land Use

There are three alignment alternatives that make up the San Francisco Bay Crossings corridor: Transbay, Dumbarton, and Fremont Central Park.

Trans Bay Crossing – Transbay Transit Center: The Trans Bay Crossing – Transbay Transit Center alignment begins at 7th and Townsend Street in San Francisco where it passes through industrial, commercial, and recreational land uses and crosses the San Francisco Bay in a tunnel. On the eastern side of the bay, the alignment alternative continues to the City of Alameda and through Oakland Inner Harbor and east across I-880 where it merges with the Oakland to San Jose alignment alternative.

Trans Bay Crossing – 4th & King: The existing land uses are the same for the Trans Bay Crossing – 4th & King alignment alternative as for the Trans Bay Crossing – Transit Center alignment alternative.

Dumbarton (High Bridge): The Dumbarton (High Bridge) alignment alternative begins just south of Redwood City near Middlefield Road. Land uses in this area are predominantly single-family and multifamily residential, with a mixture of commercial and industrial uses. Industrial uses are generally located adjacent to San Francisco Bay and on the east side of Highway 101, but are most predominant on both sides of the Dumbarton Bridge. The Dumbarton alignment alternative would follow the existing Dumbarton Rail Bridge corridor to the east side of the bay where it crosses over Newark Slough. Proceeding south, the alignment alternative crosses through salt ponds in Newark and continues east crossing ACE/Amtrak in a highly industrial area. The alignment alternative crosses I-880 near single-family residences and institutional uses. The alignment alternative then proceeds via tunnel through the Diablo Mountain Range and merges with the existing UPRR alignment.

Dumbarton (Low Bridge): Existing land uses along the Dumbarton (Low Bridge) alignment alternative are the same as the Dumbarton (High Bridge) alignment alternative.

Dumbarton (Tube): Existing land uses along the Dumbarton (Tube) alignment alternative are the same as the Dumbarton (High Bridge) alignment alternative except that the alignment alternative would cross under the Bay in a tube.

Fremont Central Park (High Bridge): The Fremont Central Park (High Bridge) alignment alternative splits from the Dumbarton alignment alternative just west of Newark. The alignment alternative crosses I-880 south of Stevenson Boulevard before intersecting single-family residential neighborhoods and Blacow Park. East of Blacow Park, the alignment alternative proceeds to the east of Fremont Central Park. The alignment alternative connects with the existing UPRR alignment west of the Diablo Mountain Range.

Fremont Central Park (Low Bridge): Existing land uses along the Fremont Central Park (Low Bridge) alignment alternative are the same as the Fremont Central Park (High Bridge) alignment alternative.

Fremont Central Park (Tube): Existing land uses along the Fremont Central Park (Tube) alignment alternative are the same as the Fremont Central Park (High Bridge) alignment alternative except that the alignment alternative would cross under the Bay in a tube.

Population Characteristics

The San Francisco Bay Crossing alignment alternatives include San Francisco, San Mateo, and Alameda counties. Between 1990 and 2000, this area's population increased by over 10% from 2.7 million to over 2.9 million. In this area from 2000 to 2030, the population is expected to grow to 3.7 million people, an increase of 25%. Alameda County expects the most growth during the same time period, with an estimated growth of 31%.

According to 2000 U.S. Census data, minority persons accounted for the following percentages of total population in the counties for the bay crossings (lowest to highest): San Mateo, 41%; San Francisco, 50%; and Alameda County, 51%. Ethnic minority populations within the areas along the San Francisco Bay Crossing alignment alternatives accounted for the following percentages of total population within the alignment alternatives (lowest to highest): Fremont Central Park, 58%; Trans Bay Crossing, 64%; and Dumbarton, 69%.

Income

According to 2000 U.S. Census data, nearly 10% of the households in Alameda and San Francisco counties were below the poverty threshold in 1999 as defined by the Department of Health and Human Services. San Mateo County households below the poverty threshold accounted for nearly 5% of the population.

Neighborhoods and Communities

Trans Bay Crossing – Transbay Transit Center: The Trans Bay Crossing – Transbay Transit Center alignment alternative begins in San Francisco on existing right-of-way and terminates in Oakland. No neighborhoods or communities are traversed.

Trans Bay Crossing – 4th & King: The Trans Bay Crossing – 4th & King alignment alternative begins in San Francisco on existing right-of-way and terminates in Oakland. No neighborhoods or communities are traversed.

Dumbarton (High Bridge): The Dumbarton (High Bridge) alignment alternative begins just south of Redwood City on existing right-of-way, passing through single-family and multifamily residential neighborhoods interspersed with commercial and industrial uses. After crossing San Francisco Bay south of the Dumbarton Bridge, it passes through single-family and multifamily residential neighborhoods in the cities of Newark and Fremont.

Dumbarton (Low Bridge): The Dumbarton (Low Bridge) alignment alternative would pass through the same neighborhoods and communities as the Dumbarton (High Bridge) alignment alternative.

Dumbarton (Tube): The Dumbarton (Tube) alignment alternative would pass through the same neighborhoods and communities as the Dumbarton (High Bridge) alignment alternative.

Fremont Central Park (High Bridge): The Fremont Central Park alignment alternative splits from the Dumbarton alignment alternative just west of Newark. The alignment alternative intersects some single-family residential neighborhoods in Newark. Portions of this alignment alternative, east of I-880, are not located on existing transportation right-of-way.

Fremont Central Park (Low Bridge): The Fremont Central Park (Low Bridge) alignment alternative would pass through the same neighborhoods and communities as the Fremont Central Park (High Bridge) alignment alternative.

Fremont Central Park (Tube): The Fremont Central Park (Tube) alignment alternative would pass through the same neighborhoods and communities as the Fremont Central Park (High Bridge) alignment alternative.

Central Valley Corridor

The Central Valley corridor includes the areas of the Central Valley from the City of Stockton south to the northern areas of Madera County. Two alignment alternatives within the Central Valley corridor traverse along the existing UPRR and BNSF rail lines.

Existing Land Use

The Central Valley corridor includes the areas of the Central Valley generally along the existing UPRR and BNSF rail lines from the City of Stockton south to the northern areas of Madera County.

BNSF – UPRR: Between the Cities of Stockton and Modesto, the BNSF – UPRR alignment alternative passes through agricultural lands with scattered residences. Leaving Stockton in a southeasterly direction, the alignment alternative passes farmlands until it enters the City of Escalon. The BNSF – UPRR alignment alternative runs along Main Street through the center of Escalon, traversing residential and commercial areas. This alignment alternative continues southeast along the existing rail line past large agricultural parcels with scattered residences until it crosses the San Joaquin County/Stanislaus County line at the Stanislaus River. The community of Riverbank at the Stanislaus River is the only residential area before the Modesto Briggsmore Station.

The BNSF – UPRR alignment alternative would follow the existing BNSF rail corridor through predominantly agricultural lands south of Modesto. Within Stanislaus County, long stretches of farmlands are occasionally broken by the small rural communities of Empire, Hughson, and Denair. Between Empire and Hughson, the alignment alternative passes the Whitehurst-Lakewood Memorial Park Cemetery just south of the Tuolumne River.

In Atwater, the alignment alternative passes the Castle Air Museum, Bloss Hospital, and Castle Park. For a potential station location at Castle AFB, the alignment alternative would bypass the community of Winton and Atwater through farmlands east of Winton and would then pass through developed residential area between Castle AFB and Atwater. Land uses in this area include the California Army National Guard, former military buildings, and the Atwater Sports Club. South of Castle AFB, the BNSF – UPRR alignment alternative diverges from the BNSF alignment, cutting through agricultural lands to join the existing UPRR rail right-of-way northwest of the City of Merced.

Within Merced County, the BNSF – UPRR alignment alternative traverses a number of communities, including Delhi, Livingston, and Atwater. Beyond Atwater, land use density increases as it approaches the City of Merced. Agricultural land uses are predominant between the Cities of Merced and Chowchilla. Upon entering Chowchilla, land use becomes light industrial.

BNSF: The BNSF alignment alternative would be the same as the BNSF – UPRR alignment alternative except that south of Merced, the alignment alternative would continue along the existing BNSF rail corridor through agricultural land uses before entering Chowchilla, where land use becomes light industrial.

UPRR N/S: Between the Cities of Stockton and Modesto, the UPRR N/S alignment alternative passes through several developed communities. South of Stockton, the alignment alternative passes through the communities of French Camp, Lathrop, Manteca, and Ripon, before entering Stanislaus County. While much of this portion is agricultural, there are large residential tracts and smaller commercial areas along the alignment in Manteca and Ripon. South of the county line at the Stanislaus River, the UPRR N/S alignment alternative passes the community of Salida before immediately entering Modesto. The alignment alternative continues through the central portion of Modesto, passing Modesto Junior College West, Modesto Junior College East, the Modesto Convention Center, Tuolumne Regional River Park, and the community of Ceres immediately south of the Tuolumne River.

South of the Modesto (Downtown) station location option, the land uses surrounding the alignment alternative consist of a mix of residential, commercial, and industrial development. Development becomes increasingly sparse as the alignment alternative continues south through rural residential and agricultural development. The UPRR N/S alignment alternative bisects the City of Ceres, passing the Stanislaus County Fairgrounds and the downtown area including Central Park and the Chamber of Commerce.

Within Merced County, the UPRR N/S alignment alternative traverses a number of communities, including Delhi, Livingston, and Atwater. Beyond Atwater, land use density increases as it approaches the City of Merced. Agricultural land uses are predominant between the cities of Merced and Chowchilla. Upon entering Chowchilla, land use becomes light industrial.

BNSF Castle: The BNSF Castle alignment alternative would be the same as the BNSF – UPRR alignment alternative except that the alignment alternative would continue just west of Castle AFB through mostly agricultural land before continuing along the existing BNSF right-of-way through mostly agricultural land uses before entering Madera.

UPRR – BNSF Castle: The UPRR – BNSF Castle alignment alternative would be the same as the UPRR N/S alignment alternative through Turlock and the same as the BNSF Castle alignment alternative north of Winton with the exception of the connection between the UPPR and BNSF alignments just south of the Merced County line; the alignment alternative would continue through agricultural land uses.

UPRR – BNSF: The UPRR – BNSF alignment alternative would be the same as the UPRR N/S alignment alternative to the San Joaquin County border, the connection to the BNSF alignment alternative north of Winton, and the BNSF alignment alternative south of the connection.

Population Characteristics

The Central Valley corridor includes portions of San Joaquin, Stanislaus, and Merced counties. Population grew from approximately 1.0 million people in 1990 to over 1.2 million people in 2000, an increase of 19%. The region's population is expected to increase by over 1.0 million people between

2000 and 2030, an increase of over 85%. The largest growth in the region is expected to occur in San Joaquin County with an expected growth of nearly 98% over the same time period.

According to 2000 U.S. Census data, minority persons accounted for the following percentages of total population in the counties in this corridor (lowest to highest): Stanislaus, 43%; San Joaquin, 53%; and Merced, 60%. The Central Valley corridor alignment alternatives have an ethnic minority population of 52%. The BNSF and UPRR N/S alignment alternatives have minority populations of 44 and 56%, respectively.

Income

According to 2000 U.S. Census data, the percentages of households identified as below poverty level (as defined by the Department of Health and Human Services) for this corridor by county are (lowest to highest): Stanislaus, 14%; San Joaquin, 15%; and Merced, 18%.

According to the 2000 U.S. Census, low-income households within the Central Valley corridor represent nearly 17% of the population. The BNSF Castle and UPRR N/S alignment alternatives have the greatest low-income households with 22 and 20%, respectively. Low-income households account for over 13% within the BNSF alignment alternatives.

Neighborhoods and Communities

The Central Valley corridor includes the Central Valley neighborhood and community areas generally located along the UPRR and BNSF rail lines from the City of Stockton south to the northern portions of Madera County.

BNSF – UPRR: The BNSF – UPRR alignment alternative is bordered predominantly by agricultural lands with scattered residences. Leaving eastern Stockton, the alignment alternative follows existing BNSF right-of-way through the rural communities of Burnham, Avena, Escalon, Huntley, and Riverbank. The alignment alternative continues southeast and passes through the small community of Claus, Modesto, and the residential neighborhoods of Empire, Hughson, Denair, Cortez, Ballico, and Cressey. Residential neighborhoods become denser as the alignment alternative traverses the communities of Winton and The Grove. As the alignment alternative continues south, it passes through the suburban community of Castle Gardens and the urban neighborhoods of Merced and through the agricultural communities of Lingard and Athlone. The alignment alternative passes through the small rural community of Minturn and continues south through rural Fairmead before passing through eastern Chowchilla.

BNSF: The BNSF alignment alternative would affect the same neighborhoods as the same as the BNSF – UPRR alignment alternative except that south of Merced, the alignment alternative would continue along the existing BNSF rail corridor southeast of Merced through the rural communities of Plainsburg and Le Grand.

UPRR N/S: The UPRR N/S alignment alternative begins in the City of Stockton and continues on existing UPRR right-of-way through several residential neighborhoods including Mormon, The Homestead, and El Pinal. The alignment alternative then continues through the unincorporated communities of French Camp, Lathrop, and Manteca and passes through several residential neighborhoods. The alignment alternative continues through the unincorporated community of Ripon along SR 99 and adjacent residential neighborhoods. It continues along existing right-of-way through residential neighborhoods in the town of Salida, Modesto, and Ceres before continuing through Keyes, Central Turlock, Delhi, and Livingston. It continues south through western Atwater and Merced and through the agricultural communities of Lingard and Athlone. The alignment alternative passes through the small rural community of Minturn and continues south through rural Fairmead before passing through eastern Chowchilla.

BNSF Castle: The BNSF Castle alignment alternative would be the same as the BNSF – UPRR alignment except that the alignment would continue just west of Castle AFB before continuing along the existing BNSF rail right-of-way passing through Planada before continuing on to Madera.

UPRR – BNSF Castle: The UPRR – BNSF Castle alignment alternative would affect the same neighborhoods as the UPRR N/S alignment alternative through Turlock and the BNSF Castle alignment alternative north of Winton with the exception of the connection between the UPRR and BNSF corridors just south of the Merced County line where the alignment alternative would not pass through any additional neighborhoods.

UPRR – BNSF: The UPRR – BNSF alignment alternative would affect the same neighborhoods as the UPRR N/S alignment alternative in San Joaquin County, the connection to the BNSF alignment alternative north of Winton, and the BNSF alignment alternative south of the connection.

3.7.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

Land use and local communities will change between 2006 and 2030 as a result of population growth and changes of economic activity in the study areas for the six corridors studied (see Chapter 5, "Economic Growth and Related Impacts"). The No Project Alternative is based on existing conditions and the funded and programmed transportation improvements that would be developed and in operation by 2030. Although it is expected that the No Project Alternative would result in some changes related to land use compatibility, communities and neighborhoods, property, and environmental justice, it was assumed that projects included in the No Project Alternative would include typical design and construction practices to avoid or minimize potential impacts and would be subject to a project-level environmental review process to identify potentially significant impacts and to include feasible mitigation measures to avoid or substantially reduce potential impacts. Although some changes would be likely, attempting to estimate such changes would be speculative. Therefore, no additional potential impacts were quantified for the No Project Alternative.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

Table 3.7-3 provides a summary comparison of alignment alternatives for the land use evaluations. A review of the land use impacts for each corridor follows the table.

Table 3.7.3.
Land Use Summary Data Table for
Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	H Compatible with existing Caltrain Corridor.	N	L Corridor would be built mostly within existing Caltrain Corridor.	M Alignment within existing rail right-of-way. Percentages of EJ populations in study area exceed thresholds.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
	1 of 1	Dumbarton to San Jose	H Compatible with existing Caltrain Corridor.	N	L Corridor would be built mostly within existing Caltrain Corridor.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
Station Location Options						
Transbay Transit Center			H Compatible with transportation and high-density office use.	N	L Station would be located at the current Transbay Terminal.	L Percentages of EJ populations are lower than the thresholds.
4th and King (Caltrain)			H Compatible with existing Caltrain station and surrounding uses.	N	L Station would be located at the current Caltrain station site.	L Percentages of EJ populations are lower than the thresholds.
Millbrae/SFO			H Compatible with existing transportation uses at the Millbrae BART/Caltrain Station area.	N	L Station would be located at the Millbrae BART/ Caltrain Station site.	L Percentages of EJ populations are lower than the thresholds.
Redwood City (Caltrain)			H Compatible with existing Caltrain station and adjacent downtown commercial/service oriented uses. Consistent with plans that promote transit alternatives to the automobile.	N	L Station would be located at the current Caltrain station site.	L Percentages of EJ populations are lower than the thresholds.
Palo Alto (Caltrain)			H Compatible with Caltrain station, multifamily housing, and facilities associated with Stanford University. Consistent with multi-modal transit center.	N	L Station would be located at the current Caltrain station site.	L Percentages of EJ populations are lower than the thresholds.
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	H Compatible with existing UPRR right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
		12th Street/City Center to Niles Junction	H Compatible with existing UPRR right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
	1 of 2	Niles Junction to San Jose via Trimble	H Compatible with existing UPRR/I-880 right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
		Niles Junction to San Jose via I-880	H Compatible with existing UPRR/I-880 right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
Station Location Options						
West Oakland/7th Street			H Compatible with existing West Oakland BART Station and transit-oriented district. Consistent with plans for transit oriented district.	N	L Station would be constructed below grade at the existing West Oakland BART Station.	M Station constructed below grade. Percentages of EJ populations within station area exceed thresholds.
12th Street/City Center			H Compatible with 12th Street/City Center BART Station, civic center, and high-intensity commercial uses associated with Downtown Oakland. Consistent with plans for transit oriented district.	N	L Station would be constructed below grade at the existing Oakland City Center/12th Street BART Station.	M Station constructed below grade. Percentages of EJ populations within station area exceed thresholds.
Coliseum/Airport			H Compatible with industrial uses and commercial uses associated with the McAfee Coliseum and ORACLE Arena. Consistent with plans for transit oriented district.	N	L Station would be located south of the Coliseum/Oakland Airport BART Station along UPRR right-of-way.	M Station constructed at existing Coliseum/ Oakland BART Station. Percentages of EJ populations within station area exceed thresholds.
Union City (BART)			H Compatible with Union City BART Station and industrial and	N	L Station would be located near the current Union City BART Station.	M Station constructed near existing Union City BART Station. Percentages of EJ

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
			commercial uses. Consistent with plans for development of a regional intermodal facility and research and development campus.			populations within station area exceed thresholds.
Fremont (Warm Springs)			H Compatible with existing industrial and transportation uses. Consistent with plans for future BART station.	N	L Potential impacts on undeveloped properties.	H New station constructed outside of existing right-of-way. Percentages of EJ populations within station area exceed thresholds.
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	M Highly compatible with existing Caltrain Corridor between San Jose and Gilroy. Low compatibility with agricultural land and open space, east of Gilroy.	N	L Alignment within existing Caltrain Corridor between San Jose and Gilroy. East of Gilroy, alignment within agricultural and open space.	M Alignment within existing rail right-of-way, north of Gilroy. New alignment east of Gilroy. Although the EJ percentage thresholds are exceeded east of Gilroy, the EJ populations are sparse and distant from the HST line.
	1 of 3	Henry Miller (UPRR Connection)	M Highly compatible with existing Henry Miller Road between Santa Nella and Elgin Avenue. New alignment right-of-way would be incompatible with agricultural uses east of Elgin Avenue.	N	L Alignment would be built through agricultural land. Impacts would be minimal.	L Alignment alternative would create new transportation right-of-way. Although the EJ percentage thresholds are exceeded, the populations are sparse and distant from the HST line.
		Henry Miller (BNSF Connection)	M Highly compatible with existing Henry Miller Road between Santa Nella and Elgin Avenue. New alignment right-of-way would be incompatible with agricultural uses east of Elgin Avenue.	N	L Alignment would be built through agricultural land. Impacts would be minimal.	L Alignment alternative would create new transportation right-of-way. Although the EJ percentage thresholds are exceeded, the populations are sparse and distant from the HST line.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
		GEA North	L Incompatible with agricultural uses.	N	L Alignment would be built through agricultural and open space. Impacts would be minimal.	H Alignment alternative would create new transportation right-of-way. Percentages of EJ populations exceed thresholds.
San Jose (Diridon)			H Compatible with San Jose Diridon Caltrain station and industrial uses. Consistent with plans for downtown redevelopment.	N	L Station would be located at the current Caltrain station site.	L Percentage of EJ populations is lower than the thresholds.
Morgan Hill (Caltrain)			H Compatible with Morgan Hill Caltrain station and commercial uses. Consistent with plans for development of multi-modal transit transfer center.	N	L Station would be located at the current Caltrain station site.	L Percentages of EJ populations are lower than the thresholds.
Gilroy (Caltrain)			M Highly compatible with existing Gilroy Caltrain station and commercial uses. Low compatibility with single-family residential use. Consistent with policies for development of a multi-modal transit center.	N	L Station would be located at the current Caltrain station site.	M Station constructed at existing Gilroy Caltrain Station. Percentages of EJ populations within station area exceed thresholds.
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	H Compatible with existing highway/ rail right-of-way.	N	H Potential for high impacts on residential properties and medium impacts on nonresidential properties.	L Percentages of EJ populations are lower than the thresholds.
		I-580/ UPRR	H Compatible with existing highway/ rail right-of-way. Incompatible with single-family uses.	N	M Potential for high impacts on residential properties and low to medium impacts on nonresidential properties.	L Percentages of EJ populations are lower than the thresholds

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
		Patterson Pass/UPRR	H Compatible with commercial, industrial, multifamily residential and open space uses and existing rail right-of-way.	N	L – M Alignment would traverse mostly through unincorporated and unused portions of Alameda County; however, there is a potential to have medium impacts on residential properties and low to medium impacts on nonresidential properties west of Livermore.	L Percentages of EJ populations are lower than the thresholds.
		UPRR	M - H Highly compatible with existing rail right-of-way, commercial and industrial uses. Low compatibility with agricultural uses.	N	M Potential for high impacts on residential properties and low to medium impacts on nonresidential properties.	L Percentages of EJ populations are lower than the thresholds.
	1 of 4	Tracy Downtown (BNSF Connection)	M Highly compatible with existing transportation right-of-way, agricultural and industrial uses. Low compatibility with residential uses.	N	M Potential impacts on residential and nonresidential uses.	L Percentages of EJ populations are lower than the thresholds.
		Tracy ACE Station (BNSF Connection)	M Highly compatible with existing rail right-of-way, agricultural and industrial uses. Low compatibility with residential uses.	N	M Potential impacts on residential and nonresidential uses.	L Percentages of EJ populations are lower than the thresholds.
		Tracy ACE Station (UPRR Connection)	M Highly compatible with existing rail right-of-way, agricultural and industrial uses. Low compatibility with residential uses.	N	M Potential impacts on residential and nonresidential uses.	L Percentages of EJ populations are lower than the thresholds.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
		Tracy Downtown (UPRR Connection)	M Highly compatible with existing transportation right-of-way, agricultural and industrial uses. Low compatibility with residential uses.	N	M Potential impacts on residential and nonresidential uses.	L Percentages of EJ populations are lower than the thresholds.
	2 of 2	East Bay Connections	H Compatible with existing UPRR right-of-way.	N	L Corridor would be built mostly within existing UPRR right-of-way.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
Station Location Options						
Pleasanton (I-680/Bernal Rd)			M Incompatible with single-family residential use. Medium compatibility with nearby schools and community parks. Moderately consistent with plans for adjacent parks, athletics fields and public utilities. Compatible with existing ACE station.	N	L Station would be located at the Pleasanton ACE station site.	L Percentages of EJ populations are lower than the thresholds.
Pleasanton (BART)			H Compatible with Dublin/Pleasanton BART station and existing transit corridor. Consistent with planned mixed-use development around BART station.	N	L Station would be located at the Dublin/Pleasanton BART Station.	L Percentages of EJ populations are lower than the thresholds.
Livermore (Downtown)			H Compatible with industrial and transportation uses. Consistent with policies for development of mixed-use downtown development.	N	L Potential for low potential impacts on undeveloped property	L Percentages of EJ populations are lower than the thresholds.
Livermore (I-580)			H Compatible with existing transportation uses. Consistent with	N	L Potential for low potential impacts on undeveloped property	L Percentages of EJ populations are lower than the thresholds.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
			plans for neighborhood commercial land uses.			
Livermore (Greenville Road/UPRR)			H Compatible with industrial uses. Consistent with proposed industrial use.	N	M Potential for medium impacts on industrial property.	L Percentages of EJ populations are lower than the thresholds.
Livermore (Greenville Road/I-580)			M Compatible with industrial uses. Incompatible with existing and proposed agricultural uses. Not consistent with proposed agricultural use.	N	L Potential for low impacts on undeveloped property.	L Percentages of EJ populations are lower than the thresholds.
Tracy (Downtown)			H Highly consistent with planned downtown mixed-use development.	N	L Potential for low impacts on undeveloped property.	L Percentages of EJ populations are lower than the thresholds.
Tracy (ACE)			M Compatible with industrial and agricultural uses. Consistent with policies to encourage improved regional rail service.	N	M Potential for medium impacts on industrial property.	L Percentages of EJ populations are lower than the thresholds.
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	H Highly compatible with transportation and industrial uses.	N	L Potential for low impacts on residential and nonresidential properties because alignment would be below grade.	M Alignment below grade. Percentages of EJ populations exceed thresholds.
		Trans Bay Crossing – 4th & King	H Highly compatible with transportation and industrial uses.	N	L Potential for low impacts on residential and nonresidential properties because alignment would be below grade.	M Alignment below grade. Percentages of EJ populations exceed thresholds.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
	1 of 6	Dumbarton (High Bridge)	M Highly compatible with multifamily residential, industrial and commercial, and existing rail right-of-way uses. Low compatibility with crossing of Newark Slough.	N	M Potential for low impacts on industrial, commercial properties and high impacts on residential properties.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
		Dumbarton (Low Bridge)	M Highly compatible with multifamily residential, industrial and commercial, and existing rail right-of-way uses. Low compatibility with crossing of Newark Slough.	N	M Potential for low impacts on industrial, commercial properties and high impacts to residential properties.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
		Dumbarton (Tube)	M Highly compatible with multifamily residential, industrial and commercial, and existing rail right-of-way uses. Low compatibility with crossing of Newark Slough.	N	M Potential for low impacts on industrial, commercial properties and high impacts on residential properties.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
		Fremont Central Park (High Bridge)	L Low compatibility with Don Edwards San Francisco Bay Wildlife Refuge. Medium compatibility with industrial and commercial uses.	N	H Potential for high impacts on residential properties.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
		Fremont Central Park (Low Bridge)	L Low compatibility with Don Edwards San Francisco Bay Wildlife Refuge. Medium compatibility with industrial and commercial uses.	N	H Potential for high impacts on residential properties.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
		Fremont Central Park (Tube)	L Low compatibility with Don Edwards San Francisco Bay Wildlife Refuge. Medium compatibility with industrial and commercial uses.	N	H Potential for high impacts on residential properties.	M Alignment within existing rail right-of-way. Percentages of EJ populations exceed thresholds.
Station Location Options						
Union City (Shinn)			M Highly compatible with industrial uses. Low compatibility with single-family residential uses.	N	M Potential impacts on industrial properties.	H New station constructed outside of existing right-of-way. Percentages of EJ populations within station area exceed thresholds.
Central Valley	1 of 6	BNSF – UPRR	M High compatibility with existing rail corridor and industrial and commercial uses. Low compatibility with residential use.	N	L Alignment alternative traverses mostly rural land.	M New alignment mostly within existing right-of-way. Percentages of EJ populations exceed thresholds.
		BNSF	M High compatibility with existing rail corridor and industrial and commercial uses. Low compatibility with residential use.	N	L Alignment alternative traverses mostly rural land.	M New alignment within existing right-of-way. Percentages of EJ populations exceed thresholds.
		UPRR N/S	M High compatibility with existing rail corridor and industrial, agricultural and commercial uses. Low compatibility with residential uses.	N	L Alignment alternative traverses mostly rural land and would be built within the existing UPRR right-of-way.	M New alignment within existing right-of-way. Percentages of EJ populations exceed thresholds.
		BNSF Castle	M High compatibility with existing rail corridor and industrial, agricultural and commercial uses. Low compatibility with residential uses.	N	L - M Alignment alternative traverses mostly rural land. Potential for property impacts on nonresidential and residential properties.	M New alignment mostly within existing right-of-way. Percentages of EJ populations exceed thresholds.

Corridor	Possible Alignments	Alignment Alternative	Land Use Compatibility (H,M,L)	Community Cohesion Impacts (Y/N)	Potential For Property Impacts (H,M,L)	Environmental Justice (EJ) Impacts (H,M,L)
		UPRR – BNSF Castle	M High compatibility with existing rail corridor and industrial, agricultural and commercial uses. Low compatibility with residential uses.	N	L - M Alignment alternative traverses mostly rural land. Potential for property impacts on nonresidential and residential properties.	M New alignment mostly within existing right-of-way. Percentages of EJ populations exceed thresholds.
		UPRR – BNSF	M High compatibility with existing rail corridor and industrial, agricultural and commercial uses. Low compatibility with residential uses.	N	L - M Alignment alternative traverses mostly rural land. Potential for property impacts on nonresidential and residential properties.	M New alignment mostly within existing right-of-way. Percentages of EJ populations exceed thresholds.
Station Location Options						
Modesto (Downtown)			H Compatible with industrial and commercial uses.	N	M Medium potential for impacts on industrial properties.	L Percentages of EJ populations are lower than the thresholds.
Briggsmore (Amtrak)			L Incompatible with single-family residential and agricultural uses.	N	L Low potential for impacts on rural undeveloped properties.	L Percentages of EJ populations are lower than the thresholds.
Merced (Downtown)			M Compatible with commercial use. Incompatible with single-family .residential use.	N	M Medium potential for impacts on industrial properties.	H New station constructed outside of existing right-of-way. Percentages of EJ populations within station area exceed thresholds.
Castle AFB			M Compatible with industrial use and inactive Castle AFB. Incompatible with residential use.	N	L Low potential for impacts on rural undeveloped properties.	H New station constructed outside of existing right-of-way. Percentages of EJ populations within station area exceed thresholds.

San Francisco to San Jose

Land Use Compatibility

Alignment Alternatives

San Francisco to Dumbarton: The San Francisco to Dumbarton alignment alternative would be highly compatible with existing land use because it would be constructed primarily within the existing

Caltrain corridor. Grade separations along the alignment alternative would entail the conversion of residential and nonresidential property.

Dumbarton to San Jose: The land use compatibility for the Dumbarton to San Jose alignment alternative would be the same as the San Francisco to Dumbarton alignment alternative.

Station Location Options

Transbay Transit Center: An underground HST station location option at the proposed Transbay Transit Center in downtown San Francisco would be highly compatible with the existing transportation use at the terminal site. The Transbay Transit Center station location option would be supportive of the high-intensity land use associated with the San Francisco financial district.

Fourth and King. An underground HST station location option at Fourth and King in the City of San Francisco would be highly compatible with the existing Caltrain station and yard under which it would be located. The 4th & King station location option would support other land use in the vicinity of the Caltrain station, including Pacific Bell Park and the Mission Bay Redevelopment area.

Millbrae/SFO: The Millbrae/SFO station location option would be highly compatible with the existing Caltrain/BART station and would support future planned use for the creation of a transit-oriented district surrounding the Millbrae BART/Caltrain station area. Construction of the HST parking and drop-off facilities would convert approximately 2 ac of commercial property to transportation use.

Redwood City: An HST station location option at Redwood City would be highly compatible with the existing Caltrain station and adjacent downtown commercial/service oriented uses. The station location option would be consistent with the *Redwood City Strategic General Plan,* which promotes development of convenient transit alternatives to the use of the automobile.

Palo Alto: An HST station location option at Palo Alto would be highly compatible with existing land use in the area, including multifamily housing and other facilities associated with Stanford University. The Palo Alto station location option would be consistent with the *Palo Alto Comprehensive Plan*, which supports the continued development and improvement of the University Avenue Multi-modal Transit Station. The Plan is supportive of a quiet, fast rail system that encircles the Bay and the development of intracounty and transbay transit systems that link Palo Alto to the rest of Santa Clara County and adjoining counties. Construction of the Palo Alto station location option, parking garage, and ancillary facilities would entail conversion of approximately 10 ac of industrial property to transportation use.

Communities and Neighborhoods

The San Francisco to San Jose corridor would be primarily within an existing, active commuter and freight rail corridor and therefore would not constitute any new physical or psychological barriers that would divide, disrupt, or isolate neighborhoods, individuals, or community focal points in the corridor. Between the 4th & King station location option and the Transbay Transit Center, the alignment alternative would be constructed underground and would not have an effect on community cohesion. Construction of grade separations along the corridor between San Francisco and San Jose would have a beneficial effect on community cohesion by improving circulation between neighborhood areas.

Property

San Francisco to Dumbarton: There would be a low potential for property impacts along this alignment alternative because the rail improvements would be mostly contained within existing rail right-of way. Grade separations along the alignment alternative could entail the conversion of residential and nonresidential property.

Dumbarton to San Jose: The potential for property impacts for the Dumbarton to San Jose alignment alternative would be the same as the San Francisco to Dumbarton alignment alternative.

Environmental Justice

The San Francisco to San Jose corridor would be along an existing transportation corridor; therefore, it would not be expected to result in disproportionate impacts on the environmental justice communities identified in the study area. The five potential station location options (Transbay Transit Center, 4th and King, Millbrae/SFO, Redwood City, and Palo Alto) do not have substantial minority or low-income populations in their respective vicinities. Although there is the potential for impacts on environmental justice communities, they are not disproportionate to these communities. Therefore, the potential for impacts would be medium.

Oakland to San Jose Corridor

Land Use Compatibility

Alignment Alternatives

West Oakland to Niles Junction: Land use compatibility levels for the West Oakland to Niles Junction alignment alternative would be high because it would be constructed primarily within the existing UPRR/I-880 corridor. Grade separations along the alignment might entail the conversion of residential and nonresidential property.

12th Street/City Center to Niles Junction: The land use compatibility levels for the 12th Street/City Center to Niles Junction alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative.

Niles Junction to San Jose via Trimble: The land use compatibility levels for the Niles Junction to San Jose via Trimble alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative including the portion of the alignment alternative that travels via tunnel at Trimble Road.

Niles Junction to San Jose via I-880: The land use compatibility levels for the Niles Junction to San Jose via I-880 alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative because it would travel along the I-880 corridor through San Jose.

Station Location Options

West Oakland/7th Street: An underground HST station location option at West Oakland would be highly compatible with the existing West Oakland BART station at this location. Existing residential uses in the vicinity are primarily single family; however, the *Oakland General Plan* designates the West Oakland station area as a transit-oriented district and proposes increased intensity of use over the planning period. Approximately 2 ac of land would be acquired for construction of the West Oakland station location option parking area. The property that would be acquired is currently in transportation/utility use; therefore, no land use conflict would occur.

12th Street/City Center: An underground HST station location option at 12th Street in the City of Oakland would be highly compatible with the existing civic center and high-intensity commercial and service uses associated with downtown Oakland. The proposed station location option would be consistent with the existing 12th Street/City Center BART station and would support policies in the *Oakland General Plan* that designate the 12th Street/City Center station area as a transit-oriented district.

Oakland Airport: The Oakland Airport station location option would be highly compatible with the nearby industrial complexes and the commercial and service uses associated with the McAfee Coliseum and ORACLE Arena. The proposed station location option would be consistent with the

Oakland General Plan, which designates the station location option area as a transit-oriented district and as an intermodal transfer point.

Union City (BART): The Union City (BART) station location option would be highly compatible with the transportation facilities and industrial uses in the surrounding area. An HST station location option at the existing Union City BART station would be consistent with the *Union City General Plan* to implement policies for development of a regional intermodal facility at this location. The station location option would also be supportive of future planned land use to develop a research and development campus in the area.

Fremont (Warm Springs): The Fremont (Warm Springs) station location option would be highly compatible with the transportation facilities and industrial uses surrounding the station location option. It would also be consistent with plans for a future BART station at this location.

Communities and Neighborhoods

The Niles/I-880 alignment alternative would have no effect on community cohesion because it would be constructed primarily within the existing UPRR/I-880 right-of-way or beneath grade. Although the alignment alternative may require the relocation of residential property for the construction of grade separations, it would not create a new physical barrier within existing neighborhoods.

Property

West Oakland to Niles Junction: The West Oakland to Niles Junction alignment alternative would be mostly contained within existing UPRR/I-880 right-of-way; therefore, it would have a low potential for property impacts. Grade separations along the alignment alternative could entail the conversion of residential and nonresidential property.

12th Street/City Center to Niles Junction: The potential for property impacts for the 12th Street/City Center alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative.

Niles Junction to San Jose via Trimble: The potential for property impacts for the Niles Junction to San Jose via Trimble alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative.

Niles Junction to San Jose via I-880: The potential for property impacts for the Niles Junction to San Jose via I-880 alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative.

Environmental Justice

Substantial percentages of minority populations are located in the study area for the Oakland to San Jose corridor. Because the alignment alternatives would be mostly contained within existing rail right-of-way, they would not be expected to result in disproportionate impacts on environmental justice communities.

The six potential station location options along this corridor also have substantial environmental justice populations nearby. Because the West Oakland/7th Street and Oakland/12th Street stations would be built below grade and the Oakland Airport and Union City (BART) stations would be built at existing BART stations, construction of these is not expected to have disproportionate impacts on environmental justice communities. The Shinn and Warm Springs stations would be constructed outside the existing rail right-of-way, but because these stations would be constructed on industrial properties, they are not expected to have disproportionate impacts on environmental justice communities.

San Jose to Central Valley Corridor

Land Use Compatibility

Alignment Alternatives

Pacheco: The Pacheco alignment alternative would be highly compatible with the existing Caltrain corridor between San Jose and Gilroy. However, as the alignment alternative veers from the existing right-of-way east of Gilroy, it would potentially be incompatible as it proceeds through agricultural land and parkland. Overall, this alignment alternative would have a medium compatibility with surrounding land uses.

Henry Miller (UPRR Connection): The Henry Miller (UPRR Connection) alignment alternative is compatible with existing land uses as it traverses at-grade along Henry Miller Road between Santa Nella and Elgin Avenue. The alignment alternative becomes highly incompatible with agricultural land uses east of Elgin Avenue and the GEA. Overall, the alignment alternative would have a medium land use compatibility rating.

Henry Miller (BNSF Connection): Land use compatibility for the Henry Miller (BNSF Connection) alignment alternative would be the same as the Henry Miller (UPRR Connection) alignment alternative.

GEA North: The GEA North alignment alternative would be highly incompatible with existing agricultural uses. West of the City of Atwater, alignment alternative segments that would connect with the Central Valley alignment alternative would be highly incompatible with agricultural uses. Overall, this alignment alternative would have a low compatibility with existing land uses.

Station Location Options

San Jose (Diridon): The proposed San Jose (Diridon) station location option would be highly compatible with the existing San Jose Diridon Caltrain station and the surrounding industrial and high-density residential uses. The station location option would be consistent with the *San Jose Downtown Strategy Plan* that promotes redevelopment of the downtown toward the west and closer to the station location option.

Morgan Hill: The Morgan Hill station location option would be highly compatible with the existing Caltrain station and nearby commercial/service oriented and other urban uses. The station location option would be consistent with the *City of Morgan Hill General Plan* policies that support the expansion of alternative transportation systems, as well as the development of a multi-modal transit transfer center.

Gilroy: The Gilroy station location option would be highly compatible with the existing Caltrain station and adjoining commercial uses; however, it would be incompatible with the adjacent single-family residential uses. The proposed station would be consistent with the policies and actions stated in the *Gilroy General Plan* that place a high priority on strengthening and restoring the downtown area, including the development of an active multi-modal transit center. Although the proposed station location option would be incompatible with the existing low-density residential uses, the general plan promotes the future development of higher-density residential and mixed uses in close proximity to the Caltrain station and the multi-modal transit center.

Communities and Neighborhoods

Pacheco: This alignment alternative traverses the dense urban city of San Jose but also travels through small rural cities such as Coyote, Morgan Hill, Gilroy, and San Felipe, which consist of small single-family residential neighborhoods and farmsteads. In northern San Felipe, the alignment alternative has a low potential to impact farmstead; however, there would be no loss of community or neighborhood cohesion as a result. In other locations where this alignment alternative would create a new transportation corridor (east of Gilroy), the alignment alternative would primarily pass through agricultural or open space lands and would not result in community cohesion impacts on neighborhoods.

Henry Miller (UPRR Connection): The Henry Miller (UPRR Connection) alignment alternative primarily passes through agricultural lands and would not result in community cohesion impacts on neighborhoods.

Henry Miller (BNSF Connection): The Henry Miller (BNSF Connection) alignment alternative primarily passes through agricultural lands and would not result in community cohesion impacts on neighborhoods.

GEA North: The GEA North alignment alternative traverses primarily through agricultural lands and would not result in community cohesion impacts on neighborhoods.

Property

Pacheco: Between the proposed Diridon and Gilroy station location options, grade separations along the alignment alternative could entail the conversion of residential and nonresidential property. The proposed San Jose to Central Valley Corridor would require new right-of-way east of the City of Gilroy. Overall, potential for property impacts is low.

Henry Miller (UPRR Connection): Because the Henry Miller (UPRR Connection) alignment alternative would traverse areas with agricultural or open space land uses, it would be expected to result in a low potential for property impacts on homes or buildings.

Henry Miller (BNSF Connection): The potential for property impacts with the Henry Miller (BNSF Connection) alignment alternative would be the same as the Henry Miller (UPRR Connection) alignment alternative.

GEA North: The GEA North alignment alternative would traverse areas with agricultural or open space land uses and would be expected to result in a low potential for property impacts on homes or buildings.

Environmental Justice

The study area for the San Jose to Central Valley corridor includes a variety of neighborhoods and a diverse multiethnic population. All four alignment alternatives have environmental justice populations that exceed the thresholds. Where the alignment alternatives use existing rail rights-of-way (i.e., along the Caltrain Corridor), they would not be expected to result in disproportionate impacts on environmental justice communities. The environmental justice population(s) percentages exceed the thresholds east of Gilroy in the open space and more rural areas, but these populations are sparse and distant from the alignment alternatives.

East Bay to Central Valley Corridor

Land Use Compatibility

Alignment Alternatives

I-680/580/UPRR: The I-680/580/UPRR alignment alternative would be highly compatible with existing land uses because it would primarily pass through existing freeway and rail right-of-way. At the base of the Diablo Mountain Range, the alignment alternative would have a low compatible rating as it crosses through the Castlewood Country Club before continuing north within existing I-680 right-of-way.

I-580/UPRR: The I-580/UPRR alignment alternative would be highly compatible with existing land uses as it proceeds by cut or tunnel through the Altamont Pass and its parkland and open space land uses. The alignment alternative is also compatible as it proceeds through agricultural land uses on existing rail right-of-way. However, for a short distance, the alignment alternative becomes incompatible as it traverses, at-grade, existing single-family residential land uses.

Patterson Pass/UPRR: The Patterson Pass/UPRR alignment alternative would be highly compatible with existing land uses as it proceeds by cut or tunnel through the Diablo Mountain Range, which contains parkland and open space land uses. Beyond the mountain range, the Patterson Pass/UPRR alignment alternative either follows existing rail right-of-way or proceeds by cut or tunnel through agricultural and open space land uses, which makes it highly compatible with existing land uses.

UPRR: The UPRR alignment alternative would be highly compatible with existing land uses as it proceeds by cut or tunnel through the Diablo Mountain Range, which contains parkland and open space land uses. When the alignment alternative is not proceeding by tunnel, it passes through on an existing rail corridor through single-family residential, agricultural, and rural residential land uses.

Tracy Downtown (BNSF Connection): The Tracy Downtown (BNSF Connection) alignment alternative would be highly compatible with existing land uses as it traverses along existing rail right-of-way through Tracy and SR 120 through Manteca. The alignment alternative would also be highly compatible with industrial and agricultural uses in the eastern portions of Tracy and Manteca as it traverses along existing transportation right-of-way. Residential land uses through the central portion of Tracy and southwestern Manteca would have a low compatibility rating. Agricultural land uses in the vicinity of the Tracy Downtown (BNSF Connection) alignment alternative would have a low compatibility with the alignment alternative where it would create a new transportation corridor east of Escalon.

Tracy ACE Station (BNSF Connection): The Tracy ACE Station (BNSF Connection) alignment alternative would be highly compatible with existing freight and passenger rail right-of-way, industrial uses southeast of Tracy and south of Lathrop, and agricultural uses in unincorporated areas of San Joaquin County. However, in the southern portion of Tracy, residential neighborhoods have a low compatibility rating with the proposed alignment alternative. Agricultural land uses along the Tracy ACE Station (BNSF Connection) alignment alternative would have low compatibility with the alignment alternative where it would create a new transportation corridor east of Escalon. Overall, the alignment alternative would have a medium land use compatibility.

Tracy ACE Station (UPRR Connection): The Tracy ACE Station (UPRR Connection) alignment alternative would be the same as the Tracy ACE Station (BNSF Connection) alignment alternative except that at the UPRR connector, adjacent industrial land uses would be highly compatible.

Tracy Downtown (UPRR Connection): The Tracy Downtown (UPRR Connection) alignment alternative would be the same as the Tracy Downtown (BNSF Connection) alignment alternative except that at the UPRR connector, adjacent industrial land uses would be highly compatible.

Station Location Options

Pleasanton (I-680/Bernal): The Pleasanton (I-680/Bernal) station location option would have a medium compatibility with surrounding land uses, including single-family residential uses, Pleasanton Middle School, and the Fairways Golf Course. This proposed station location option is at the existing Pleasanton ACE station and is highly compatible with planned office land uses as set forth by the *Downtown Specific Plan* by the City of Pleasanton. Policies for the *Draft Bernal Property Phase II Specific Plan,* which call for the construction of community and neighborhood parks, athletics fields, and public utilities on land west and adjacent to the proposed site, would be moderately consistent.

Dublin/Pleasanton: The Dublin/Pleasanton station location option would be highly compatible with the existing BART station and transit corridor. This station location option would be consistent with policies in the *Pleasanton General Plan,* which call for the planned mixture of land uses around the Dublin/Pleasanton BART Station.

Livermore (Downtown): The Livermore (Downtown) station location option would be constructed on and would be highly compatible with the industrial property along an existing commuter/freight corridor. This proposed station location option would be consistent with the *Livermore General Plan* (2003) policies for the development of mixed-use downtown development along the existing commuter/freight rail corridor.

Livermore (I-580): The Livermore (I-580) station location option would be located adjacent to I-580 and would be highly compatible with the existing transportation corridor. The proposed station location option would be consistent with the *Livermore General Plan* (2003) policies for neighborhood commercial land uses at this location.

Livermore (Greenville Road/UPRR): The proposed Livermore (Greenville Road/UPRR) station location option would be highly compatible with the industrial uses at this location. It would also be consistent with the *Livermore General Plan* (2003) proposed industrial use at this location.

Livermore (Greenville Road/I-580): This proposed HST station location option would be located near the median of I-580, just east of the Greenville Road interchange. The proposed station location option facilities would be highly compatible with the existing industrial uses located west of the site. The proposed station location option would not be consistent with existing and proposed agricultural uses. Overall, the alignment alternative would have a medium land use compatibility.

Tracy (Downtown): The proposed Tracy (Downtown) station location option would have a high compatibility rating because it would be located in downtown Tracy and would be consistent with planned downtown mixed-use development, as stated in the *Draft City of Tracy General Plan.* However, there are existing single-family residential uses near the site.

Tracy (ACE): The proposed Tracy (ACE) station location option would have a medium compatibility with surrounding agricultural lands and existing and proposed industrial land uses in the vicinity of the site. The proposed station would be consistent with specific policies in the *Draft City of Tracy General Plan* to encourage improved regional rail service.

Communities and Neighborhoods

Most of the alignment alternatives in this corridor would pass through communities and neighborhoods within an existing active highway or commuter/freight rail right-of-way. In locations where the alignment alternatives would create a new transportation corridor, the alignment alternative would primarily pass via cut or tunnel through the Diablo Mountain Range and would not result in community cohesion impacts in neighborhoods.

Property

Within the East Bay to Central Valley corridor, areas of potentially high property impacts would occur in the vicinity of urbanized areas in the cities of Pleasanton, Livermore, Tracy, and Manteca, where the alignment alternatives would be adjacent to existing industrial, commercial, and residential properties.

I-680/580/UPRR: There would be a potential for high property impacts on industrial properties along this alignment alternative in Pleasanton and Livermore. The potentially affected properties would be adjacent to the existing highway corridor.

I-580/UPRR: The potential for property impacts along this alignment alternative would be low to medium because it would either create a new transportation corridor through rural undeveloped land in unincorporated areas of Alameda. There is a potential for property impacts on industrial properties adjacent to the existing highway corridor.

Patterson Pass/UPRR: Overall, the potential for property impacts for this alignment alternative would be low to medium. The potential for medium property impacts would occur in industrial areas of Pleasanton and Livermore. A new HST line through rural, undeveloped areas in unincorporated parts of Alameda County would have low to medium potential for property impacts. The potential for property impacts along the proposed Patterson Pass/UPRR alignment alternative is low because it would traverse through an unincorporated portion of Alameda County, east of Livermore. Grade separations along the alignment alternative could entail the conversion of residential and nonresidential property.

UPRR: Overall, the potential for property impacts for this alignment alternative would be medium. Along the UPRR alignment alternative, the potential for property impacts would be high in the residential areas of Pleasanton and Livermore that are adjacent to the existing rail corridor. The potential for medium property impacts would occur in industrial areas of Pleasanton and Livermore. A new HST line through rural, undeveloped areas in unincorporated parts of Alameda County would have low to medium potential for property impacts. Grade separations along the alignment alternative could entail the conversion of residential and nonresidential property.

Tracy Downtown (BNSF Connection): The Tracy Downtown (BNSF Connection) alignment alternative would be mostly contained within existing freight right-of-way. However, grade separations along the alignment alternative could entail the conversion of residential and nonresidential property, which would have a medium potential for property impacts. The BNSF connector would traverse areas with mostly agricultural or open space land uses, they would be expected to result in a low potential for property impacts on homes or buildings.

Tracy ACE Station (BNSF Connection): Overall, the Tracy ACE Station alignment alternative would be mostly contained within existing rail right-of-way. Grade separations along the alignment alternative might entail the conversion of residential and nonresidential property; therefore, the potential for property impacts would be medium. Because the alignment alternative would traverse areas with mostly agricultural or open space land uses, it would be expected to result in a low potential for property impacts on homes or buildings.

Tracy ACE Station (UPRR Connection): The Tracy ACE Station (UPRR Connection) alignment alternative would be the same as the Tracy ACE Station (BNSF Connection) alignment alternative except that at the UPRR connector would be a medium potential for impacts on industrial properties west of Manteca.

Tracy Downtown (UPRR Connection): The Tracy Downtown (UPRR Connection) alignment alternative would be the same as the Tracy Downtown (BNSF Connector) alignment alternative except that at the UPRR connector there would be a medium potential for impacts on industrial properties west of Manteca.

Environmental Justice

The environmental justice populations in the study areas for the East Bay to Central Valley corridor and proposed stations do not exceed the percentage thresholds.

San Francisco Bay Crossings

Land Use Compatibility

Alignment Alternatives

Trans Bay Crossing – Transbay Transit Center: The Trans Bay Crossing – Transbay Transit Center alignment alternative between San Francisco and Alameda counties would be highly compatible with existing transportation and industrial uses located in the cities of San Francisco and Oakland.

Trans Bay Crossing – 4th & King: Land use compatibility for the Trans Bay Crossing – 4th & King alignment alternative would be the same as the Trans Bay Crossing – 4th & King alignment alternative.

Dumbarton (High Bridge): The Dumbarton alignment alternative would generally be highly compatible with existing transportation corridors, multifamily residential, and commercial land uses. Industrial uses on both sides of the Dumbarton Bridge would also be highly compatible with the alignment alternative. However, the alignment alternative would result in a low compatibility where it crosses the Newark Slough. Overall, this alignment alternative would have a medium compatibility.

Dumbarton (Low Bridge): *Land* use compatibility for the Dumbarton (Low Bridge) alignment alternative would be the same as the Dumbarton (High Bridge) alignment alternative.

Dumbarton (Tube): Land use compatibility for the Dumbarton (Tube) alignment alternative would be the same as the Dumbarton (High Bridge) alignment alternative.

Fremont Central Park (High Bridge): The Fremont Central Park (High Bridge) alignment alternative would potentially have a low to medium compatibility with existing single-family residential and community park land uses in the City of Fremont. The proposed alignment alternative would pass through the Don Edwards San Francisco Bay National Wildlife Refuge on existing rail, resulting in a low compatibility with the existing land uses of the refuge. Nearby industrial and commercial uses, east of I-880, would have the potential for high compatibility.

Fremont Central Park (Low Bridge): Land use compatibility for the Fremont Central Park (Low Bridge) alignment alternative would be the same as the Fremont Central Park (High Bridge) alignment alternative.

Fremont Central Park (Tube): Land use compatibility for the Fremont Central Park (Tube) alignment alternative would be the same as the Fremont Central Park (High Bridge) alignment alternative.

Station Location Options

Union City (Shinn): The Union City (Shinn) station location option would be compatible with the industrial uses located in the surrounding area. The proposed station location option would have low compatibility with the single-family residential use to the south of the proposed alignment alternative.

Communities and Neighborhoods

The Trans Bay Crossing alignment alternatives would proceed via tunnel under the San Francisco Bay between the cities of San Francisco and Oakland and would not result in any community cohesion impacts. The Dumbarton alignment alternatives would follow an existing rail alignment and would not result in community cohesion impacts on neighborhoods. The Fremont Central Park alignment alternatives would follow an existing rail alignment west of I-880 in Newark. East of I-880, the alignment alternatives would create a new transportation corridor between two neighborhoods in the City of Fremont. There would be no community cohesion impacts as a result of these alignment alternatives because they would follow an exiting major utility corridor.

Property

Trans Bay Crossing – Transbay Transit Center: The Trans Bay Crossing – Transbay Transit Center alignment alternative would have areas of potentially low property impacts because the new transportation corridor would be constructed in an urban setting below grade.

Trans Bay Crossing – 4th & King: The Trans Bay Crossing – 4th & King alignment alternative would have the same potential for property impacts as the Trans Bay Crossing – Transbay Transit Center alignment alternative.

Dumbarton (High Bridge): The Dumbarton alignment alternative would have the potential for medium property impacts because it would generally follow an existing corridor through suburban industrial, commercial, and residential areas. Grade separations could entail the conversion of residential and nonresidential property.

Dumbarton (Low Bridge): The Dumbarton (Low Bridge) alignment alternative would have the same potential for property impacts as the Dumbarton (High Bridge) alignment alternative.

Dumbarton (Tube): The Dumbarton (Tube) alignment alternative would have the same potential for property impacts as the Dumbarton (High Bridge) alignment alternative.

Fremont Central Park (High Bridge): Areas of potentially high property impacts would occur along the Fremont Central Park (High Bridge) alignment alternative because the proposed alignment alternative would traverse through a new transportation corridor between two neighborhoods in Fremont, east of Blacow Park. Grade separations could entail the conversion of residential and nonresidential property.

Fremont Central Park (Low Bridge): The Fremont Central Park (Low Bridge) alignment alternative would have the same potential for property impacts as the Fremont Central Park (High Bridge) alignment alternative.

Fremont Central Park (Tube): The Fremont Central Park (Tube) alignment alternative would have the same potential for property impacts as the Fremont Central Park (High Bridge) alignment alternative.

Environmental Justice

Ethnic minority populations have been identified within the study areas for all of the proposed San Francisco Bay Crossings. The potential impacts, if any, for these communities would depend in part on the extent of the new right-of-way that would be required for the HST Alignment Alternatives. Because the alignment would be mostly contained within existing rail right-of-way, it would not be expected to result in disproportionate impacts on environmental justice communities.

Central Valley Alignment

Land Use Compatibility

Alignment Alternatives

BNSF – UPRR: North of Merced, the BNSF – UPRR alignment alternative contains some residential development and, given the relatively low potential to impact residents, the compatibility rating would be high. However, because of the high percentage of agricultural production, this alignment alternative would have a medium compatibility. In Merced County, along the existing UPRR corridor, land uses are mostly agricultural with some residential. This land use pattern is considered to have a medium compatibility with this alternative.

BNSF: The BNSF alignment alternative would be the same as the BNSF – UPRR alignment alternative except that south of Merced, the alignment alternative would continue along the existing BNSF corridor traveling through mostly agricultural land with some industrial and commercial uses. Overall, this alignment alternative would have a medium compatibility with existing land uses.

UPRR N/S: The UPRR alignment alternative contains some residential development between the cities of Stockton and Modesto. The predominant land use adjoining the route consists of orchards, groves, vineyards, and nurseries. Between the cities of Modesto and Chowchilla, along the existing UPRR corridor, land uses are mostly agricultural with some residential. This land use pattern is considered to have a medium compatibility with the alignment alternative.

BNSF Castle: The BNSF Castle alignment alternative would be the same as the BNSF – UPRR alignment alternative except that the alignment alternative would continue just west of Castle AFB before continuing along the existing BNSF rail right-of-way, traveling through mostly agricultural land with some industrial and commercial uses. Overall, this alignment alternative would have a medium compatibility with existing land uses.

UPRR – BNSF Castle: The UPRR – BNSF Castle alignment alternative would be the same as the UPRR N/S alignment alternative through Turlock and the BNSF Castle alignment alternative north of Winton with the exception of the connection between the UPRR and BNSF corridors just south of the Merced County line, where the alignment alternative would pass through agricultural land uses. Overall, this alignment alternative would have a medium compatibility with existing land uses.

UPRR – BNSF: The UPRR – BNSF alignment alternative would be the same as the UPRR N/S alignment alternative in San Joaquin County, the connection to the BNSF north of Winton, and the BNSF alignment alternative south of the connection.

Station Location Options

Modesto (Downtown): The Modesto (Downtown) station location option area has a small amount of residential land uses. Predominant land uses in the area are commercial and industrial, which would result in a high level of compatibility with the HST station location option.

Briggsmore (Amtrak): The Briggsmore station location option in the City of Modesto has nearly double the residential use as the Modesto (Downtown) station location option. The residential development in this area is lower density rural, mobile homes, and single-family subdivisions. The HST station location option is therefore considered to have a low compatibility with existing land uses.

Merced (Downtown): The Merced (Downtown) station location option is characterized by a moderate amount of residential development and supportive community commercial and governmental functions. Because of the extent of residential uses and the community-serving nature of the commercial activities (as opposed to more regional-serving uses), this station location option is assigned a medium compatibility rating.

Castle AFB : The Castle AFB station location option along the existing UPRR right-of-way is surrounded by agricultural uses and rural residential uses. The station location option along the existing BNSF right-of-way is surrounded by the inactive Castle AFB to the north and agricultural lands to the south. Both station location options are rated as having medium compatibility with these types of land uses.

Communities and Neighborhoods

For much of the Central Valley corridor, the alignment alternatives follow existing rail lines, either the UPRR or BNSF. In many cases, smaller rural communities are developed along the existing UPRR railroad tracks. There would be no neighborhood cohesion impact on these communities as a result of the alignments. In larger communities such as Stockton, French Camp, Ripon, Modesto, Ceres, Atwater, Merced, and Chowchilla, the existing UPRR rail line divides the community. The existing BNSF corridor also divides large communities such as Escalon, Riverbank, and Empire. A parallel, at-grade set of tracks would therefore not generally be expected to result in an additional physical separation which exists between land uses on either side of the corridor.

Property

BNSF – UPRR: For this alignment alternative, areas of potentially high property impacts would occur in urbanized areas where the alignment alternative would be located adjacent to an existing transportation corridor. Areas of potentially high and medium impacts are located between Stockton and Merced along both the existing UPRR and BNSF alignments. Grade separations along the alignment alternative might entail the conversion of residential and nonresidential property. Because the alignment alternative would be mostly contained within existing UPRR and BNSF right-of-way and would traverse through mostly agricultural land and open space, there would be a low potential for property impacts.

BNSF: The potential for property impacts with the BNSF alignment would be the same as the BNSF – UPRR alignment alternative except that the alignment alternative would follow the existing BNSF right-of-way and not the UPRR right-of-way.

UPRR N/S: The potential for property impacts with the UPRR N/S alignment alternative would be the same as the BNSF – UPRR alignment alternative except that the alignment alternative would follow the existing UPRR right-of-way and not the BNSF right-of-way.

BNSF Castle: For this corridor, the potential for property impacts with the BNSF Castle alignment alternative would range from low to medium. The alignment alternative that would be within existing BNSF right-of-way would have the potential for low property impacts. A portion of the alignment alternative, east of Winton, would travel near Castle AFB and a residential neighborhood; the potential for property impacts for this area would be medium.

UPRR – BNSF Castle: The potential for property impacts with the UPRR – BNSF Castle alignment alternative would be the same as the BNSF Castle alignment alternative except that the alignment alternative would follow the existing UPRR right-of-way within San Joaquin County.

UPRR – BNSF: The potential for property impacts with the UPRR – BNSF alignment alternative would be the same as the BNSF Castle alignment alternative except that the potential for property impacts would be medium in areas north of Merced.

Environmental Justice

Within the corridor study area, environmental justice populations have been identified along the UPRR N/S alignment alternative and in the Merced (Downtown) and Castle AFB station areas. Since both alignment alternatives would be along existing rail corridors, they are not expected to result in disproportionate impacts on environmental justice communities. Although there is the potential for impacts on environmental justice communities, they are not disproportionate to these communities. Therefore, the potential for impacts would be medium.

3.7.4 Role of Design Practices in Avoiding and Minimizing Effects

The Authority is committed to utilizing existing transportation corridors and rail lines for the proposed HST system to minimize the need for additional rights-of-way and the associated potential property impacts. Most HST Alignment Alternatives are either within or adjacent to a major existing transportation corridor (existing railroad or highway right-of-way). To a large extent, these existing transportation corridors already present barriers and impose other impacts on existing communities. Although the HST system would often introduce an additional (fenced) barrier, the HST system would maintain and in many cases improve existing access conditions through the grade separation of existing services. Moreover, portions of the alignment alternatives would be on aerial structures or in tunnels, allowing for vehicular or pedestrian access across the alignment alternatives.

The Authority has also adopted strategies for HST station location options that would incorporate transit-oriented design and smart growth land use policies as described in Chapter 6.

3.7.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the design practices in Section 3.7.4, the HST Alignment Alternatives would have a potentially significant impact related to land use compatibility at the various locations identified. The station location options and the alignment alternatives for the San Francisco to San Jose and the Oakland to San Jose corridors have a high land use compatibility overall because they are mostly within existing transportation right-of-way. The East Bay to Central Valley corridor (including stations) would have a medium to high compatibility with existing land use. Medium land use compatibility for the stations and rail alignment occurs along the East Bay to Central Valley and San Francisco Bay Crossings corridors as they travel through a mixture of areas of low (e.g. agricultural and residential) and high (e.g. existing transportation) compatibility. The San Jose to Central Valley corridor would have the most potentially significant impact on land use because it would mostly create a new transportation corridor through agricultural and open space land uses. The station location options for the San Jose to Central Valley corridor, however, would be highly compatible with existing transportation land uses.

While every effort has been made to incorporate alignment alternatives and station location options that are compatible with existing local land use plans and ordinances to the extent feasible, in many cases local plans and ordinances do not address transportation options such as the HST system. In addition, many local land use plans and ordinances have not been updated for several years, though they may be updated over time to acknowledge and support implementation of a HST system. The potential for land use incompatibility is considered significant at this programmatic level due to the uncertainties involved; however, such impacts may not be realized over the 20- to 25-year time horizon for implementing the HST system.

Mitigation strategies, as well as the design practices in Section 3.7.4, can be refined and applied at the project level to reduce this impact, as discussed below. These mitigation measures would be incorporated as feasible.

A. LAND USE COMPATIBILITY

Local land use plans and ordinances would be further considered in the selection of alignment alternatives and station location options. Project-level review would consider consistency with existing and planned land use, neighborhood access needs, and multi-modal connectivity opportunities.

Potential mitigation strategies to alleviate or minimize land use related impacts associated with the HST Alignment Alternatives might include, but are not limited to, the following:

- Continue to apply design practices to minimize property needed for the HST system and to stay within or adjacent to existing transportation corridors to the extent feasible.
- Work with local governments to consider local plans and local access needs and to apply design practices to limit disruption to communities.
- Work with local governments to establish requirements for station location option area plans and opportunities for transit-oriented development.
- Work with local governments to enhance multi-modal connections for HST station location options.

- Coordinate with cities and counties to ensure that HST facilities will be consistent with land use planning processes and zoning ordinances.
- Provide opportunities for community involvement early in project-level studies.
- Hold design workshops in affected neighborhoods to develop understanding of vehicle, bicycle, and pedestrian linkages in order to preserve those linkages through use of grade-separated crossings and other measures.
- Ensure that connectivity is maintained across the rail corridor (pedestrian/bicycle and vehicular crossings) where necessary to maintain neighborhood integrity.
- Develop facility, landscape, and public art design standards for HST corridors that reflect the character of adjacent affected neighborhoods.
- Maintain a high level of visual quality of HST facilities in neighborhood areas by implementing such measures as visual buffers, trees and other landscaping, architectural design, and public artwork.
- Establish requirements for station area plans and opportunities for transit-oriented development (see Chapter 6).

B. COMMUNITIES AND NEIGHBORHOODS

Alignment alternatives would be further refined in consultation with local governments and planning agencies, with consideration given to minimizing barrier effects in order to maintain neighborhood integrity. Potential mitigation strategies to reduce the effects of any new barriers would be considered at the project-level environmental review and could include grade separating planned rail lines and streets, new pedestrian crossings, new cross-connection points, improved visual quality of project facilities, and traffic management plans to maintain access during and after construction.

In addition, mitigation measures would also be developed for temporary construction-related impacts on any nearby neighborhoods and communities. Potential mitigation strategies to alleviate or minimize community cohesion related impacts associated with the alignment alternatives might include, but are not limited to, the following:

- Provide opportunities for community involvement early in project-level studies.
- Hold design workshops within each affected neighborhood to develop an understanding of key vehicle, bicycle, and pedestrian linkages across the rail corridor so that those linkages can be preserved, including the use of grade-separated crossings.
- Develop facility, landscape, and public art design standards for project corridors that reflect the character of adjacent affected neighborhoods.
- Ensure that connectivity (pedestrian/bicycle and vehicular crossings) across the rail corridor is maintained where necessary to maintain neighborhood integrity.
- Develop a traffic management plan to reduce barrier effects during construction.
- To the extent feasible, maintain connectivity during construction.
- Maintain high level of visual quality of project facilities in neighborhood areas by implementing such measures as visual buffers, trees and other landscaping, architectural design, and public artwork.

C. PROPERTY

Potential land use displacement and property acquisition (temporary use and/or permanent and nonresidential property) are expected to be avoided to the extent feasible by considering further alignment alternative adjustments and design changes in the future at the project level. In addition, analysis at the project level would take into account relocation assistance in accordance with the Federal Uniform Relocation and Real Property Acquisition Policies Act of 1970. Design strategies would be developed for application at the project level to avoid or minimize the temporary or permanent acquisition of residential and nonresidential property.

Access modifications, including possible over or under crossings, may be needed to mitigate impacts arising from partial property acquisitions that result in division of a farm or other land use.

D. ENVIRONMENTAL JUSTICE

Overall, the HST system is not expected to result in disproportionate adverse effects to minority or low-income populations in the Bay Area to Central Valley study region. Additional consideration of environmental justice issues would occur during project-level review, which would include consideration of potential localized impacts and potential benefits to and enhancements for communities along potential HST Alignment Alternatives. Project-level review would also include consideration of detailed mitigation measures, including mitigation for temporary construction-related impacts. Project-level review would also include outreach to potentially affected communities as part of the public review process.

Potential mitigation strategies to alleviate or minimize land use related impacts associated with the HST Alignment Alternatives might include, but are not limited to, the following.

- EO 12898 requires federal agencies to ensure effective public participation and access to information. Consequently, a key component of compliance with EO 12898 is outreach to the potentially affected minority and/or low-income population to discover issues of importance that otherwise may not be apparent. Outreach to affected communities will be conducted as part of the decision-making process, and this outreach will be documented.
- In addition to examining all impacts, specific attention will be given to the permanent impact categories that are commonly of concern for this type of project and to those that previously have been identified as being of concern. These include:
  - Air quality
  - Noise and vibration
  - Public health
  - Visual/aesthetics
  - Parklands
  - Relocation

The above mitigation strategies are expected to reduce the land use compatibility impacts of the alignment alternatives to a less-than-significant level. Additional environmental assessment would allow a more precise evaluation in the second-tier, project-level environmental analyses.

3.7.6 Subsequent Analysis

Subsequent environmental evaluations and project-level review of proposed segments and facilities would address the need for the following studies.

- Land use studies for specific alignment alternatives and station location option areas potentially impacted, including evaluation of potential land use conversion, potential growth, and potential community benefits.
- Review of localized potential environmental justice issues.

- Relocation impact analysis for potentially displaced housing and businesses.
- Pedestrian and vehicular circulation studies.

3.8 Agricultural Lands

This section describes the agricultural lands in the San Francisco Bay Area to Central Valley study area and identifies the potential for impacts on agricultural lands that would be caused by the various HST Alignment Alternatives[1]. This programmatic evaluation focuses on the potential direct conversion of agricultural lands to nonagricultural uses from the HST Alignment Alternatives and the potential for the indirect conversion of agricultural lands to nonagricultural uses as a result of segmentation of agricultural lands or severing of access to agricultural lands so that the remaining parcels are not economically suitable for farmland use. The potential for conflicts with federal, state, and local programs and policies related to farmland preservation, beyond the impacts of conversion, requires a level of detail beyond that available for this program-level analysis; this detailed analysis will be conducted in project-level environmental documents. The potential for impacts on agricultural land as a result of growth is discussed in Chapter 5, “Economic Growth and Related Impacts.”

3.8.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Many regulatory and nonregulatory strategies are used to discourage and prevent farmland conversion (i.e., the conversion of land in agricultural use to nonagricultural use).

<u>Federal Farmland Protection Policy Act</u>

The U.S. Department of Agriculture’s (USDA’s) Natural Resources Conservation Service (NRCS) oversees the Farmland Protection Policy Act (FPPA) (7 U.S. Code [USC] § 4201 *et seq.*; see also 7 Code of Federal Regulations [CFR] 658). The FPPA (a subtitle of the 1981 Farm Bill) is national legislation designed to protect farmland. The FPPA states its purpose is to “minimize the extent to which federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses.” The FPPA applies to projects and programs that are sponsored or financed in whole or in part by the federal government. The FPPA does not apply to private construction projects subject to federal permitting and licensing, projects planned and completed without assistance from a federal agency, federal projects related to national defense during a national emergency, or projects proposed on land already committed to urban development. The FPPA spells out requirements to ensure federal programs to the extent practical are compatible with state, local, and private programs and policies to protect farmland and calls for the use of the Land Evaluation and Site Assessment (LESA) system to aid in analysis. Because the Authority may ultimately seek some federal funding, the FPPA is considered in this document.

<u>Williamson Act and Farmland Security Zone Contracts</u>

The California Land Conservation Act (Government Code §51200 *et seq.*) of 1965, commonly known as the Williamson Act, provides a tax incentive for the voluntary enrollment of agricultural and open space lands in contracts between local government and landowners. The contract enforceably restricts the land to agricultural and open space uses and compatible uses defined in state law and local ordinances. An agricultural preserve, which is established by local government, defines the boundary of an area within which a city or county will enter into contracts with landowners. Local governments calculate the property tax assessment based on the actual use of the land instead of the potential land value assuming full development.

Williamson Act contracts are for 10 years and longer. The contract is automatically renewed each year, maintaining a constant, 10-year contract, unless the landowner or local government files to

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

initiate nonrenewal. Should that occur, the Williamson Act would terminate 10 years after the filing of a notice of nonrenewal. Only a landowner can petition for a contract cancellation. Tentative contract cancellations can be approved only after a local government makes specific findings and determines the cancellation fee to be paid by the landowner.

The State of California has the following policies regarding public acquisition of and locating public improvements on lands in agricultural preserves and on lands under Williamson Act contracts (Government Code §51290–51295):

- State policy is to avoid locating federal, state, or local public improvements and improvements of public utilities, and the acquisition of land, in agricultural preserves.
- State policy is to locate public improvements that are in agricultural preserves on land other than land under Williamson Act contract.
- State policy is that any agency or entity proposing to locate such an improvement, in considering the relative costs of parcels of land and the development of improvements, give consideration to the value to the public of land, particularly prime agricultural land, in an agricultural preserve.

Since 1998, another option in the Williamson Act Program has been established with the creation of Farmland Security Zone contracts. A Farmland Security Zone is an area created within an agricultural preserve by a board of supervisors upon the request of a landowner or group of landowners. Farmland Security Zone contracts offer landowners greater property tax reduction and have a minimum initial term of 20 years. Like Williamson Act contracts, Farmland Security Zone contracts renew annually unless a notice of nonrenewal is filed.

Potential cancellation of Williamson Act and Farmland Security Zone contracts would be addressed in subsequent project-level documents.

Farmland Mapping and Monitoring Program

The Farmland Mapping and Monitoring Program (FMMP) is the only statewide land use inventory conducted on a regular basis. The California Department of Conservation administers the FMMP, under which it maintains an automated map and database system to record changes in the use of agricultural lands. Farmland under the FMMP is listed by category—Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance. Information regarding locations of farmland by category is readily available, and the potential conversion of FMMP lands is addressed in this document. The farmland categories listed under the FMMP are described below. The categories are defined pursuant to USDA land inventory and monitoring criteria, as modified for California.

Prime Farmland

Prime Farmland is land with the best combination of physical and chemical features to sustain long-term production of agricultural crops. These lands have the soil quality, growing season, and moisture supply necessary to produce sustained high yields. Soil must meet the physical and chemical criteria determined by the NCRS. Prime Farmland must have been used for production of irrigated crops at some time during the 4 years prior to the mapping date by the FMMP.

Farmland of Statewide Importance

Farmland of Statewide Importance is similar to Prime Farmland but with minor differences, such as greater slopes or a lesser ability of the soil to store moisture. Farmland of Statewide Importance must have been used for production of irrigated crops at some time during the 4 years prior to the mapping date.

Unique Farmland

Unique Farmland has lesser quality soils than Prime Farmland or Farmland of Statewide Importance. Unique Farmland is used for the production of the state's leading agricultural crops. These lands are usually irrigated but may include nonirrigated orchards or vineyards found in some climatic zones in California. Unique Farmland must have been used for crops at some time during the 4 years prior to the mapping date.

Farmland of Local Importance

Farmland of Local Importance is farmland that is important to the local agricultural community as determined by each county's board of supervisors and local advisory committees.

California Conservation Easements

Conservation easements are voluntarily established restrictions that are permanently attached to property deeds, with the general purpose of retaining land in its natural, open-space, agricultural, or other condition while preventing uses that are deemed inconsistent with the specific conservation purposes expressed in the easements. Agricultural conservation easements define conservation purposes that are tied to keeping land available for continued use as farmland. Such farmlands remain in private ownership, and the landowner retains all farmland use authority, but the farmland is restricted in its ability to be subdivided or used for nonagricultural purposes, such as urban uses. The California Farmland Conservancy Program (Public Resources Code §10200 *et seq.*) supports the voluntary granting of agricultural conservation easements from landowners to qualified nonprofit organizations, such as land trusts, as well as local governments. Potential impacts on conservation easements would be addressed in subsequent project-level documents.

Local Policies and Regulations

Local jurisdictions (cities and counties) also have policies and regulations that protect agricultural resources or regulate farmland. These may include establishment of agricultural preserves or agricultural districts, policies protecting identified farmland, and agricultural zoning. Specific local policies are not addressed in this program-level analysis. Project-level farmland policy analysis would be addressed in subsequent project-level documents.

B. METHOD OF EVALUATION OF IMPACTS

Method of Determining Study Areas

The study area for the proposed HST Alignment Alternatives was developed to address two different potential improvement scenarios. The first scenario was for potential alignment alternatives adjacent to existing rail corridors. In these cases, the study area extended 100 ft (30 m) from the rail right-of-way on the side that was selected for study based on conceptual engineering studies. The same method would also be used for alignments adjacent to existing highway corridors. This method allows the development of an estimate of the area that could be needed for a proposed HST system and an estimate within that area of the land now in agricultural use that would potentially be affected. This approach is illustrated below in Figure 3.8-1a.

The case shown in Figure 3.8-1a represents a conservative approach to quantifying potential impacts because it would be possible to fit the HST within a 50-foot (15-meter) right-of-way in areas of high agricultural impact. Moreover, it may be possible to fit the entire HST line into existing rail corridors, given agreements with private rail operators. To the extent this could be done, it would reduce the potential impacts of the proposed alternatives to a nearly negligible level of impact on agricultural lands in existing railway areas.

The second scenario was developed for new alignments in undeveloped areas (i.e., areas outside the urban/metropolitan area that do not have existing rail rights-of-way) that are separate from existing rail/highway corridors. In this scenario, the study area would extend 50 ft (15 m) on both sides of the proposed rail centerline, for a total width of 100 ft (30 m). This method is a conservative approach because it would be possible to fit the HST line within a 50-foot (15-meter) right-of-way in constrained areas. This approach is illustrated in Figure 3.8-1b.

Construction practices for the HST have not been determined at this program level, so a detailed analysis of construction-related impacts on agricultural lands cannot be addressed until the project-level documents. However, for this program document, it is assumed that construction impacts generally would be within the 100-foot buffer identified for the long-term operational impacts.
To ascertain the possible extent of potential farmland impacts, the study areas for the proposed alignment alternatives were overlaid atop the FMMP farmland GIS data (California Division of Land Resource Protection 2006). GIS was used to calculate the acreage of farmland that potentially would be converted for the proposed alignment alternatives and improvements in the study area for each FMMP category. This analysis was used to calculate potential impacts on farmlands and accounts for proposed improvements that would expand existing transportation corridors, potential alignments that would be adjacent to existing transportation corridors, and potential alignments that would traverse undeveloped areas. The station facilities that would be included in the proposed alignment alternatives are assumed to be located primarily in the study areas considered. HST Alignment Alternatives have been ranked as having the least potential impacts on agricultural land (LPI) or the greatest potential impacts on agricultural land (GPI). Alignment alternatives other than the LPI and GPI would be expected to have levels of impact between those of the LPI and GPI.

For purposes of this discussion, *farmland severance* is defined as the division of one farmland parcel into two or more areas of farmland operation by the placement of a barrier (in this case rail line) through the parcel. Potential severance locations are discussed qualitatively, not quantitatively, in this program-level document. A qualitative discussion of farmland severance was based on aerial photographs to provide a general assessment of the level of potential farmland severance for the various alignments. Because quantification estimates from aerial photographs may lead to misleading results, the qualitative assessment of farmland severance was conducted. Parcel-specific information is not considered in this program-level analysis. Project-level farmland conversion and severance impacts that are determined to be significant adverse impacts would be addressed in subsequent project-level documents.

C. CEQA SIGNIFICANCE CRITERIA

Under CEQA, impacts on agricultural resources are considered significant if the project would:

- Convert Prime Farmland, Farmland of Statewide Importance, or Unique Farmland, as shown on the maps prepared pursuant to the FMMP of the California Resources Agency, to nonagricultural use.
- Sever farmland by the placement of barriers in a manner that impedes access to that land and could result in conversion of farmland to a nonagricultural use.

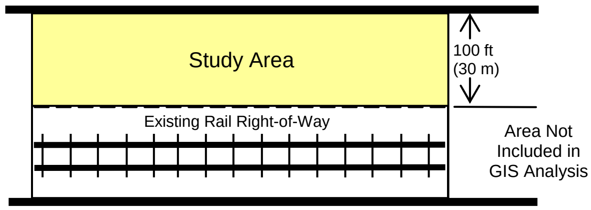
3.8.2 Affected Environment

A. STUDY AREA DEFINED

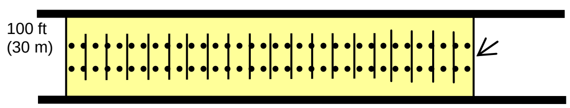
The study area for the proposed HST Alignment Alternatives is the 100-foot (30-meter) corridor, as described above in Methods of Evaluation of Impacts.

B. GENERAL DISCUSSION OF AGRICULTURAL LANDS

California is the leading agricultural producer and exporter in the United States. In 2004, California's agricultural production reached $31.8 billion, accounting for approximately 13% of the nation's gross cash receipts. The most recent statistics (2004) indicate that California has approximately



3.8-1a. In Existing Railway Areas



3.8-1b. In Undeveloped Areas

26.7 million ac (10.8 hectares [ha]) of land in farms, has approximately 77,000 farms (less than 4% of the nation's total), and produces more than 350 different crop types. Although California has many areas of farmland production, its largest area of agricultural production is the Central Valley. Six of the top ten California agricultural counties in 2001 were located in the Central Valley. (California Department of Food and Agriculture 2005.)

Urban growth frequently results in the conversion of agricultural land to nonagricultural uses. According to an estimate in a May 2001 report by the University of California Agricultural Issues Center, California lost approximately 497,000 ac (201,000 ha) of farmland to urbanization in the decade between 1988 and 1998, a loss rate of approximately 49,700 ac (20,100 ha) per year (Kuminoff et al. 2001).

C. AGRICULTURAL RESOURCES IN THE BAY AREA TO CENTRAL VALLEY REGION

Land identified as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance occurs throughout the study area except in the heavily urbanized areas and the mountainous areas. The largest amount of agricultural land occurs in the Central Valley. The amount of farmland in each alignment alternative is identified below.

3.8.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

The No Project Alternative assumes that, in addition to existing conditions, additional transportation improvements would be developed and operational by 2030. The transportation improvements include projects that are programmed or funded to 2030 (Chapter 2).

It was not possible as part of this study to identify or quantify the amount of farmland that might be affected by the transportation improvements in the No Project Alternative. For existing transportation facilities, it is assumed that conversion of agricultural lands was previously addressed in the environmental documents for those projects, and only small additional or increased impacts are expected from the future transportation improvement included in the No Project Alternative. Thus, no additional impacts, beyond existing conditions are quantified under the No Project Alternative. In some cases, widening of existing corridors or similar improvements could convert additional farmland or could affect access to farmland.

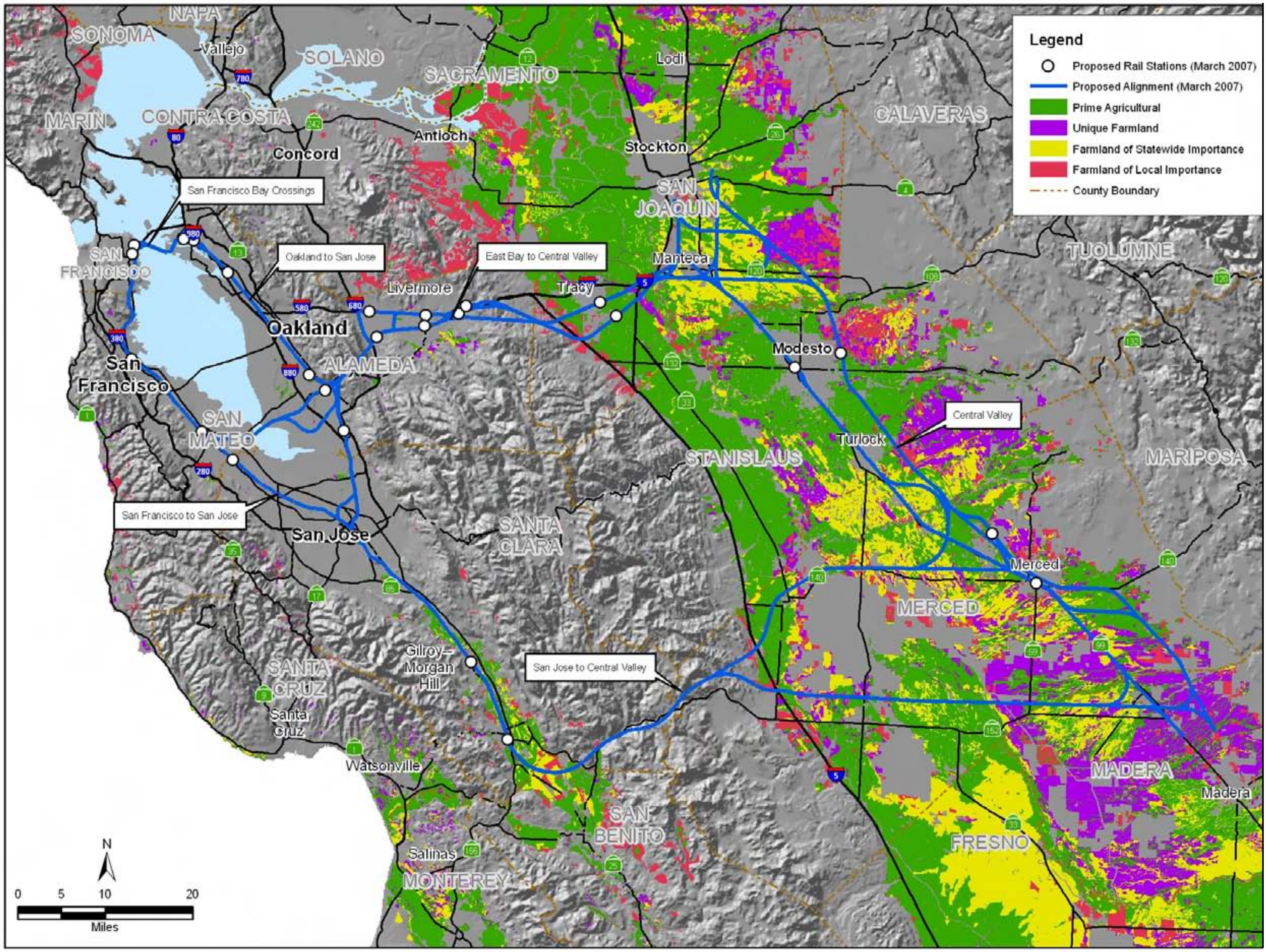
B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

Potential Conversion of Agricultural Land

Table 3.8-1 lists the amount of identified farmland for each HST corridor by alignment alternative and station location. This represents the potential for direct conversion of agricultural land to nonfarming uses (i.e., transportation uses). Figure 3.8-2 illustrates the farmland in relation to each alignment alternative.

Table 3.8-1. Farmland Summary Data Table for
Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignment Segments	Alignment	Prime Farmland (acres)	Farmland of Statewide Importance (acres)	Unique Farmland (acres)	Farmland of Local Importance (acres)
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	0	0	0	0
	1 of 1	Dumbarton to San Jose	0	0	0	0
Station Location Options						
Transbay Transit Center			0	0	0	0
4th and King (Caltrain)			0	0	0	0
Millbrae/SFO			0	0	0	0
Redwood City (Caltrain)			0	0	0	0
Palo Alto (Caltrain)			0	0	0	0
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	0	0	0	0
		12th Street/City Center to Niles Junction	0	0	0	0
	1 of 2	Niles Junction to San Jose via Trimble	6.4	0	0	0
		Niles Junction to San Jose via I-880	6.4	0	0	0
Station Location Options						
West Oakland/7th Street			0	0	0	0
12th Street/City Center			0	0	0	0
Coliseum/Airport			0	0	0	0
Union City (BART)			0	0	0	0
Fremont (Warm Springs)			0	0	0	0
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	176.0	56.2	0	8.8
	1 of 3	Henry Miller (UPRR Connection)	128.3	75.6	39.5	22.0
		Henry Miller (BNSF Connection)	129.6	58.1	77.6	29.2
		GEA North	136.8	105.6	12.2	16.3



SOURCE: ESRI Streetmap USA (2005), California High Speed Rail Authority (2007), California Department of Conservation, Land Resources (2004)

FLY CALIFORNIA

U.S. Department of Transportation Federal Railroad Administration

Figure 3.8-2
Bay Area to Central Valley Farmland

Corridor	Possible Alignment Segments	Alignment	Prime Farmland (acres)	Farmland of Statewide Importance (acres)	Unique Farmland (acres)	Farmland of Local Importance (acres)
Station Location Options						
San Jose (Diridon)			0	0	0	0
Morgan Hill (Caltrain)			0	0	0	0
Gilroy (Caltrain)			0	0	0	0
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	11.7	1.9	0	0
		I-580/ UPRR	12.1	0	0	0
		Patterson Pass/UPRR	7.1	0	0	2.5
		UPRR	7.1	0	0	0
	1 of 4	Tracy Downtown (BNSF Connection)	203.7	199.8	25.3	17.1
		Tracy ACE Station (BNSF Connection)	162.1	206.8	17.2	55.5
		Tracy ACE Station (UPRR Connection)	87.1	59.5	0	35.2
		Tracy Downtown (UPRR Connection)	151.7	68.1	8.1	14.7
	1 of 1	East Bay Connections	0	0	0	0
Station Location Options						
Pleasanton (I-680/Bernal Rd)			0	0	0	0
Pleasanton (BART)			0	0	0	0
Livermore (Downtown)			0	0	0	0
Livermore (I-580)			0	0	0	0
Livermore (Greenville Road/UPRR)			0	0	0	0
Livermore (Greenville Road/I-580)			0	0	0	0
Tracy (Downtown)			0	0	0	0
Tracy (ACE)			0	0	0	0
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing—Transbay Transit Center	0	0	0	0
		Trans Bay Crossing—4th & King	0	0	0	0

Corridor	Possible Alignment Segments	Alignment	Prime Farmland (acres)	Farmland of Statewide Importance (acres)	Unique Farmland (acres)	Farmland of Local Importance (acres)
	1 of 6	Dumbarton (High Bridge)	2.3	0	0	0
		Dumbarton (Low Bridge)	2.3	0	0	0
		Dumbarton (Tube)	2.3	0	0	0
		Fremont Central Park (High Bridge)	0	0	0	0
		Fremont Central Park (Low Bridge)	0	0	0	0
		Fremont Central Park (Tube)	0	0	0	0
Station Location Options						
Union City (Shinn)			0	0	0	0
Central Valley	1 of 6	BNSF—UPRR	326.0	192.7	113.9	143.4
		BNSF	407.3	164.0	101.6	165.0
		UPRR N/S	268.9	161.0	67.3	37.4
		BNSF Castle	385.7	149.2	140.7	141.7
		UPRR—BNSF Castle	331.4	117.3	91.9	81.5
		UPRR—BNSF	318.2	160.8	67.3	64.0
Station Location Options						
Modesto (Downtown)			0	0	0	0
Briggsmore (Amtrak)			0	0	0	0
Merced (Downtown)			0	0	0	0
Castle AFB			12.0	0	0	0

The key findings of the farmland analysis by corridor and alignment alternatives are summarized below. For a complete summary of all potential agricultural land conversions by segment see Table 3.8-A-1 in Appendix 3.8-A.

San Francisco to San Jose Corridor: Caltrain

- No potential impacts on farmland in any of the four farmland categories were identified because the area is already urbanized.
  - Station Location Options: No potential impacts on farmland at any of the station location options were identified in this corridor.

Oakland to San Jose Corridor: Niles/I-880

- Niles/I-880 (West Oakland to Niles Junction) and Niles/I-880 (12th Street/City Center to Niles Junction): No potential impacts on farmland in any of the four farmland categories were identified for either alignment alternative because the area is already urbanized.
- Niles/I-880 (Niles Junction to San Jose via Trimble) and Niles/I-880 (Niles Junction to San Jose via I-880): A total of 6.4 ac (2.60 ha) of Prime Farmland potentially would be converted under either alignment alternative.
  - Station Location Options: No potential impacts on farmland at any of the station location options were identified in this corridor.

San Jose to Central Valley Corridor: Pacheco Pass

- Pacheco: A combined total of 240.99 ac (97.53 ha) of Prime Farmland, Farmland of Statewide Importance, and Farmland of Local Importance potentially would be converted.
- Henry Miller and GEA North (Western Valley to BNSF/UPRR): The Henry Miller (BNSF Connection) Alignment Alternative is the GPI compared to the GEA North or Henry Miller (UPRR Connection) alignment alternatives. A combined total of 294.6 ac (119.21 ha) of farmland in all four farmland categories potentially would be converted with the Henry Miller (BNSF Connection) Alignment Alternative. The GEA North Alignment Alternative would have a combined total of 270.9 ac (109.64 ha) of farmland in all four farmland categories that potentially would be converted and would have the most prime farmland potentially converted at approximately 137 ac (55.38 ha) (by only a small amount). The Henry Miller (UPRR Connection) is the LPI and would have slightly less impact on farmlands, with a combined total of 265.3 ac (107.35 ha) in all four categories.
  - Station Location Options: No potential impacts on farmland at any of the station location options were identified in this corridor.

East Bay to Central Valley Corridor: Altamont Pass

- Niles to Altamont: GPI is I-680/580/UPRR. LPI is UPRR. Small amount of farmland potentially would be converted for Altamont Pass between Niles and Altamont because of terrain (13.6 ac [5.49 ha] of Prime Farmland and Farmland of Statewide Importance for I-680/580/UPRR, 12.1 ac [4.91 ha] of Prime Farmland for I-580/UPRR, 9.5 ac [3.85 ha] of Prime Farmland and Farmland of Local Importance for Patterson Pass/UPRR, or 7.1 ac [2.85 ha] of Prime Farmland for UPRR).
- Tracy Downtown and ACE Station: GPI is the Tracy Downtown (BNSF Connection) Alignment Alternative with minimally greater impacts than the Tracy ACE Station (BNSF Connection) Alignment Alternative. A combined total of 445.9 ac (180.45 ha) of farmland in all four farmland categories potentially would be converted and of that, approximately 204 ac (82.56 ha) would be prime farmland, the highest of the alignment alternatives within this corridor. The Tracy ACE Station (BNSF) Connect would have just slightly less farmland potentially converted at 441.5 ac (178.69 ha). The Tracy ACE Station (UPRR Connection) Alignment Alternative is the LPI with 181.7 ac (73.53 ha) (in all four categories) potentially converted, and the Tracy Downtown (UPRR Connection) Alignment Alternative would be just slightly higher with a potential to convert 242.5 ac (98.16 ha) of farmland.
- East Bay Connections: Neither of the East Bay Connection alignment alternatives would result in conversion of farmland.
  - Station Location Options: No potential impacts on farmland at any of the station location options in this corridor were identified.

San Francisco Bay Crossings Corridor

- Trans Bay Crossings: No potential impacts on farmland in any of the four farmland categories were identified because of the location (in a tunnel under the bay and in urbanized areas).

- Dumbarton (High Bridge, Low Bridge, or Tube): GPI (with minimally greater impacts) (no differences between optional vertical alignments). A total of only 2.3 ac (0.94 ha) of Prime Farmland potentially would be converted with any alignment alternative because the area is already urbanized.
- Fremont Central Park (High Bridge, Low Bridge, or Tube): LPI (with minimally fewer impacts) (no differences between optional vertical alignments). No potential impacts on farmland in any of the four farmland categories were identified because the area is already urbanized.
  - Station Location Options: No potential impacts on farmland at the station location option in this corridor were identified.

Central Valley Corridor

- BNSF—UPRR: A combined total of 775.9 ac (314.01 ha) of farmland in all four farmland categories potentially would be converted.
- BNSF: GPI. A combined total of 837.8 ac (339.05 ha) of farmland in all four farmland categories potentially would be converted.
- UPRR N/S: LPI. A combined total of 534.6 ac (216.35 ha) of farmland in all four farmland categories potentially would be converted.
- BNSF Castle: A combined total of 817.3 ac (330.75 ha) of farmland in all four farmland categories potentially would be converted.
- UPRR—BNSF Castle: A combined total of 622.1 ac (251.74 ha) of farmland in all four farmland categories would potentially be converted.
- UPRR—-BNSF: A combined total of 610.3 ac (246.99 ha) of farmland in all four farmland categories potentially would be converted.
  - Station Location Options: The station location option at Castle AFB (associated with the BNSF Castle and UPRR—BNSF Castle Alignments) has the potential to affect 12.0 ac (4.85 ha) of Prime Farmland. The other station location options in this corridor would not result in any impacts on farmland.

Potential Farmland Severance

Farmland severance, or the division of one farmland parcel into two or more areas of operation by the placement of a barrier (in this case rail line) through the parcel, would potentially occur with the project in some locations. Potential severance locations would be limited, however, because most of the alignment alternatives follow existing transportation corridors. The East Bay to Central Valley alignment alternatives, including the Tracy Downtown (BNSF Connection), Tracy ACE Station (BNSF Connection), Tracy Downtown (UPRR Connection), and Tracy ACE Station (UPRR Connection) alignment alternatives, each would have some potential for farmland severance impacts, particularly where these alignment alternatives connect to the Central Valley alignment alternatives near Lathrop and Manteca. The San Jose to Central Valley alignment alternatives, including the Pacheco and GEA North alignment alternatives, each of which includes significant amounts of agricultural lands, generally would not follow existing railroads or roadway rights-of-way, so the potential for severance impacts is greatest for these alignments. The Henry Miller alignment alternatives are generally adjacent to Henry Miller Road but would still have the potential for farmland severance on the western and eastern ends of the alignments. For other alignment alternatives, the addition of an alignment alternative in or adjacent to existing rail or roadway corridors still could lead to limited severance of farmland as a result of greater restrictions on crossing of the corridor.

Parcel-specific information was not considered in this program-level analysis. Project-level farmland severance impacts would be addressed in subsequent project-level documents.

Potential Conflict with Farmland Programs and Policies

The level of detail required for the LESA evaluation under the federal FPPA is beyond that available for this program-level analysis. This assessment will be required during preparation of project-level environmental documents. The parcel-level detail required to assess the conflict of alignments with lands covered by Williamson Act or Farmland Security Zone contracts is also beyond that available for this program-level analysis. Normally, converting land covered by these contracts would result in tax penalties. However, because the land would be converted to a public use, the penalties would not be applicable. Project-level environmental documents would examine whether cancellation of any such contracts, which were developed to protect farmland from conversion, has the potential to lead to further conversion of farmland to nonagricultural use. Project-level environmental documents also would examine any conflicts that alignments may have with local government policies that protect agricultural resources or regulate farmland.

3.8.4 Role of Design Practices in Avoiding and Minimizing Effects

The strategy beginning early in the conceptual design stage of the HST system was to avoid farmland wherever feasible. Throughout the initial screening of alternatives, a number of potential alignments were eliminated because of the high potential for farmland impacts, as well as other impacts (e.g., potential new alignments in the foothills of the Central Valley). Where potential impacts on farmland would occur, the effort would focus on reducing the potential impact. Potential systemwide impacts on farmland have been reduced by sharing existing rail rights-of-way wherever feasible or by placing the alignment immediately adjacent to them. The Authority is committed to using existing transportation corridors and rail lines in the proposed HST system to minimize the need to encroach on agricultural lands.

Portions of some of the HST Alignment Alternatives would be either within or adjacent to a major existing transportation corridor (existing railroad or highway right-of-way). These existing transportation corridors, along which the HST system would be placed, already have divided properties and agricultural lands. Moreover, portions of the alignment would be on an aerial structure or in a tunnel, allowing for vehicular or pedestrian access across the alignment. Some portions of the HST alignment alternatives would be in new at-grade rail corridors (not on an aerial structure and not in a tunnel) and not within or adjacent to an existing transportation right-of way, where there would be the potential to divide or sever properties. For the HST system, underpasses or overpasses would be constructed at reasonable intervals to provide property access, and/or appropriate severance payments would be made to the property owners whose land is severed. The Authority would work directly with landowners during the final design of the system regarding the location(s) for access passages (overpasses or underpasses) to allow adequate property access.

To minimize the potential impact on agricultural lands, the HST right-of-way width potentially could be reduced to 50 ft (15 m) in constrained areas. In addition, the Authority is committed to pursuing agreements with existing owners/rail operators to place the HST alignment within existing rail rights-of-way, which would avoid or minimize potential impacts on agricultural resources.

3.8.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the design practices described in Section 3.8.4, each of the HST Alignment Alternatives would have a significant impact on agricultural lands. Some direct conversion of agricultural lands to transportation uses would be expected. This impact would not occur or would be very small in the urbanized corridors and would be greatest in the Central Valley corridor. The only station location option that would result in the conversion of agricultural land is the Castle AFB site. The HST Alignment Alternatives also may result in severance of agricultural parcels, which could indirectly contribute to agricultural land conversion. At this programmatic level of analysis, it is not possible to know precisely the location, extent, or particular characteristics of agricultural lands that would be involved or the precise impacts on those lands. The impact is therefore considered significant overall for each HST Alignment Alternative.

Mitigation strategies, as well as the design practices discussed above, can be refined and applied at the project level to reduce this impact. In the decision documents for this program process, the Authority is expected to make a commitment to the acquisition of easements to protect prime farmland. For the direct conversion of agricultural land, these strategies would include consideration of the following:

- Avoid farmland whenever feasible during the conceptual design stage of the project.
- Reduce the potential for impacts by sharing existing rail rights-of-way where feasible or by aligning HST features immediately adjacent to existing rail rights-of-way.
- Reduce the potential for impacts by reducing the HST right-of-way width to 50 ft in constrained areas.
- Increase protection of existing important farmland by securing easements or participating in mitigation banks where appropriate.
- Coordinate with and provide financial support to the California Farmland Conservancy Program to secure appropriate conservation easements on prime farmland. For those communities with HST stations, focus this financial support in proximity to areas where farmland conversion impacts are expected and where threats of farmland conversion are greatest.
- Coordinate with private agricultural land trusts, local programs, mitigation banks, and Resource Conservation Districts to identify additional measures that are appropriate and feasible to limit important farmland conversion or provide further protection to existing important farmland.

For the indirect conversion of agricultural land that may result from farmland severance, these strategies would include consideration of the following:

- Avoid farmland whenever feasible during the conceptual design stage of the project.
- Minimize severance of agricultural land by constructing underpasses and overpasses at reasonable intervals to provide property access.
- Work with landowners during final design of the system to allow adequate property access.
- Provide appropriate severance payments to landowners.

The Authority would coordinate farmland mitigation efforts at the project level with other mitigation initiatives, such as the California Farmland Conservancy Program (California Public Resources Code section 10222 *et seq.*), which is managed by the California Department of Conservation. This program provides grant funding for the purchase of agricultural easements and grants for farmland policy and planning projects. The Authority would review what this program is doing and the areas in which it has identified needs for farmland preservation. During project-level review, where the co-lead agencies determine that farmland mitigation will be needed to address site-specific impacts from the HST system, one strategy may be to provide financial support for easements that further this existing conservation program.

The feasibility of mitigation strategies would be evaluated further at the project-specific level and would depend on factors such as an assessment of the land under the state LESA model or other significance criteria, the number of voluntary participants in local or regional programs, and the cost of acquiring easements or other mitigation. Possible mitigation strategies for severance impacts could include alternative access, HST realignment, or over-crossings at select locations.

The Authority has established policies regarding the use of smart growth and transit-oriented development strategies for station areas (Chapter 6), which will help to avoid secondary growth impacts on agricultural lands.

The above mitigation strategies are expected to substantially lessen or avoid impacts on agricultural lands in many circumstances. Sufficient information is not available at this programmatic level, however, to conclude with certainty that the above mitigation strategies will reduce impacts on agricultural lands to a less-than-significant level in all circumstances. This document therefore concludes that impacts on agricultural lands would remain significant, even with the application of mitigation strategies. Additional environmental assessment would allow a more precise evaluation in the second-tier project-level analysis.

3.8.6 Subsequent Analysis

As indicated earlier, the above analysis does not provide a parcel-specific potential impact analysis for farmland. Subsequent project-level analysis will address local issues once the potential alignment alternatives are defined in more detail. Subsequent project-level environmental documentation would include more detailed information on potential severance impacts and potential impacts on FMMP-listed farmland, farmland under Williamson Act contracts, and farmland easements.

3.9 Aesthetics and Visual Resources

Visual resources are the natural and human-made features of a landscape that characterize its form, line, texture, and color. This section describes the existing landscape in the region and identifies potential impacts on visual resources for each HST Alignment Alternative related to the proposed addition of infrastructure in, or removal of infrastructure from, the existing landscape.[1] Infrastructure may include HST improvements/construction, tunnels, fences, noise walls, elevated viaducts and overpasses for railways, highways and pedestrians, catenaries,[2] and stations. This assessment evaluates the potential changes related to the introduction of the HST system to existing scenic landscapes, both during construction (addition of construction staging areas, site work, construction equipment, temporary barriers, fences, and temporary power poles) and operation.

3.9.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY

There are no specific regulatory requirements or federal or state standards for aesthetics and visual resources. However, both federal and state environmental guidelines require addressing topics related to the visual environment. The most explicit guidance is in the CEQA environmental checklist, which requires that a project proponent identify whether a project would have a substantial adverse effect on a scenic vista; substantially damage scenic resources, including trees, rock outcroppings, and historical buildings within a state scenic highway; substantially degrade the existing visual character or quality of the site and its surroundings; or create a new source of substantial light or glare that would adversely affect day or nighttime views in the area (State CEQA Guidelines Appendix G Environmental Checklist Form 2001). The FRA Procedures for Considering Environmental Impacts (FRA Docket No EP-1, Notice 5, May 26, 1999), under the topic of aesthetic environmental and scenic resources, states: "The EIS should identify any significant changes likely to occur in the natural landscape and in the developed environment." Consideration of local community design guidelines would be part of a subsequent phase of analysis for project-specific environmental review when more detailed engineering and architectural information would be developed for proposed alternatives. Caltrans design standards would apply to state highway improvements.

B. METHOD OF EVALUATION OF IMPACTS

The analysis of aesthetic and visual resources for this Program EIR/EIS focuses on a broad comparison of potential impacts on visual resources (particularly scenic resources, areas of historic interest, and natural open space areas and significant ecological areas [SEAs]) along proposed HST Alignment Alternatives and around HST station location options. The potential impacts of each of these alternatives are evaluated against the existing conditions, as described in Section 3.9.2, Affected Environment.

Photo simulations have been prepared to illustrate the conceptual design of the facilities associated with the HST Alignment Alternatives for a set of typologies (or general descriptions) selected from each of the regions and representative of highly scenic landscapes most subject to potential major visual impacts. These simulations have been used to evaluate how the distinguishable (dominant) visual features (color, line, texture, form) that characterize the existing landscape would change if the alternative alignment or station location option were implemented. Of particular interest are locations where plans and profiles show elevated structures (overpasses) and tunnel portals or extensive cut or fill. Also addressed in the evaluation is the potential shadow effect of elevated

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

[2] *Catenaries* are the wires and support-pole system that deliver the power supply to the proposed HST system.

structures and the light and glare effects of the proposed alignment alternatives. For the HST Alignment Alternatives, the linear feature of the overhead electric wires and poles to supply power to the train, and the fenced track and potential noise barriers, are considered in the evaluation.

Potential changes to the dominant landscape features, or potential visual impacts, are described and ranked as high, medium, or low according to the potential extent of change to existing visual resources. Visual contrast rankings, or impact rankings, are defined as follows.

- *High visual impacts* would be sustained if features of the alignment or station were obvious and began to dominate the landscape and detract from the existing landscape characteristics or scenic qualities.
- *Medium visual impacts* would be sustained if features of the alignment or station were readily discernable but did not dominate the landscape or detract from existing dominant features.
- *Low visual impacts* would be sustained if features of the alignment or station were consistent with the existing line, form, texture, and color of other elements in the landscape and did not stand out.
- *Shadow impact ranking* would be high if the new (not existing) elevated structure were within 75 ft (23 m) of residential or open space, natural areas, or parkland.
- *Beneficial visual impact* would result if the alignment eliminated a dominant feature in the landscape that currently detracts from scenic qualities or blocks vistas.

C. CEQA SIGNIFICANCE CRITERIA

Under CEQA, a project would have a significant impact if it would (a) have a substantial adverse effect on a scenic vista, (b) substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway, (c) substantially degrade the existing visual character or quality of the site and its surroundings, or (d) create a new source of substantial light or glare that would adversely affect day or nighttime views in the area. Each corridor, alignment alternative, and station location option has been rated, as identified above, and a rating of high or medium can generally be considered as significant.

3.9.2 Affected Environment

A. STUDY AREA DEFINED

For the No Project Alternative, the affected environment is divided into typologies along both sides of existing highway and rail corridors. Several of the HST Alignment Alternatives being evaluated are either within or adjacent to these existing highway or rail corridors and therefore potentially would affect many of the same landscapes. The study area for aesthetics and visual resources is defined as 0.25 mi (0.40 km) from the centerline of proposed HST Alignment Alternatives and around station location options. However, where there are scenic viewing points or overlooks within 1 mi (2 km) of the HST Alignment Alternative, these scenic viewing points have been included in the study area. The distance range of up to 0.25 mi (0.40 km) from proposed alignment alternatives and station location options and up to 1 mi (2 km) from proposed alignment alternatives and facilities for scenic viewing points is considered the area where a change in landscape features would be most noticeable to viewers, and where newly introduced features could begin to dominate the visual character of the landscape.

B. GENERAL DISCUSSION OF AESTHETICS AND VISUAL RESOURCES

The region includes a number of distinct types of landscape typologies spread over a large geographic area, many of which are common among the regions. A typology of typical landscapes is used to describe the aesthetic and visual resources in the study area. The typologies provide the baseline or existing conditions against which the analysis of potential change or visual impact for each of the proposed alternatives is evaluated. Photographs of highly scenic and typical landscapes in each of the five corridors are provided to illustrate the dominant line, form, color, and texture for that landscape typology.

The landscape typologies discussed are urban mixed use, urban suburban, traditional small urban community, industrial use, rural agriculture, and natural open space and parks.

Urban Mixed Use

The high-density urban mixed-use landscape typology consists of multifamily housing, high-rise office buildings, at-grade and elevated transportation systems (Caltrain, BART, VTA light rail, freight railways), street grids, and limited vegetation. This landscape typology characterizes the major metropolitan areas in the study area: San Francisco, Oakland, and San Jose. An example of the urban mixed use landscape typology is shown in Figure 3.9-1.

Urban Suburban

The urban suburban landscape typology consists of suburban areas of low-density development—modern single-family houses, yards set back, trees and ornamental landscaping—located around more densely developed metropolitan areas. This typology also includes commercial, retail, and office structures and infrastructure such as roads, highways, overpasses, underpasses, rail lines, and utilities. Examples include South San Jose, Mountain View, Fremont, Hayward, Livermore, Tracy, and Merced. An example of the urban suburban landscape typology is shown in Figure 3.9-2.

Traditional Small Urban Community

The traditional small urban community landscape typology is characterized by long-established rural communities—older buildings and historic architecture two to three stories high, with mature street trees—along existing highways or rail corridors. This typology comprises historic or early post-World War II residential neighborhoods characterized by small- to mid-size houses on small lots with narrow streets and retail, commercial, and institutional mixed uses along arterial streets. Examples include Morgan Hill, Gilroy, San Mateo, Pleasanton, and Palo Alto. An example of the traditional small urban community typology is shown in Figure 3.9-3.

Industrial Use

The industrial use landscape typology features industrial complexes with structures and warehouses of widely varied areas, sizes, and scales, and includes freight tracks and rail yards, transmission towers, substations, and utility lines. This typology typically is found along existing rail corridors or major highways. An example of the industrial landscape typology is shown in Figure 3.9-4.

Rural Agricultural

Broad, open agricultural fields with or without fences, along with barns, silos, and other farm structures, farm equipment, isolated farm houses, and low-density rural commercial strips typify the rural agricultural landscape typology. The horizontal topography is characterized by crop fields, farm roads, fence and pole lines, and wind breaks, punctuated by barns, houses, sheds, water towers, and other agriculture-related structures. This landscape typography is typical of the Central Valley region. An example of the rural agricultural landscape typology is shown in Figure 3.9-5.

Natural Open Space and Parks

Undeveloped natural areas such as coastal lagoons, forested mountains, mountain lakes and streams, rolling hills with woodlands and grasslands, and forested ridges and valleys with lush vegetation form the dominant visual features of these landscape typologies. These landscapes typologies are typically scenic with high aesthetic qualities. Examples include the Pacheco Pass, Altamont Pass, Central Merced County, and Niles Canyon. An example of the natural open space and parks typology is shown in Figure 3.9-6.

C. AESTHETICS AND VISUAL RESOURCES IN THE BAY AREA TO CENTRAL VALLEY REGION

San Francisco to San Jose

Starting from San Francisco, the landscapes along the Caltrain Corridor are typically urban mixed use or industrial, with stretches of urban suburban residential and commercial landscapes. The existing nonelectric rail tracks and stations along the Caltrain Corridor are one of a number of dominant linear features in the landscape between San Francisco and San Jose. Views of the Bay are part of the aesthetic landscape experience along some portions of the Caltrain Corridor near the cities of Brisbane and South San Francisco. Views of the hills along the peninsula are scattered along the line. Views of the skyline of San Francisco and the San Francisco Bay are visible from the Caltrain Corridor approaching the city. In many locations, the line runs behind businesses and buildings that visually shield the line from the surrounding community. Views of the Caltrain tracks are visible from several local parks and from San Bruno Mountain hiking trails; however, the tracks are not a dominant visual feature in these landscapes (the multiple-lane freeways and bridges are dominant).

Oakland to San Jose

Starting from Oakland, the landscapes along the corridor are typically urban mixed use or industrial, with stretches of urban suburban residential and commercial landscapes. The mostly elevated BART tracks are dominant linear features in the landscape between Oakland and Fremont, along with the two UPRR corridors. South of Fremont, the corridor is dominated by the I-880 freeway as it passes through commercial landscapes. As the corridor approaches San Jose, alternate routings continue along I-880 or Montague Expressway, Trimble Road, and the UPRR corridor to reach the San Jose Diridon station location option. Both HST Alignment Alternatives traverse commercial landscapes and a portion of parkland. The corridor ends at the Diridon station location option in San Jose. Views from the line include the East Bay hills and Mission Peak, south of San Jose. The South Bay wetlands would be visible from the elevated portions along I-880.

San Jose to Central Valley

This corridor traverses a variety of landscapes. Leaving San Jose, the landscape is a mix of urban suburban and industrial. The landscape transitions to rural agricultural and traditional small urban communities, with recurrence of urban suburban near Morgan Hill and Gilroy. As the line passes through San Benito County, the landscape is rural agricultural. Entering the valley leading to Pacheco Pass, paralleling SR 152, the landscape is open space. A series of tunnels brings the line to the edge of the Central Valley. Each alignment alternative in this corridor crosses the valley through a mix of rural agriculture and open space and parklands, and ends in the urban suburban landscape of Atwater and Merced.

Views from the line include the Santa Cruz Mountains, Mount Hamilton, San Eligo Lagoon, Elephant Head, Pacheco Peak, San Luis Reservoir, and the Grasslands Ecological Area. The line would be visible from locations in Henry Coe State Park, San Luis Reservoir State Recreation Area, San Joaquin National Cemetery, Volta State Wildlife Area, Los Banos State Wildlife Area, Great Valley Grasslands State Park, and the Fremont Ford State Recreation Area. In these areas, the HST alignment alternative would constitute a new form in the landscape, a medium to high visual impact.

Figure 3.9-1
Urban Mixed Use Typology

Figure 3.9-2
Urban Suburban Typology

Figure 3.9-3
Traditional Small Urban Typology

Figure 3.9-4
Industrial Typology

Figure 3.9-5
Rural Agricultural Typology

Figure 3.9-6
Natural Open Space and Parks Typology

East Bay to Central Valley

This corridor begins in the hills east of Fremont, where the HST Alignment Alternatives would all run in a tunnel through the Niles Canyon area. The alignment alternatives would emerge from the tunnel just west of Foothill Road and Arroyo de la Laguna and transition to an aerial structure. From here, there are several alignment alternatives.

The first would join the UPRR, on which the ACE trains operate. The alignment alternative would cross through the communities of Pleasanton and Livermore, a mixed landscape of traditional small urban community, urban suburban, and natural open space, with some industrial on the far east side of Livermore. Another alignment alternative would follow I-680 and I-580 through an urban suburban and open space landscape. These alignment alternatives meet at the western base of the Altamont Pass.

There are two alignment alternatives for the Livermore Valley. One goes through Altamont Pass and the other near Patterson Pass, which can be accessed only from the UPRR alignment. The two alignment alternatives meet west of I-580, west of Tracy. Across either pass, the landscape is open space, characterized by rolling hills dotted with wind turbines of all styles and sizes. As the hills descend into the Central Valley, the landscape is a mix of receding rural agriculture and industrial before it gives way to the urban suburban landscape of the city of Tracy.

There are four alignment alternatives in the Tracy area. The Tracy Downtown alignment alternatives would follow the historic Southern Pacific Railroad through the urban suburban and traditional small urban community that is found around downtown Tracy. East of downtown Tracy, the landscape changes back to rural agricultural, where the alignment alternatives join the Tracy ACE alignment alternatives. The Tracy ACE alignment alternatives would skirt the south and east sides of the city, running along the boundary of the urban suburban landscape of Tracy and the rural agricultural outskirts. The Tracy alignment alternatives meet near Oakwood Lake, on the west side of Manteca.

The Tracy alignment alternatives cross Manteca in the right-of-way of SR 120. If the UPRR alignment alternative were chosen between Stockton and Merced, the alignment alternatives would end at UPRR and SR 99. If the BNSF alignment alternative were chosen, the Tracy alignments would extend to Escalon, in the right-of-way of the proposed SR 120 freeway.

Views from the corridor include the open space over the Altamont Pass and the riparian areas along the San Joaquin River. The line would be visible from the Pleasanton Ridge Regional Park, Shadow Cliffs Regional Park in Pleasanton, and along Bernal Creek. The HST alignment alternatives, when viewed from Pleasanton Ridge and Shadow Cliffs, would be a minimal visual impact, because the existing railways and highways would continue to be the dominant features. When viewed from Bernal Creek, the HST system would dominate because it would be on a structure close to the creek.

San Francisco Bay Crossings

The landscape of the Transbay alignment alternatives varies. The majority is open space, in the form of San Francisco Bay and the abandoned runways and tarmac of the former Alameda Naval Air Station. The Port of Oakland, BNSF and UPRR rail yards, and surrounding support facilities are industrial. The developed areas of Oakland and San Francisco are urban mixed use, with higher concentrations of uses in San Francisco.

The Dumbarton alignment alternatives begin in the urban suburban landscape of Redwood City and pass through an industrial landscape before entering the park and open space of the Don Edwards San Francisco Bay National Wildlife Area and San Francisco Bay. On the east side of the bay, the alignment alternatives cross the industrial and urban suburban landscape of Newark and mainly residential urban suburban landscape of Fremont before meeting in the open space of the hills east of Fremont.

Central Valley Alignment

The Central Valley corridor traverses landscapes that alternate between urban suburban and industrial near the cities and a mix of rural agricultural and traditional small urban communities in the smaller towns. Brief landscapes dominated by grain silos or other rail-industrial installations occur at times in the rural agricultural landscape. See Figure 3.9-7—Rail-Industrial Rural Landscape for an example of typical structures serving agriculture.

Views from the rail lines in this corridor are limited because of the flat terrain. Short vistas of riparian area occur when passing rivers. The HST line would be visible from some locations in the downtown districts of the cities through which it passes.

3.9.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

The existing conditions in 2007, or existing landscapes, are used as the baseline and are assumed to be representative for the analysis of potential visual impacts of the HST Alignment Alternatives and stations. The highway projects approved and funded for construction by 2030 and included in the No Project Alternative are described in Chapter 2, "Alternatives." These improvements or changes to the existing highways and airports are generally expansions or reconfigurations of existing facilities that would not result in substantial visual contrasts or changes to the dominant line, form, color, or texture characterizing the existing landscape condition. No significant visual impacts, shadow, or glare impacts have been identified for the changes between the existing conditions and No Project Alternative for this program-level analysis. As these projects advance, the project sponsors (not the Authority) may identify and address some localized visual impacts in separate environmental documentation.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

The study area is divided into six corridors: San Francisco to San Jose, Oakland to San Jose, San Jose to Central Valley, East Bay to Central Valley, San Francisco Bay Crossings and Central Valley. Alignment alternatives and station location options within each corridor are discussed in the overall corridor description. Table 3.9-1 summarizes the visual impacts by alignment alternative and station location option (Appendix 3.9-A provides more detail). This section focuses on the anticipated long-term impacts of the HST Alignment Alternatives and station location options. A general review of the short-term impacts that would occur during project construction is provided at the end of this section.

Figure 3.9-7
Rail-Industrial Rural Landscape

Table 3.9.1. Visual Impacts Summary Data Table for
Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignment	Alignment	Change	Visual Impact Ranking	Alignment Visual Impact Ranking
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	Two additional tracks	Low	Low visual impact
			Pedestrian overcrossings at stations	High visual impact	
			Pedestrian undercrossings at stations	Low	
			Raised Caltrain right-of-way	Low	
	1 of 1	Dumbarton to San Jose	Two additional tracks	Low	Low
			Pedestrian overcrossings at stations	High	
			Pedestrian undercrossings at stations	Low	
			Raised Caltrain right-of-way	Low	
			New two-track bridge next to historic San Francisquito Creek truss bridge	Low	
			Two additional tracks at El Palo Alto Redwood	Low	
			Elevated facilities at Diridon San Jose station	Medium	
Station Location Options					
Transbay Transit Center			Underground facilities at station	No	
4th and King (Caltrain)			Underground facilities at station	No	
Millbrae/SFO			Additional two tracks west of existing tracks	No	
Redwood City (Caltrain)			Elevated four-track station	Low	
Palo Alto (Caltrain)			Additional track between existing tracks, one to the east of existing tracks, pedestrian underpasses	Low	
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	Highway grade separations	Low	Low
			Elevated alignment	Medium and shadowing impacts	
		12th Street/City Center to Niles Junction	Highway grade separations	Low	Low
			Elevated alignment	Medium and shadowing impacts	
	1 of 2	Niles Junction to San Jose via	Elevated alignment adjacent to residential	Medium and shadowing impacts	Medium

Corridor	Possible Alignment	Alignment	Change	Visual Impact Ranking	Alignment Visual Impact Ranking
		Trimble	Elevated alignment along I-880 freeway	Low	
			Elevated alignment along Montague and Trimble Road	Low	
			Elevated alignment near historic Santa Clara Depot and Tower	Medium	
			Elevated facilities at Diridon San Jose station	Medium	
		Niles Junction to San Jose via I-880	Elevated alignment adjacent to residential	Medium and shadowing impacts	Medium
			Elevated alignment along I-880 freeway	Low	
			Elevated facilities at Diridon San Jose station	Medium	
Station Location Options					
West Oakland/7th Street			Underground station	Low	
12th Street/City Center			Underground station	Low	
Coliseum/Airport			At-grade station	Low	
Union City (BART)			At-grade station	Low	
Fremont (Warm Springs)			Elevated station	Low	
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	Elevated facilities at Diridon San Jose station	Medium	Medium
			Elevated facilities south of Diridon station	Low and shadowing impacts	
			Highway grade separations	Low	
			Expansion of existing railway corridor along Monterey Highway	Medium	
			New transportation corridor between Gilroy and Pacheco Valley	Medium	
			Elevated crossing of SR 152 in Pacheco Valley	High	
			Cut and fill sections over Pacheco Pass	Medium	
	1 of 3	Henry Miller (UPRR Connection)	Trench alignment near San Joaquin National Cemetery	Medium	Low
			Elevated crossing of I-5	Low	
			Wetlands crossing	Medium	
			UPRR Connection	Low	

Corridor	Possible Alignment	Alignment	Change	Visual Impact Ranking	Alignment Visual Impact Ranking
		Henry Miller (BNSF Connection)	Trench alignment near San Joaquin National Cemetery	Medium	Low
			Elevated crossing of I-5	Low	
			Wetlands crossing	Medium	
			BNSF connection	Low	
		GEA North (UPRR Connection)	New transportation corridor between Pacheco Pass and Gustine	Medium	Medium
			Elevated crossing of I-5	High	
			Wetlands crossings	Medium	
			New transportation corridor connections to UPRR in Atwater	Medium	
		GEA North (BNSF Connection)	New transportation corridor between Pacheco Pass and Gustine	Medium	Medium
			Elevated crossing of I-5	High	
			Wetlands crossings	Medium	
			New transportation corridor connections to BNSF in Atwater	Medium	
Station Location Options					
San Jose (Diridon)			Elevated concourse and platforms at San Jose Diridon station	Medium	
Morgan Hill (Caltrain)			Elevated station	Medium	
Gilroy (Caltrain)			Elevated station	Medium	
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	Trench alignment from tunnel portal to I-680	Low	Medium
			Elevated alignment along I-680	Medium and shadowing impacts	
			Elevated alignment through I-680, I-580 interchange	Medium	
			Elevated approaches to station	High	
			Elevated crossing of I-580	Medium	
		I-580/UPRR	Trench alignment from tunnel portal to east of I-680	Low	Medium
			Elevated alignment along existing UPRR in Pleasanton	Medium and shadowing impacts	
			At-grade alignment along existing UPRR through Livermore	Low	

Corridor	Possible Alignment	Alignment	Change	Visual Impact Ranking	Alignment Visual Impact Ranking
			Deep cut at Altamont Summit	Medium	
		Patterson Pass/UPRR	Aerial alignment from tunnel portal to east of I-680	High	Low
			Elevated alignment along existing UPRR in Pleasanton	Medium and shadowing impacts	
			At-grade alignment along existing UPRR through Livermore	Low	
			Cut and fill across summit	Low	
		UPRR	Trench alignment from tunnel portal to east of I-680	Low	Medium
			Elevated alignment along existing UPRR in Pleasanton	Medium and shadowing impacts	
			At-grade alignment along existing UPRR through Livermore	Low	
			Deep cut and fill across summit	Medium	
	1 of 4	Tracy Downtown (BNSF Connection)	New at-grade corridor from summit to I-580	Low	Low
			Elevated crossing of I-580	Medium	
			At-grade alignment through Tracy	Low	
			At-grade alignment in median of SR 120	Low	
			New at-grade corridor from SR 99 to BNSF	Low	
		Tracy ACE Station (BNSF Connection)	New at-grade corridor from summit to I-580	Low	Low
			Elevated crossing of I-580	Medium	
			At-grade alignment along UPRR	Low	
			At-grade alignment in median of SR 120	Low	
			New at-grade corridor from SR 99 to BNSF	Low	
		Tracy ACE Station (UPRR Connection)	New at-grade corridor from summit to I-580	Low	Low
			Elevated crossing of I-580	Medium	
			At-grade alignment along UPRR	Low	
			At-grade alignment in median of SR 120	Low	

Corridor	Possible Alignment	Alignment	Change	Visual Impact Ranking	Alignment Visual Impact Ranking
		Tracy Downtown (UPRR Connection)	New at-grade corridor from summit to I-580	Low	Low
			Elevated crossing of I-580	Medium	
			At-grade alignment through Tracy	Low	
			At-grade alignment in median of SR 120	Low	
	2 of 2	East Bay Connections	Aerial across Niles Canyon Road and Alameda Creek	Medium	Medium
Station Location Options					
Pleasanton (I-680/Bernal Rd)			Elevated station	Medium	
Pleasanton (BART)			Elevated station	High	
Livermore (Downtown)			At-grade station	Low	
Livermore (I-580)			Elevated station	High	
Livermore (Greenville Road/UPRR)			At-grade station	Low	
Livermore (Greenville Road/I-580)			Elevated station	Medium	
Tracy (Downtown)			Elevated station	Medium	
Tracy (ACE)			Elevated station	Medium	
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing—Transbay Transit Center	Underground alignment	No	No
		Trans Bay Crossing—4th & King	Underground alignment	No	No
	1 of 6	Dumbarton (High Bridge)	High-level bridge	Medium Medium impacts on Centerville alignment across Fremont	Medium
		Dumbarton (Low Bridge)	Low-level bridge	Low Medium impacts on Don Edwards Preserve and Centerville alignment across Fremont	Medium

Corridor	Possible Alignment	Alignment	Change	Visual Impact Ranking	Alignment Visual Impact Ranking
		Dumbarton (Tube)	Underground alignment	No Medium impacts on Don Edwards Preserve and Centerville alignment across Fremont	Medium
		Fremont Central Park (High Bridge)	High-level bridge	Medium Medium impacts on Don Edwards Preserve and through Newark	Medium
		Fremont Central Park (Low Bridge)	Low-level bridge	Low Medium impacts on Don Edwards Preserve and through Newark	Low
		Fremont Central Park (Tube)	Underground alignment	No Medium impacts on Don Edwards Preserve and through Newark	Low
Station Location Option					
Union City (Shinn)			Elevated station	High	
Central Valley	1 of 6	BNSF—UPRR	Elevated crossing of SR 4 viaduct in downtown Stockton	Medium	Low
			Elevated crossing of SR 99 near French Camp	Medium	
			Elevated structure through Escalon	Low	
			Elevated structure through Riverbank	Low	
			Curve realignment at Tuolumne River	High	
			Curve realignment at Chowchilla River	Low	
		BNSF	New alignment south of Lodi	Low	Low
			Elevated structure through Escalon	Low	
			Elevated structure through Riverbank	Low	
			Curve realignment at Tuolumne River	High	

Corridor	Possible Alignment	Alignment	Change	Visual Impact Ranking	Alignment Visual Impact Ranking
			Curve realignment south of Merced	Low	
			Curve realignment at Chowchilla River	Low	
		UPRR N/S	Elevated crossing of SR 4 viaduct in downtown Stockton	Medium	Low
			Elevated crossing of SR 99 near French Camp	Medium	
			Elevated structure through downtown Manteca	Low	
			Curve realignment in Modesto	Low	
			Elevated structure through downtown Turlock	Low	
			Elevated structure through downtown Chowchilla	Low	
		BNSF Castle	New alignment south of Lodi	Low	Low
			Elevated structure through Escalon	Low	
			Elevated structure through Riverbank	Low	
			Curve realignment at Tuolumne River	High	
			New alignment into Castle AFB	Medium	
			Curve realignment south of Merced	Low	
			Curve realignment at Chowchilla River	Low	
		UPRR—BNSF Castle	Elevated crossing of SR 4 viaduct in downtown Stockton	Medium	Low
			Elevated crossing of SR 99 near French Camp	Medium	
			Elevated structure through Escalon	Low	
			Elevated structure through Riverbank	Low	
			Curve realignment at Tuolumne River	High	
			New alignment into Castle AFB	Medium	
			Curve realignment at Chowchilla River	Low	
		UPRR—BNSF	Elevated crossing of SR 4 viaduct in downtown Stockton	Medium	Low

Corridor	Possible Alignment	Alignment	Change	Visual Impact Ranking	Alignment Visual Impact Ranking
			Elevated Crossing of SR 99 near French Camp	Medium	
			Elevated structure through downtown Manteca	Low	
			Curve realignment in Modesto	Low	
			Elevated structure through downtown Turlock	Low	
			Curve realignment at Chowchilla River	Low	
Station Location Options					
Modesto (Downtown)			At grade station	No	
Briggsmore (Amtrak)			At grade station	No	
Merced (Downtown)			At grade station	Low	
Castle AFB			At grade station	No	

A discussion of these impacts organized by corridor follows.

San Francisco to San Jose Corridor

This corridor runs from the Transbay Transit Center in San Francisco to Diridon station location option in San Jose. It contains two alignment alternatives: San Francisco to Dumbarton and Dumbarton to San Jose.

Visual Impacts

To accommodate HSTs, the Caltrain line would be expanded from two to four tracks. Currently, there are two sections of four-track mainline, as noted above, through portions of Brisbane and South San Francisco, and in Sunnyvale. In most locations, the addition of two tracks would be within the existing right-of-way and would have a low visual impact. In some cases, it would be necessary to remove mature trees along the line. New plantings can replace the removed trees to minimize the visual impact. Where the additional tracks necessitate widening overcrossings or placing the railway on retained fill, the new structures can be designed to complement the historic character of nearby structures, as has been done at the San Carlos station.

The addition of the HST alignment alternative to the Caltrain Corridor also would require the full grade-separation of the railway. This means that all street and pedestrian crossings would go over or under the tracks. Some smaller crossings may be closed. In the locations where the railway is to be raised to pass over streets, there would be a visual impact from the raised embankment. A simulation of a raised section of railway is shown in Figure 3.9-8—Grade Separation at Burlingame Station.

Additional passenger boarding platforms would be built for the HST at certain stations, and underpasses or overpasses would be necessary to eliminate passengers crossing the railway tracks at grade at all stations. These projects would alter the existing visual qualities of the Caltrain stations.

Figure 3.9-8a
Grade Separation at Burlingame Station

Figure 3.9-8b
Grade Separation at Burlingame Station
Project Simulation

In some cases, such as the San Carlos station, projects previously have been undertaken to improve the station platforms through grade separations. The San Carlos station project was designed to complement the historic details and materials of the existing station building. New grade-separated, four-track stations were completed recently on the Caltrain line at Bayshore and Lawrence. The Bayshore station uses a pedestrian overcrossing for the grade separation. Lawrence uses a pedestrian undercrossing. The visual impact of the overcrossing is high because it consists of two towers with an elevator and stairs connected by a bridge over the tracks. The undercrossing's visual impact is low. These stations are representative of improvements that would be expected to be made to other stations along the line where the HST is not expected to stop.

Historic Buildings, Neighborhoods, Landscapes

Several stations on the Caltrain line are historic—the Millbrae (1907), Burlingame (1894), San Carlos (1888), Menlo Park (1867), Palo Alto (1941), Santa Clara station (1864) and tower (1920s), and San Jose Diridon (1935). The HST station location option in San Jose is addressed below in the San Jose to Central Valley corridor. The proposed HST alignment alternative would include stops at Millbrae, Redwood City *or* Palo Alto, San Jose, and the Transbay Transit Center and/or 4th and King in San Francisco. Many of the communities along the Caltrain corridor developed with construction of the railway. The result is that many of the main streets in these communities are oriented toward the Caltrain line. Introduction of two more tracks for HST, catenary, grade separations, and protective fencing and barriers would be visible to people on the downtown streets, but in most cases, the station buildings dominate the vista from downtowns toward the railway, blocking the visual impact of these changes on downtown vistas. In all cases except San Jose, the station building is on the west side of the railway. In all cases except San Jose, Palo Alto, and Redwood City, the downtown district is also to the west of the railway. This gives the station building the ability to mask the view of the railway tracks from most of the peninsula cities' commercial districts, minimizing the visual impact of the HST.

Millbrae is the terminus of BART in the West Bay and a stop served by almost all Caltrain services. It is the station where travelers transfer from Caltrain to BART to make the connection to the San Francisco International Airport. The introduction of HST to the Caltrain line would only reinforce the importance of the Millbrae station as a major regional station. The historic Millbrae station building is south of the existing BART/Caltrain station and currently home to the Millbrae Historical Society.

The introduction of HST to the Caltrain system would require that the current two-track Caltrain configuration at the Millbrae station be expanded to four tracks. (A third track and platform are south of the existing station but do not carry through the station.) The additional tracks would be added to the west of the existing tracks, and a new outside boarding platform would be constructed; the existing shared BART-Caltrain platform would be lengthened to 1,400 ft (400 m). The addition of the two tracks would require relocation of the historic station. It is assumed that the relocation would keep the building close to the station complex. The station was relocated to its current location in 1980 as part of a road-widening project. The relocation of the building again should not cause a visual impact because the landscape is dominated by the Millbrae Avenue overcrossing and the existing Caltrain/BART station.

Redwood City is a station location option. If the HST service continues south to San Jose, a choice would need to be made between Redwood City and Palo Alto for the HST station location. Regardless of the station location option decision, the line would be elevated through Redwood City and would be a major stop for Caltrain. Redwood City's Downtown Precise Plan includes a rendering of a fully elevated station on its cover, indicating that the city is planning for the eventual elevation and expansion of the existing tracks. If the tracks are elevated in concert with the planned redevelopment of the area surrounding the station, the visual impact should be low because proposed buildings around the station would be much taller than the buildings there currently. See Figure 3.9-9—Future Caltrain Station, Redwood City Downtown Precise Plan.

The Caltrain truss bridge over San Francisquito Creek, built in 1902, is the only through truss bridge on the line. The design of the bridge to carry the two new tracks over the creek should have a low visual impact because the dominant view to the bridge is from the adjacent roadways and bike/pedestrian bridge, and a new bridge could be designed to allow the existing truss bridge to remain the dominant form along the rail line.

To the east of the Caltrain tracks, between Menlo Park and Palo Alto on the south bank of San Francisquito Creek, is a coast redwood called *El Palo Alto*. It is California Historical Landmark No. 2, recognized by the National Arborist Association and International Society of Arboriculture for its historical significance. It was a campsite for the Portola Expedition Party (1769), a gathering place for the Costanoan/Ohlone Indians, and used as a sighting tree by surveyors plotting out El Camino Real. It appears on the city of Palo Alto's official seal and on the seal of Stanford University. The addition of two tracks to the west of the existing Caltrain tracks and the installation of poles and catenary for electrification should have a low visual impact on El Palo Alto because the 110-foot tree dominates the landscape.

If HST service extends the length of the Caltrain line, Palo Alto would be a station location option. If this were the case, the existing configuration of two tracks with outside platforms would be replaced by a configuration of four tracks with twin island platforms, extending from the station building toward Alma Avenue on the east side. Underpasses to each side of the tracks would connect the platforms. Designing the platform canopies in an art-deco style complementary to the station building would help ensure that this expansion would have a low visual impact on the historic station building.

Affected Views from State Scenic Highways

Designated and eligible state scenic highways in the corridor include I-280 from its terminus near the 4th and King Street station location option in San Francisco to I-880 in San Jose. The alignment is within 1 mi (2 km) of I-280 in the City of San Francisco and would be visible from the highway between the Cesar Chavez Street and US 101. The railway and highway pass through an industrial landscape in this area. The addition of two tracks to the existing Caltrain railway would have no impact on the visual quality experienced from I-280.

Oakland to San Jose Corridor

This corridor runs from Oakland to Diridon station in San Jose. It contains four alignment alternatives, reflecting two alternate terminal sites in Oakland and two alternate routings between Milpitas and San Jose. The alignments are West Oakland to Niles Junction, 12th Street/City Center to Niles Junction, Niles Junction to San Jose via Trimble Road, and Niles Junction to San Jose via I-880.

Visual Impacts

In this corridor, the HST alignment alternatives would require a pair of dedicated tracks. Starting from the north, the alignment alternatives begin at grade along the I-880 freeway in west Oakland. The West Oakland alignment alternative descends into a tunnel near Seventh Street to travel toward an underground station adjacent to the West Oakland BART station. From there, it continues in tunnel past downtown Oakland, emerging along the UPRR corridor near 14th Avenue. The 12th Street/City Center alignment alternative begins in the same location along I-880 in west Oakland, but runs north, descending into a tunnel crossing under west Oakland to downtown Oakland, where an underground station would be constructed beneath and perpendicular to the 12th Street BART station. The alignment would then continue in a tunnel to emerge along the UPRR corridor near 14th Avenue. The elevated I-880 freeway dominates the landscape where the alignment alternative would be above grade. Elsewhere, the alignment alternative would be underground. Each station location option would require the construction of a station entrance above the underground station, but in either case, the visual impact of the building would be low. A west Oakland station location would be built adjacent to the elevated West Oakland BART station, where the elevated BART station would

Figure 3.9-9
Future Caltrain Station, Redwood City
Downtown Precise Plan

continue to be the dominant visual feature in the landscape. For the 12th Street alignment alternative, the station building would be set in the middle of Oakland's downtown commercial district, characterized by visually dominant high-rise buildings.

Between 14th Avenue in Oakland and Niles Junction, the two HST alignment alternatives would follow the same alignment, sharing right-of-way with the UPRR as it passes through industrial and urban suburban residential landscapes. The alignment alternatives would run outside the historic centers of cities along the corridor. Most of the communities along this corridor developed after the railway was built. In many residential areas, soundwalls already exist along the edges of the railroad right-of-way. The two additional tracks for an HST, with its associated infrastructure, would be hidden from many existing residential areas behind existing soundwalls, creating no new visual impact. In areas where new soundwalls are deemed appropriate, the new walls would continue a visual theme already present in the corridor.

The addition of HST to this corridor would require the full grade-separation from streets and rail spurs off the UPRR. This means that all streets, pedestrian crossings, and rail spur tracks would go over or under the HST tracks. Some smaller road crossings may be closed and some spur tracks abandoned. In the locations where roadways are lowered to cross under the railway, there would be a low visual impact. A simulation of a roadway undercrossing of railway is shown in Figure 3.9-10—Undercrossing at Fruitvale Avenue.

Two intermediate stations are planned in the corridor. The Coliseum station location option would be built between the existing BART station and Oakland Coliseum Complex, vastly expanding the existing Coliseum station of the Capitol Corridor trains. Pedestrian access to the HST and Capitol Corridor platforms would be from an elevated concourse. The existing footbridge between the BART station and the Coliseum station would be expanded to serve as the concourse. This station location option would have a low visual impact because the Oakland Coliseum and Arena facilities would continue to dominate the landscape visually.

A station location option is also planned adjacent to BART's Union City station and the proposed Capitol Corridor station. The HST station would be located along the existing Capitol Corridor tracks, a few hundred feet east of the BART station. The HST station would be at grade, with two outside platforms and four tracks. The outer tracks would serve trains stopping at the station; the inner tracks would be used by express trains. The new station would have a low visual impact on the surrounding landscape.

South of the station, a pair of tracks may diverge from the line, turn to the east, and enter a tunnel into Niles Canyon to connect to the Altamont alignment alternative in the East Bay to Central Valley corridor. Past this junction, the line would pass the historic town of Niles and transition to an elevated structure through the Niles Junction area. The elevated structure would have a low visual impact on the surrounding residential area and medium shadowing impacts before returning to an at-grade alignment.

South of Lake Elizabeth and Paseo Padre Parkway in Fremont, the HST would transition to an elevated alignment above the UPRR and planned BART line. The elevated structure would be between 26 ft (7.9 m) and 50 ft (15.2 m) high. This would introduce a new elevated lineal element into the immediate landscape. The structure would have a medium visual impact on residential areas along the west side of the corridor, including shadow impacts, especially where the structure ascends to its maximum height to cross above highway overcrossings of the existing railway and planned BART line at Washington Boulevard and Auto Mall Parkway.

Another potential HST station location option would be located adjacent to BART's proposed Warm Springs station in Fremont. The station would consist of four tracks with two outside platforms. The tracks and platforms would be elevated about 26 ft (7.9 m) above grade, with the platform shelter canopies extending to about 40 ft (12.1 m). The station would be more than 1,400 ft (400 m) long, with additional length at either end for the track fans (switches and trackwork) to allow the two-track mainline to split to four tracks. While this would be a large structure, it would not dominate the surrounding industrial landscape. The alignment would leave the UPRR/BART right-of-way near Mission Boulevard and enter the I-880 right-of-way, where it would remain on an elevated structure, in the median of the freeway. The elevated structure would be between 26 ft (7.9 m) and 50 ft (15.2 m), reaching the maximum when passing over highway overpasses. The aerial structure would be a dominant, compatible, linear feature along the freeway. The landscape along the freeway is predominantly industrial and commercial, with some residential on the east side in the city of Milpitas. While the aerial structure would be visible, the freeway would continue to dominate the landscape, resulting in a low visual impact.

Where Montague Expressway intersects I-880, two alignment alternatives exist for the reminder of the corridor into Diridon station in San Jose. The Niles Junction to San Jose via I-880 alignment alternative continues elevated in the median of I-880 until near SR 87. Upon leaving the freeway right-of-way, the HST railway would descend into a tunnel beneath Columbus Park and then climb to enter Diridon station. The visual impact along the freeway would be similar to what was described above.

The Niles Junction to San Jose via Trimble alignment alternative leaves the I-880 right-of-way and follows Montague Expressway and Trimble Road to the UPRR Coast Line and Caltrain line at the Santa Clara station. The landscape along this alignment alternative is industrial and commercial. The HST railway would be elevated above the median of Montague Expressway and Trimble Road and then descend to a tunnel from approximately Zanker Road to the Central Expressway. The line would ascend to an aerial structure in the UPRR right-of-way. The alignment alternative would remain on an aerial structure along the Caltrain line and into the Diridon San Jose station.

The aerial alignment would introduce a new lineal form to the landscape, but it would complement the lineal form of the highways and associated landscaping, resulting in a low visual impact. The aerial alignment along the UPRR and Caltrain railways passes through an industrial landscape. The elevated HST would have a low visual impact, except where it passes the Santa Clara station (1864). This impact is discussed below.

Historic Buildings, Neighborhoods, Landscapes

The Santa Clara Caltrain station and tower were built in 1864 and the 1920s, respectively. The elevated structure would introduce a new dominant linear form behind the historic depot. The proposed HST line, should the Trimble alignment alternative be selected, would be between 26 ft (7.9 m) and 50 ft (15.2 m). While not dominating the landscape, the aerial structure would have a medium visual impact on the historic depot and tower and would also create shadow impacts.

The HST station location option in San Jose is addressed below in the San Jose to Central Valley corridor.

Affected Views from State Scenic Highways

Designated and eligible state scenic highways in the corridor include I-680 in Alameda County. The proposed HST alignment alternative is within 1 mi (2 km) of I-680 near Mission Boulevard in south Fremont and would be visible from the highway in that location. The railway would pass through an industrial landscape in this area. The addition of two tracks above the existing railway would have a low impact on the visual quality experienced from I-680 because the HST structure would complement the lineal form of the existing railway.

Figure 3.9-10a
Undercrossing at Fruitvale Avenue

Figure 3.9-10b
Undercrossing at Fruitvale Avenue
Project Simulation

San Jose to Central Valley Corridor

This corridor extends from the Diridon station in San Jose to the Central Valley. From San Jose to Gilroy, the alignment follows the UPRR corridor. From Gilroy across the Pacheco Pass, it is generally in the vicinity of SR 152. Three alignment alternatives exist from the east side of Pacheco Pass: GEA North, Henry Miller BNSF Connection, and Henry Miller UPRR Connection. The GEA North runs north past the town of Gustine and then east across the valley to just west of the city of Atwater where it connects with the BNSF alignment alternative. The Henry Miller (UPRR Connection) and the Henry Miller (BNSF Connection) alignment alternatives share the same alignment for most of their length, running past the community of Santa Nella and parallel to Henry Miller Avenue to just west of the city of Chowchilla. The Henry Miller (UPRR Connection) splits west of Chowchilla to connect to the Central Valley UPRR N/S alignment alternative. The Henry Miller (BNSF Connection) passes south of the city of Chowchilla and splits to connect to the Central Valley HST BNSF alignment alternative.

Visual Impacts

Implementation of HST in this corridor would require a dedicated pair of tracks. The corridor begins at Diridon station in San Jose. The HST would be accommodated by building a concourse and up to six HST tracks and three platforms above the existing platforms. The proposed platforms for HST would be located at 45 ft (13.7 m) above grade. The platforms would extend more than 1,400 ft (400 m), with additional length at either end for the track fans (switches and trackwork to allow the two-track mainline to serve all six station tracks). A canopy covering the HST platforms would extend the building height to 70 ft (21 m). The City of San Jose is planning for an intensification of land uses in and around the Diridon station, so the expanded HST station would constitute a medium visual impact, given that it would be a much longer and taller structure than the existing station building but in a setting that is proposed to have many larger buildings developed in the area.

The line would run on an elevated structure up to 45 ft (13.7 m) tall until it crosses I-280, where it would descend to a retained fill section alongside the existing UPRR and Caltrain's Gilroy service. It would pass through a traditional small urban neighborhood before passing over SR 87 and ascending to an aerial alignment past the Tamien station. The retained fill and aerial sections would be a low visual impact on the surrounding landscape, creating shadow impacts on residential areas immediately adjacent to the right-of-way.

Just north of Almaden Expressway, the line returns to an at-grade alignment alongside the UPRR as it passes through the urban suburban landscape of South San Jose. A view of the current Caltrain/UPRR railway as it runs alongside Monterey Highway is provided in Figure 3.9-11—Caltrain/UPRR along Monterey Highway. The proposed configuration would continue all the way through Morgan Hill and Gilroy. New roadway grade separations would carry roadways either over or under the UPRR and HST tracks. Because the HST would be placed in an existing rail right-of-way, the visual impact would be low.

The traditional small urban community landscapes south of the highly urbanized San Jose area and through the small rural towns of Morgan Hill and Gilroy are characterized by mixed residential, commercial, and institutional uses in early to mid–20th century contiguous buildings, with average heights of 2 to 3 stories, minimal setbacks from streets, mature landscaping, and pedestrian-oriented streetscapes. Dominant visual features are historic architecture, mature street trees, and the surrounding distant mountainous ridgelines.

A station location option for the HST could be provided in either Morgan Hill or Gilroy. In either location, the station would consist of four tracks, two for non-stopping trains and two to serve outside platforms for stopping trains. At either location, Morgan Hill or the historic Gilroy station, the HST facilities would be elevated, and the visual impact would be medium.

South of Gilroy, the HST parallels the UPRR until Carnadero Junction, where it leaves the rail right-of-way to cross the valley towards San Felipe. The landscape is rural agricultural as the line crosses the Pajaro River and Tequisquita Slough and passes near San Eligo Lagoon. In this landscape, the line has a medium visual impact, introducing a new transportation corridor to a rural agricultural area.

The coastal valley landscape consists of flat or rolling landscapes ringed with low hills and mountains in the background. Dominant visual elements are vistas of agricultural bottomland and wetlands framed by background views of green hills, ridges, and mountains.

At San Felipe, the line crosses SR 152 and enters a short tunnel to pass into the Pacheco Creek Valley. This is shown in Figure 3.9-12—HST Crossing South of Gilroy. Once in the Pacheco Creek Valley, the line runs north of SR 152 along a series of cuts and fills until passing over the highway near Bell station.

The natural open space landscapes along SR 152 in Pacheco Creek Valley east of Gilroy are characterized by coastal mountains and mountain valley topography typified by rolling to steep-sloped grassland with shrubs, clusters of oaks and other native tree species, and wooded bottomland. Much of this area is part of the Henry Coe State Park and Mount Hamilton Project Area of The Nature Conservancy (described in Section 3.15, Biological Resources and Wetlands), which is designed to preserve the rich natural habitats in a 780–sq mi (1255–sq- km) area of the Diablo Range. Small farms or ranches (in bottomlands), isolated roadside businesses (e.g., Casa de Fruta), and widely dispersed small communities characterize the landscape.

A simulation of the crossing of SR 152 in the Pacheco Creek Valley is provided in Figure 3.9-13—HST Viaduct in Pacheco Creek Valley. South of the highway, the line would enter a series of tunnels and cut and fill sections, passing back to the north side of the highway in a cut just west of the pass. The line would curve north of the San Luis Reservoir and Cottonwood Bay, again partially in tunnels and partially on cut and fill sections. The visual impact of this section of the line over the pass varies from none where the line is in a tunnel, to a medium impact where there are deep cuts or fills, to a high impact where the line crosses above the highway on a viaduct. North of San Luis Reservoir, the line can diverge to one of three alignment alternatives: GEA North, Henry Miller (UPRR Connection), and Henry Miller (BNSF Connection).

The GEA North alignment alternative would cross Romero Creek and enter a series of tunnels and cut and fill sections to reach the edge of the Central Valley near the Pat Brown Aqueduct and I-5. It would turn north on an embankment to pass around the town of Gustine. The landscape transitions from the parks and open space of the Pacheco Pass to the rural agriculture of the western Central Valley. This would have a high visual impact where it crosses I-5. It would introduce a new transportation infrastructure crossing from the hills to the valley on an embankment over the freeway. I-5 in this area is a designated state scenic highway.

Passing west and north of Gustine, the line would turn toward the east and run north of SR 140. Landscape in this area is a mixture of rural agriculture and wetlands open space. The line passes near the Great Valley Grasslands State Park and the Fremont Ford State Recreation Area. It would cross wetlands on low-level elevated structures. The introduction of the HST to the open space and parklands would be a medium visual impact because the line would be low to the ground and blend with the horizontal landscape.

The GEA North alignment alternative would continue across the rural agricultural landscape of the Central Valley to meet the Central Valley BNSF mainline between the communities of Atwater and Merced. As the line approaches the urbanized area, the landscape shifts to a mix of urban suburban and rural agricultural.

Figure 3.9-11
Caltrain/UPRR along Monterey Highway

Figure 3.9-12a
HST Crossing South of Gilroy

Figure 3.9-12b
HST Crossing South of Gilroy
Project Simulation

Figure 3.9-13a
HST Viaduct in Pacheco Creek Valley

Figure 3.9-13b
HST Viaduct in Pacheco Creek Valley
Project Simulation

The GEA North alignment alternative would split south of Livingston and curve to the north, eventually parallel to Arena Way. The introduction of the railway to a new alignment across the agricultural landscape would have a low visual impact. Near the existing BNSF railway, the line would cross the Merced River on a new alignment. This new river crossing would have a medium visual impact to the riparian landscape along the river.

Both the BNSF and UPRR Henry Miller alignment alternatives would run across the Central Valley just north of Henry Miller Avenue. The line would exit the hills east of Pacheco Pass and follow Romero Creek. This takes the line past the San Joaquin National Cemetery in a trench, where the line would have a medium visual impact, introducing a major transportation facility to an open landscape designated for reflection and quiet. This area is shown in Figure 3.9-14—Romero Creek from San Joaquin National Cemetery. The alignment alternative would also pass the O'Neill Forebay of the California Aqueduct and the San Luis Reservoir State Recreation Area.

The line would pass through the roadside community of Santa Nella and cross I-5, which is a designated state scenic highway in this area. The impact of the highway crossing is low because the railway crosses in an area where the landscape comprises highway-commercial uses and an existing roadway overcrossing.

East of Santa Nella, the line would traverse a landscape of rural agriculture and wetlands open space, including a number of state and federal wildlife areas. The alignment alternative would be placed on a low structure to cross the wetland areas. A simulation of this is shown in Figure 3.9-15—HST Viaduct along Henry Miller Avenue. The introduction of the HST to the open space and parklands would be a medium visual impact because the line would be low to the ground and would blend with the horizontal landscape. The line would be visible from the Volta Wildlife Area and Los Banos Wildlife Area.

West of the city of Chowchilla, the Henry Miller (UPRR Connection) and Henry Miller (BNSF Connection) alignment alternatives would partially split. The leg connecting to the UPRR northbound would turn north from the alignment and cross agricultural lands to meet the Central Valley UPRR N/S alignment alternative north of the city of Chowcilla. The Henry Miller (UPRR Connection) southbound leg would continue east before turning south to meet the Central Valley UPRR N/S alignment alternative near the town of Fairmead. This alignment alternative, both the north and south legs, would have a low visual impact because it would run at grade.

The Henry Miller (BNSF Connection) alignment alternative would pass to the south of the city of Chowchilla. After crossing SR 99, the line divides into two legs to connect with the Central Valley HST line (BNSF alignment alternative) near the Valley State Prison for Women. The two legs would have a low visual impact because they would run at grade.

Historic Buildings, Neighborhoods, Landscapes

In San Jose, the HST is to be accommodated at the Diridon station by building a concourse and up to six HST tracks and three platforms above the existing platforms. The San Jose Diridon station is a designated historic property listed on the National Register of Historic Places. The station dates to 1935, with architectural features characteristic of that period. The proposed platforms for the HST would be located at 45 ft (13.7 m) above grade. The platforms would extend more than 1,400 ft (400 m), with additional length at either end for the track fans (switches and trackwork to allow the two-track mainline to serve all six station tracks). A canopy covering the HST platforms would extend the building height to 70 ft (21 m). The City of San Jose is planning an intensification of land uses in and around the Diridon station, so the expanded HST station location option would constitute a medium visual impact, given that it would be a much longer and taller structure than the existing station building but in a setting that is proposed to have many larger buildings developed in the area.

The San Jose to Central Valley corridor south of the urbanized areas of San Jose traverses a largely rural and agricultural landscape. Historic buildings, like the 21-Mile House in Morgan Hill, no longer exist. The Gilroy Caltrain station would be visually affected by the HST, but the impact can be minimized though careful and thoughtful design. The traditional small town landscape present at the core of Morgan Hill and Gilroy has coexisted with the railway for all of their histories. The visual impact of the HST project is medium, compared with the contrast of recent commercial and residential suburban growth.

In this corridor, most of the visual impact would be from adding new transportation infrastructure into an undeveloped rural landscape. The historic character of Monterey Highway, immediately adjacent to the UPRR and proposed HST alignment, would be affected by the removal of mature trees that visually separate the highway from the railroad. This is shown in the context of the urban suburban landscape of South San Jose in Figure 3.9-10. In many places, the trees are denser and older than the surrounding landscape. Their removal to expand the rail corridor to accommodate HST would have a medium visual impact on the views along much of the Monterey Highway.

To pass from the UPRR right-of-way to the SR 152 corridor, the HST would develop a new transportation corridor across agricultural and open space, not aligned with any existing grid of roads or natural features. This would have a medium visual impact on the existing landscape, but that impact can be lessened by keeping the HST at grade and planting native flora along the right-of-way.

Through the Pacheco Creek Valley, the railway would follow the existing highway corridor. The major visual landmarks along the highway, such as Elephant Head (a large rock outcropping), would not be visually affected by the railway. As the valley narrows, the railway would be mostly out of sight, running in tunnels.

East of Pacheco Pass, the HST would follow Romero Creek past the San Joaquin Valley National Cemetery. The alignment would be in trench as it passes the cemetery, crossing northeast of the entry road to the cemetery. This would have a medium visual impact on the landscape and the cemetery's remote and quiet setting.

The three alignment alternatives across the valley would pass through similar landscapes, including grasslands and wetlands. The HST infrastructure would have an impact on these open landscapes, but the impact can be minimized by running at grade and planting native flora along the line.

Affected Views from State Scenic Highways

There are a number of state scenic highways in the corridor. Designated state scenic highways, as of November 2006, include I-5 in Stanislaus County and north of SR 152 in Merced County and SR 152 in Merced County west of I-5. State highways eligible but not officially designated as scenic include SR 152 in Santa Clara County east of SR 156. All of these highways, both designated and eligible, are considered in this analysis.

The crossing of I-5 could take place in one of two locations. The GEA North alignment alternative would create a high visual impact because it would take place in an open landscape where the elevated crossing would be visible from a great distance along the freeway. The Henry Miller alignment alternatives would cross at an existing roadway overcrossing in the highway-commercial landscape of Santa Nella. This crossing would have a low visual impact because the landscape is dominated by the existing highway overcrossings and the commercial landscape along the freeway.

The line would be visible from many points along SR 152 in Santa Clara and Merced County, especially in the Pacheco Creek Valley. The visual impact of the line would vary from low to high, relative to the specific location. Where the line parallels the highway, it would have a low visual impact, with hills continuing to dominate the landscape. At the locations where the line passes over

Figure 3.9-14
Romero Creek from San Joaquin National Cemetery

Figure 3.9-15a
HST Viaduct along Henry Miller Avenue

Figure 3.9-15b
HST Viaduct along Henry Miller Avenue
Project Simulation

the highway, the elevated crossing would dominate the view from the highway, having a high visual impact. In other locations, where the railway runs on a high fill, the line would have a medium visual impact, lessening over time as the embankment is engulfed by the local flora.

East Bay to Central Valley Corridor

This corridor extends from the Niles Junction area of Fremont in the Bay Area to Manteca and Escalon in the Central Valley. The corridor generally parallels SR 84, the UPRR, I-580, I-205, and SR 120. There are four alternative alignments between Fremont and I-580 in San Joaquin County and four alternative alignments between I-580 and the UPRR in Manteca and BNSF in Escalon. The first four alternatives vary in their routes across the Amador and Livermore valleys and their routes across the hills into the Central Valley. The second four vary in following one of two routes through or around the city of Tracy and in which Central Valley HST alignment alternative, UPRR N/S or BNSF, they connect to.

Visual Impacts

The I-680/580/UPRR, I-580/UPRR, Patterson Pass/UPRR and UPRR East Bay to Central Valley alignment alternatives all begin near Niles Canyon in the hills west of Fremont, at the east end of the Dumbarton, Fremont Central Park corridor and East Bay Connection. The alignment alternatives begin in a tunnel, beneath the hills between Niles Canyon and Morrison Canyon, and continue in a northeast direction beneath Alameda Creek and Niles Canyon, Sunol Ridge, and Pleasanton Ridge before emerging just north of Castlewood Country Club at Foothill Road. Leaving the tunnel, the alignment alternatives run in a trench towards I-680, resulting in a low visual impact.

Near I-680, the four alternative alignments diverge. The I-680/580/UPRR alternative would turn to follow I-680 and I-580 to the base of the Altamont Pass. The HST would be placed on an elevated structure alongside I-680. The structure would have a medium visual impact on the adjacent residential neighborhoods and potential shadow impacts. It would turn from the freeway right-of-way and cross a commercial development and water ponds before entering the median of I-580, elevated above the BART tracks. The aerial structure, as it arcs between the two freeways, would create medium visual impacts. Its scale would be consistent with the highway ramps at the freeway interchange but it would be well outside the highway, affecting neighboring land uses.

Once in the median of I-580, the line would remain elevated above the median and BART tracks and Dublin-Pleasanton station. The elevated structure would be between 26 ft (7.9 m) to 50 ft (15.2 m), reaching the maximum when passing over highway overpasses. The aerial structure would be a dominant linear feature along the freeway. The landscape along the freeway is predominantly industrial and commercial, with some residential east of the BART station. While the aerial structure would be visible, it would be compatible with the freeway, which would continue to dominate the landscape. This is illustrated in Figure 3.9-16—HST at I-580/680 Interchange.

There are three station location options along the I-580 corridor, at the Pleasanton BART station, North Livermore, or at Greenville Road. Regardless of the location, all would be configured roughly the same. The HST would be elevated above the median of the freeway. The elevated station would introduce a 26 ft (7.9 m) to 40 ft (12.1 m) structure above the freeway. The station would extend more than 1,400 ft (400 m), with additional length at either end for the track fans (switches and trackwork) to allow the two-track mainline to split to four tracks. The center tracks would serve non-stopping trains, while the outer tracks would serve a pair of outside platforms. The platforms would be connected by elevators and escalators to potential regional rail facilities in the median of the freeway and to a pedestrian undercrossing to connect to the station building on the side of the freeway right-of-way. The structure would have a high visual impact because it would extend up to 0.5 mi. A canopy covering the HST platforms would extend the building height to 70 ft (21 m).

The Pleasanton BART station location option would locate the HST station above the existing Pleasanton BART station. The North Livermore station location option would be along I-580 just west of the North Livermore interchange. The proposed station is on property owned by BART for a future station and maintenance yard. South of the site is residential development. To the north of I-580 is open space. The Greenville Road station location option would be located just east of Greenville Road.

East of the Livermore station, the line would continue elevated in the median of I-580. The elevated structure would be between 26 ft (7.9 m) to 50 ft (15.2 m), reaching the maximum when passing over highway overpasses. The aerial structure would be a dominant linear feature along the freeway. Open space and residential landscapes dominate the north side of the freeway, while the south side is predominantly industrial and commercial. While the aerial structure would be visible, the freeway would continue to dominate the landscape.

As I-580 begins to climb to the Altamont Pass, the HST would remain in the median of the freeway until passing under the westbound lanes and crossing Carroll Road on an elevated structure and entering a tunnel under the pass. The HST would emerge from the tunnel and pass under the west and eastbound lanes of I-580 to the south of the freeway to meet the UPRR alignment alternative. As the HST passes under the freeway, the visual impact would be low. The alignment alternative meets with the other alignment alternatives near the I-580 freeway in San Joaquin County.

The I-580/UPRR, Patterson Pass/UPRR, and UPRR alignment alternatives would share the same alignment from I-680 to east of downtown Livermore, following the UPRR line through Pleasanton and Livermore.

Starting at I-680, the alignment alternatives would follow above the existing railroad right-of-way through the traditional small urban community of central Pleasanton, where the elevated structure would have a medium visual impact, running above the cross-streets and existing railroad. It would have potential shadow impacts on adjacent residential uses.

East of central Pleasanton, the I-580/UPRR alignment alternative would swing north towards I-580 at grade. The line would cross an area of gravel pits and open fields, creating a low visual impact. At I-580, the line would transition to an elevated configuration above the median of I-580. The North Livermore station location option would be along I-580 just west of the North Livermore interchange. The proposed station location option is on property owned by BART for a future station and maintenance yard. South of the site is residential development. To the north of I-580 is open space. The Greenville Road station location option would be located just east of Greenville Road.

East of the Livermore station, the line would continue elevated in the median of I-580. The elevated structure would be between 26 ft (7.9 m) to 50 ft (15.2 m), reaching the maximum when passing over highway overpasses. The aerial structure would be a dominant linear feature along the freeway. Open space and residential landscapes dominate the north side of the freeway, while the south side is predominantly industrial and commercial. While the aerial structure would be visible, the freeway would continue to dominate the landscape.

As I-580 begins to climb to the Altamont Pass, the HST would remain in the median of the freeway until passing under the westbound lanes and crossing Carroll Road on an elevated structure and entering a tunnel under the pass. The HST would emerge from the tunnel and pass under the west and eastbound lanes of I-580 to the south of the freeway to meet the UPRR alignment. As the HST passes under the freeway, the visual impact would be low. The alignment alternative meets with the other alignment alternatives near the I-580 freeway in San Joaquin County.

Figure 3.9-16a
HST at I-580/680 Interchange

Figure 3.9-16b
HST at I-580/680 Interchange
Project Simulation

The Patterson Pass/UPRR and UPRR alignment alternatives would descend to an at-grade alignment by Valley Boulevard. The line would run on the north side of the existing UPRR tracks and Stanley Boulevard past a landscape dominated by active and reclaimed gravel pits. The landscape along Stanley Boulevard between Pleasanton and Livermore is best described as industrial open space. The existing operating gravel pits are characterized by large industrial conveyor belts, silos, and constant truck activity. Some reclaimed pits have been transformed into Shadow Cliffs Regional Park, with beaches and lakes. The parklands are well below the grade of the surrounding landscape, at the bottom of the reclaimed pits. This obscures many of the local views from the pits, including that of the adjacent railway and roadway, limiting the visual impact of existing and potential transportation infrastructure.

The Patterson Pass/UPRR and UPRR alignment alternatives would pass through Livermore at-grade along the existing UPRR right-of-way. To accommodate a station in downtown Livermore, the HST would need to expand from two to four tracks. This would require the acquisition of some residential and commercial properties north of the existing rail right-of-way but would allow the station to be built at grade. This would lessen the visual impact of the station, creating a low visual impact, because the station building would be of similar scale to other buildings in the downtown area. A simulation of this is shown in Figure 3.9-17—HST at grade in Livermore.

East of downtown Livermore, near North Mines Road, the Patterson Pass/UPRR and UPRR alignment alternatives diverge.

The Patterson Pass/UPRR alignment alternative would continue to follow the UPRR tracks to just east of Greenville Road, where it would turn to due east and pass over the hills in a series of cuts and fills. West of I-580, the alignment alternative would rejoin the other alignment alternatives. Because the Patterson Pass alignment alternative crosses the hills on a repeated series of cuts and fills, none too severe, the visual impact would be low.

The UPRR alignment alternative would leave the UPRR line and follow the former Southern Pacific Railway line toward Greenville Road. The Greenville Road station location option is located just east of Vasco Road. The station would be at grade, with four tracks: two inside for through HST, and two outside for stopping trains, served by a pair of platforms. The at-grade configuration in a landscape dominated by industrial distribution warehoused would result in a low visual impact.

As the alignment alternative nears the hills, it would climb on an embankment and then transition to a tall structure as it passes over Greenville Road into the hills. Once in the open space of the Altamont Pass, the line would make a cut on its run to the summit. The cut would be deep but less visually dominant than the existing 8-lane freeway, resulting in a medium visual impact. Near the summit, this alignment alternative meets the I-580 alignment alternative.

Just west of the North Flynn Road interchange, the HST is in a deep cut to the north of the existing freeway. This is shown in Figure 3.9-18—HST alongside Freeway, Altamont Pass.

The landscape of the Altamont Pass is open space characterized by treeless, grassy hills and a multitude of wind turbines. It is crossed by two major transportation corridors and a third abandoned one. The I-580 freeway is an eight-lane facility with very heavy traffic volumes. It dominates the area, with each direction of the freeway on different alignments on the east side of the pass. The UPRR is visually obvious as it passes through the area, but it does not dominate the landscape because it is only a single-track railway, about 15% the width of the freeway. The former Southern Pacific Railroad grade is still clearly visible, including the cuts and fills, but the right-of-way has been reclaimed by grasses. The hillsides away from the freeway are dominated by lines of wind turbines. There are over 4,000 wind turbines in the Altamont Pass area. A view is shown in Figure 3.9-19—I-580, Altamont Pass. The introduction of a new HST alignment alternative to this landscape would have a low visual impact because it would be complementary to the existing railway and highway earthworks. The line would cross large cuts and fills as it descends to the Central Valley, down the east side of the pass. It would run in the same area, south of the freeway, as the existing and abandoned railway lines but would take a straighter and steeper route. The UPRR alignment alternative meets the I-680/580/UPRR and I-580/UPRR alignment alternatives just east of the Altamont summit, and the three share a common alignment until meeting the Patterson Pass/UPRR alignment alternative just west of I-580 in San Joaquin County.

There are four alignment alternatives between I-580 and Manteca and Escalon. A pair of alignment alternatives, the Tracy ACE Station (BNSF Connection) and Tracy ACE Station (UPRR Connection), would share a common alignment to the south of Tracy until diverging near Oakwood Lake, southwest of Manteca. The other pair of alternative alignments, the Tracy Downtown (BNSF) and Tracy Downtown (UPRR), would pass through the City of Tracy and diverge west of Oakwood Lake.

The Tracy ACE Station (BNSF Connection) and Tracy ACE Station (UPRR Connection) alignment alternatives run down out of the hills in a southeasterly direction, crossing I-580 near the Corral Hollow Road interchange. I-580 is a designated state scenic highway in San Joaquin County. The structure to carry the HST across the freeway and adjacent canals would be visible from a distance along the freeway. The landscape in the area is predominately open space, and the freeway runs in a straight line for miles in each direction. However, the impact of the rail crossing would be lessened by the existing adjacent highway overcrossing, resulting in a medium visual impact.

Once across the freeway, the alignment alternatives would curve to the northeast as they cross the Edward G. Brown Aqueduct and the Delta-Mendota Canal, still on an elevated structure. Once over the canals, the line would descend to grade. The route would pass south of the Tracy Municipal Airport and join the UPRR right-of-way near Linne Road.

A potential station location option is planned to serve Tracy along this route west of South Banta Road near the San Joaquin Defense Depot. The proposed station would consist of four tracks and two island platforms above a station concourse. The tracks and platforms would be elevated about 26 ft (7.9 m) above grade, with the platform shelter canopies extending to about 40 ft (12.1 m). The station would be more than 1,400 ft (400 m), with additional length at either end for the track fans (switches and trackwork) to allow the two-track mainline to split to four tracks. While this would be a large structure, it would not be as dominant as the Defense Depot buildings in the surrounding industrial and rural agricultural landscape.

The Tracy ACE Station (BNSF Connection) and Tracy ACE Station (UPRR Connection) alignment alternatives would continue to follow the UPRR, passing under I-5. Near Oakwood Lake, the northbound leg of the Tracy ACE Station (UPRR Connection) would diverge and connect with the Central Valley UPRR N/S alignment alternative near Lathrop. This connection, at grade, would be a low visual impact. The Tracy ACE Station (BNSF Connection) and Tracy ACE Station (UPRR Connection) southbound leg would cross into the median of SR 120 just east of I-5. The line would have a low visual impact along the freeway. The connection to the UPRR would be made near the intersection of SR 120 and SR 99.The Tracy ACE Station (BNSF Connection) would continue east past the intersection of SR 120 and SR 99 in the right–of-way of the future SR 120 freeway. The northbound connection to the BNSF would turn to the north east of the city of Escalon to join the BNSF alignment north of Escalon. The southbound connection would continue east until turning south to join the BNSF alignment south of Escalon. The HST would have a low visual impact as it passes through orchards and groves on the way to the BNSF line in Escalon.

The Tracy Downtown (BNSF Connection) and Tracy Downtown (UPRR Connection) alignment alternatives would leave the hills with a series of cut and fill sections. Near I-580, they would curve to the northeast and transition to an aerial structure to cross the UPRR, I-580, and adjacent canals.

Figure 3.9-17a
HST at grade in Livermore

Figure 3.9-17b
HST at grade in Livermore
Project Simulation

Figure 3.9-18a
HST alongside Freeway, Altamont Pass

Figure 3.9-18b
HST alongside Freeway, Altamont Pass
Project Simulation

Figure 3.9-19
I-580, Altamont Pass

I-580 is a designated state scenic highway in San Joaquin County. The landscape in the area is predominately open space south of the proposed crossing and a mix of open space and warehousing/industrial north of the crossing. The freeway runs in a straight line for miles in each direction, so the structure to carry the HST across the freeway would be visible from a distance along the freeway. The visual impact would be medium because the large warehousing complex is also a dominant feature in the landscape.

Across the canals, the line joins the former Southern Pacific (now UPRR) rail right-of-way to cross through Tracy. The landscape along the right-of-way is urban suburban, with new residential neighborhoods behind soundwalls that line the rail right-of-way. The introduction of HST to the area would be a low visual impact because the surrounding neighborhoods are already shielded from the rail corridor. This is shown in Figure 3.9-20—Rail Corridor in Tracy.

East of Schulte Road, the line would transition to an aerial structure into the Downtown Tracy station location option. The station would be elevated about 26 ft (7.9 m) above grade, with the platform shelter canopies extending to about 40 ft (12.1 m). The station would be more than 1,400 ft (400 m), with additional length at either end for the track fans (switches and trackwork) to allow the two-track mainline to split to four tracks. The landscape surrounding the station location option is a mix of urban suburban and traditional small urban community. The station would dominate the area because it would be of a significant size, making a medium visual impact.

East of the station location option, the tracks would transition back to grade. They would run alongside the existing freight tracks, passing under 11th Street and I-205. They would meet the Tracy ACE Station (BNSF Connection) and Tracy ACE Station (UPRR Connection) near Oakwood Lake, near the intersection of I-5 and SR 120.

Near Oakwood Lake, the northbound leg of the Tracy Downtown (UPRR Connection) alignment alternative would diverge and connect with the Central Valley UPRR N/S alignment alternative near Lathrop. This connection, at grade, would be a low visual impact. The Tracy Downtown (BNSF Connection) and Tracy Downtown (UPRR Connection) southbound leg would cross into the median of SR 120 just east of I-5. The line would have a low visual impact along the freeway. The connection to the UPRR would be made near the intersection of SR 120 and SR 99.The Tracy Downtown (BNSF Connection) would continue east past the intersection of SR 120 and SR 99 in the right of way of the future SR 120 freeway. The northbound connection to the BNSF would turn to the north east of the City of Escalon to join the BNSF alignment north of Escalon. The southbound connection would continue east until turning south to join the BNSF alignment south of Escalon. The HST would have a low visual impact as it passes through orchards and groves on the way to the BNSF line in Escalon.

Historic Buildings, Neighborhoods, Landscapes

The East Bay to Central Valley corridor passes through landscapes that were largely rural agricultural until a few decades ago. Many of the historic buildings in the corridor have either been destroyed or engulfed by the newly built urban suburban landscape.

The HST would cause a visual impact on the traditional small urban community landscape of the residential areas along the UPRR right-of-way in central Pleasanton. The alignment alternative through Downtown Tracy would also be visually affected by a HST station location option adjacent to its downtown.

The scenic landscape along Alameda Creek in Niles Canyon would be unaffected by the HST because the alignment alternative would be in a tunnel though the area. Over Altamont Pass, the HST would make deep cuts into the hills, but the freeway and thousands of wind turbines would continue to dominate the visual landscape.

Affected Views from State Scenic Highways

There are a number of state scenic highways in this corridor. Designated state scenic highways, as of November 2006, include I-680 in Alameda County and I-580 in San Joaquin County. State highways eligible but not officially designated as scenic include I-580 in Alameda County and SR 84 in Alameda County between SR 238 in Fremont and Interstate 680. All of these highways, both designated and eligible, are considered in this analysis.

SR 84 at the mouth of Niles Canyon would be affected by the East Bay connector between the East Bay to Central Valley corridor and the Oakland to San Jose corridor with a partially elevated, partially at-grade line crossing Alameda Creek and SR 84. SR 84 through Niles Canyon would not be visually affected by the HST because the alignment alternative would be in tunnels through the area.

The aerial HST along I-680 would create a medium visual impact because the structure would dominate views of the hills from the freeway. I-680 would also experience a medium visual impact as the line passes above the freeway and crosses to follow I-580 toward Livermore.

I-580 in Alameda County would be visually affected, especially at the freeway median station sites, if the alignment alternative along I-680 and I-580 were used. Views from I-580 through the Altamont Pass would be minimally affected by the cuts to take the HST Alignment Alternative through the hills. This is shown in 3.9-19.

I-580 in San Joaquin County would be visually affected where the HST crosses the freeway. Details are noted in the text above.

San Francisco Bay Crossings Corridor

There are two Trans Bay Crossing alignment alternatives between Oakland and San Francisco and six alignment alternatives between Redwood City and western mouth of Niles Canyon in Fremont, crossing the bay at Dumbarton. The Trans Bay Crossing alternatives both begin in Oakland, connecting with the Oakland-San Jose corridor and proceeding in a tunnel under San Francisco Bay. One Transbay alternative terminates at the Transbay Transit Center in Downtown San Francisco. The other terminates at the Caltrain 4th and King station in the South of Market neighborhood. The six alignment alternatives between Redwood City and Fremont are divided into three Dumbarton alternatives and three Fremont Central Park alternatives. The six alternatives share the same horizontal alignment between the Caltrain corridor in Redwood City and the eastern edge of the bay in Newark. There are three vertical alignments considered for the Dumbarton and Fremont Central Park bay crossings: a high bridge, low bridge, and underwater tunnel. The Dumbarton alignment alternative crosses Newark and Fremont along the UPRR Centerville line. The Fremont Central Park alignment alternative follows a powerline corridor across Fremont.

Visual Impacts

The two Transbay alignment alternatives differ by their terminus in San Francisco. One begins at the Townsend Street station beneath Townsend Street between Fourth and Fifth Streets in San Francisco's South of Market district and runs beneath Townsend Street to the Bay. The second begins beneath the Transbay Transit Center and runs beneath Main Street to the Bay. Each alternative leaves San Francisco in the vicinity of Pier 38-40 and crosses the Bay in a tunnel. The alignment alternatives make landfall at the southwest corner of the former Alameda Naval Air Station. At this location, the line would split, with one alignment alternative turning north to cross beneath the estuary and Port of Oakland to meet the Oakland-San Jose line at the West Oakland station location option. A second alignment alternative would run northeast to pass beneath the estuary and cross the alternate Oakland-San Jose line perpendicularly at the West Oakland station location option. This line would connect to the 12th Street/City Center Oakland alignment alternative from the Oakland to San Jose corridor. All of the Transbay alignment alternatives would be underground.

Figure 3.9-20
Rail Corridor in Tracy

There would be ventilation shafts along the alignment alternative. These structures would be visible, but most would be a minor alteration to the visual landscape in which they are located.

The Dumbarton alignment alternative begins in Redwood City, where the route leaves the Caltrain line and turns east along the existing Dumbarton rail line at grade through the urban suburban landscape. East of Willow Road, the route would approach the San Francisco Bay. There are three options for the bay crossing at Dumbarton—a high bridge where the main span would provide complete clearance over the shipping channel, a low bridge with a moveable span at the shipping channel, and a bored tunnel under the bay. All would occupy generally the same horizontal alignment. All alignment alternatives would remove the existing railway trestle and drawbridge, built in 1910, and all would run through the Don Edwards San Francisco Bay National Wildlife Area.

The landscape of the Dumbarton crossing is one of low horizontal baylands and wetlands, traversed by power lines, the Dumbarton highway bridge (SR 84), and pipe trestles that carry the Hetch Hetchy aqueduct across the bay and the rail bridge. See Figure 3.9-21—Dumbarton Landscape. The high rail bridge alignment alternative would replace the existing low-level rail bridge with a bridge closer in appearance to the existing highway bridge, but longer and narrower. The added length of the high level alignment alternative would create a medium visual impact to the view from the existing highway when contrasted with the low, horizontal views of the wetlands, but it would create a complementary view when viewed from the wetlands, creating matching bridges and removing the low-level bridge and its contrasting form, resulting in an overall medium visual impact. This is illustrated in Figure 3.9-22—Dumbarton High Bridge.

The low-level bridge alignment alternative would result in a minimal visual impact because it would be low to the Bay like the existing rail bridge and aqueduct trestles but could be designed as a more horizontal structure to complement the landscape of the wetlands. It would also span a longer distance than the existing rail bridge, allowing the wetlands to flow beneath the railway. A visual simulation of the low bridge alignment alternative is shown in Figure 3.9-23—Dumbarton Low Trestle.

A tunnel beneath the Bay would have no visual impact because it would place the HST underground and out of sight, with the exception of venting structures. The existing rail bridge would be removed, along with the existing railway embankment. A visual simulation of the tunnel option is shown in Figure 3.9-24—Tunnel Crossing at Dumbarton.

Soon after leaving the baylands, the line would be elevated. The elevated structure would be between 26 ft (7.9 m) to 50 ft (15.2 m). This would introduce a new elevated lineal element into the immediate landscape. The structure would have a medium visual impact on residential areas along the corridor, including shadow impacts, especially where the structure ascends to its maximum height to cross above highway overcrossings of the existing railway. The alignment alternative would cross the UPRR Coast Line and then leave the rail right-of-way to avoid a series of very sharp curves. The route would run elevated though a neighborhood of single and multi-family homes, requiring the acquisition and removal of some homes. This would create a high visual impact because the new elevated rail structure would be in high contrast to the existing neighborhood form and character, both in its horizontal and vertical alignment. It would cross the existing street grid at an angle, breaking the repeating grid of homes in many places. It would create shadow impacts to the remaining residential uses and Civic Center Park. East of Civic Center Park, the line would remain elevated, but it would be within the right-of-way of the UPRR.

The elevated line would pass the Centerville Depot (1910), in use today for Amtrak and ACE trains. The elevated structure would make a high visual impact on the area and create shadow impacts on the depot and plaza.

Immediately east of the BART line, an HST station location option could be provided at Shinn Street to allow interchange between the HST and BART. The station would be an elevated four track station. The total height of the station, including the canopies over the HST platforms, would extend up to 65 ft (20 m) for more than 1,400 ft (400 m). This would result in a large structure that would be the most visually dominant feature in the surrounding urban suburban landscape, creating a high visual impact. Leaving the station, the line would leave the rail right-of-way and pass over a water feature (pond) in a former gravel pit. It would then cross a residential neighborhood, requiring the removal of some homes, before entering the foothills. The elevated line in the urban suburban residential landscape would create a high visual impact.

As the HST line enters the hills east of Fremont, the route would meet the alignment alternative through Fremont and the East Bay to Central Valley corridor.

The Fremont Central Park alignment alternatives would follow the same alignment as the Dumbarton alternatives from Redwood City to the east side of San Francisco Bay, with the same three options for the bay crossing and the same visual impacts. Once across the bay, the line would run to the south of the Dumbarton route. It would begin at the edge of the baylands and curve to the south across salt ponds. The introduction of the rail line to the open space of the salt ponds would create a medium visual impact. The horizontal landscape of the salt ponds is already crossed by a number of high tension power lines, and the addition of the catenary for the HST electrification would be a similar visual component to the landscape.

The line would then turn east and transition to an elevated structure to cross the UPRR Coast line and continue elevated across the industrial landscape of Newark. A station location option would be provided just east of Boyce Road. The elevated station would be up to 45 ft (13.7 m) tall and more than 1,400 ft (400 m) long. While this would be a large structure, it is not out of scale with the existing industrial landscape, having a low visual impact.

The route would continue along an industrial railway spur, cross over I-880, and follow a power line corridor through an urban suburban residential landscape. The elevated route would pass Blacow Park, creating shadow impacts. East of Blacow Park, the line would transition into an underground alignment, continuing beneath the power line right-of-way. After passing beneath Paseo Padre Parkway, the alignment alternative would pass to the east of Fremont Central Park along the existing UPRR line. Through this area, there would be low visual impact from the at-grade line. Here the alignment meets the Oakland-San Jose corridor and the East Bay to Central Valley corridor.

Historic Buildings, Neighborhoods, Landscapes

The Transbay alignment alternatives would pass beneath the South Beach Historic District in San Francisco. There are also historic buildings on the former Naval Air Station in Alameda, including the former hangers, which form a historic landscape. The Transbay alignment alternatives are underground, so they would have no impact on the historic district or buildings.

The Dumbarton and Fremont Central Park alignment alternatives would cross the Don Edwards San Francisco Bay National Wildlife Area, a nationally significant open space. Depending on the type of Bay crossing, the visual impact would vary. A high-level bridge would have an overall medium visual impact on the open space of the bay and wetlands. The high bridge form would complement the existing highway bridge. The extended length of the crossing, relative to the existing bridge, would extend the form of the high bridge across a greater part of the landscape. A low-level bridge would have a lesser impact because it could be designed to complement the horizontal landscape of the bay and wetlands to a greater degree than the existing steel truss railroad bridge. A tunnel would have no visual impact.

Figure 3.9-21
Dumbarton Landscape

Figure 3.9-22
Dumbarton High Bridge

Figure 3.9-23
Dumbarton Low Trestle

Figure 3.9-24
Tunnel Crossing at Dumbarton

The Dumbarton alignment alternatives would require an elevated alignment past the historic Centerville Depot in Fremont. The depot was built in 1910 and is the last remaining Southern Pacific "Number 23"-style depots in service as a train station, and one of only less than a dozen left in the state of California. An elevated HST line past the station would create a high visual impact and cause shadow impacts on the historic depot.

The community of Niles was home to the early film industry and the Essanay Film Manufacturing Company studios filmed many movies in the area. The Vallejo Mill Historical Park, at the northeast corner of Niles Canyon Road and Mission Boulevard, (SR 238) commemorates the flower mill (1856) of José de Jesús Vallejo, brother of General M. G. Vallejo, on his Rancho Arroyo de la Alameda. The elevated structure and cut and fills required to bring the Centerville alignment alternative into Niles Canyon would be visible from the mill, but the line would have a low visual impact on these historic sites because the landscape surrounding them has been altered significantly by development over the past 150 years.

Affected Views from State Scenic Highways

There are no state scenic highways, designated or eligible, in this corridor.

Central Valley Corridor

This corridor extends from Lodi, through Stockton and Merced, to near Madera. There are six HST alignment alternatives. Alignment alternatives include connections between the UPRR and BNSF right-of-ways that provide alternatives that use all or portions of each rail line.

Visual Impacts

The two existing rail lines in the Central Valley are the UPRR, which generally runs adjacent to SR 99 and through the center of many communities, and the BNSF, which runs to the east of most of the valley communities between Stockton and Fresno. The UPRR alignment was originally the Southern Pacific alignment, the first railway in the Central Valley. Construction of this railway lead to the development of towns that centered on the railway station. The BNSF came later, after the towns had developed. This results in a UPRR line today that runs through more urbanized areas, while the BNSF line is still in mostly agricultural areas.

Any alignment alternative would result in the construction of a new, two-track, fully grade separated high speed railway in or adjacent to an existing railway right-of-way. In many cases, grade separations would cross both the high speed line and the existing (or relocated) freight railway. Except at stations and where soundwalls are erected, these new grade separations would be the main visual impact of the HST in this corridor.

Adding a two-track high-speed railway to the UPRR N/S alignment alternative would require fewer new grade separations because there are many existing grade separations along the line, especially where it runs adjacent to SR 99. The new separations would be mainly in the center of communities. Use of this rail line would likely require more soundwalls because it runs in a generally more developed corridor. Visual impacts from potential station location options in Stockton, Modesto, Merced, and Fresno would be generally the same as those of the BNSF line because both share many of the same station options.

The BNSF alignment alternative is more rural in nature. More new grade separations would be required, but they would be in open landscapes and likely not as complex as the separations required along the UPRR N/S alignment alternative. There would also likely be fewer soundwalls required.

The UPRR N/S, UPRR-BNSF Castle, and UPRR-BNSF alignment alternatives begin near the town of French Camp, just south of Stockton, where the line would rise to cross a rail yard. Past the rail yard, an alternative connection to the BNSF diverges. The BNSF connection alignment would turn to the east on a new alignment, crossing agricultural landscapes before meeting the existing BNSF line near Five Corners. This alignment alternative would cross above SR 99 on an elevated structure, creating a medium visual impact from the highway.

The remaining UPRR alignment alternatives would follow the existing railway through the city of Manteca, through agricultural, urban suburban, and traditional small urban community landscapes. The line would be elevated as it passes through central Manteca, creating a low visual impact because the structure would only be visible from cross streets and would not be much taller than the existing buildings in the area.

Leaving Manteca, the line would run parallel to both the UPRR railway and SR 99. Many roadways are already grade-separated from both the highway and UPRR. The introduction of the HST railway would have no visual impact because there already are the twin lineal elements of the highway and railway. This condition exists for most of the UPRR N/S alignment alternative between Manteca and Fresno. The deviation occurs where the highway leaves the railway to bypass the downtown districts of the valley cities. A typical view of the UPRR alongside SR 99 is shown in Figure 3.9-25.

In Modesto, SR 99 bypasses the downtown area. The UPRR N/S alignment alternative would remain at grade with the UPRR through Modesto, with crossing streets grade separated or closed. The Modesto station location option would be at grade, with sidings to serve the station platforms. The platforms would be accessed by an underground walkway, keeping the station profile low, resulting in no visual impact. South of the station location option, the alignment alternative would cross the Tuolumne River. There are two possible segments, eastern and western, through Modesto. The eastern segment crosses slightly upstream of the existing UPRR crossing. The western segment crosses slightly downstream through residential and industrial landscapes. The eastern segment is mainly in an industrial landscape. Either would require the removal of existing buildings, resulting in a low visual impact because the area is dominated by the existing railway and freeway.

The UPRR N/S alignment alternative rejoins SR 99 as it heads to Turlock. The alignment leaves the freeway to pass through Turlock. An elevated structure would take the HST through downtown Turlock, with a low visual impact on the existing community.

A potential at-grade station location option in Merced is planned at the location of the now vacant Southern Pacific depot. To accommodate both conventional rail and HST, the station and platforms would need to be expanded. This would require the acquisition of adjacent property for both the station facilities and the expanded trackway serving the station. The station would consist of two tracks and a single platform for conventional rail and four tracks and two platforms for HST, all connected by an elevated pedestrian crossing. Because the station is at grade, the visual impact would be low.

South of Merced, the line would continue alongside the UPRR and SR 99. An optional alignment alternative would curve to the east along McHenry Road to connect to the BNSF alignment alternative. New grade separations would be required to cross the railways and freeway in this area because SR 99 is an expressway in this area, with at grade intersections.

At the Chowchilla River, a possible connection to the Henry Miller (UPRR Connection) alignment alternative curves off to the west. Through the town of Chowchilla, the HST would ascend to an elevated structure. This would have a low visual impact on the surrounding landscape.

South of Chowchilla, a possible connection from the Henry Miller (UPRR Connection) alignment alternative would join the UPRR N/S alignment alternative. The alignment alternative would remain at grade alongside SR 99 and the UPRR all the way to Fresno.

Figure 3.9-25
UPRR along SR 99

The BNSF-UPRR, BNSF Castle, and BNSF alignment alternatives begin east of Lodi along Furry Road in an agricultural landscape. The BNSF alignment alternative continues along the existing BNSF railway. The HST would remain at grade alongside the BNSF railway through an agricultural landscape, rising on an elevated structure to pass through Escalon, with a low visual impact. South of Escalon, the HST would deviate to the west of the BNSF railway to ease a curve north of the Stanislaus River. It would then elevate to pass through the community of Riverbank, again with a low visual impact.

On the east side of Modesto, a potential HST station location option would be constructed at grade at Briggsmore Avenue. This would have low visual impact on the surrounding rural agricultural landscape to the east of the tracks and the urban suburban landscape to the west.

The BNSF alignment alternative remains at grade through the communities of Houghston and Denair, with no visual impact. The line would remain at grade with the BNSF railway until it deviates to the west to ease a curve near the Merced River.

The rural agricultural and residential urban suburban landscape between Atwater and Merced is crossed with a number of alignment alternatives. The BNSF and UPRR-BNSF alignment alternatives would follow the existing BNSF right of way through Atwater at grade and then curve to the west as it passes North Buhach Road to join the UPRR to pass through Merced. This connection from the BNSF to the UPRR would be a new alignment, passing at angles across an established rural agricultural landscape, creating a medium visual impact. Another alignment alternative for the HST through Merced, BNSF Castle, would continue to follow the BNSF railway at grade through Merced.

The UPRR N/S alignment alternative through Merced would be at grade, with a combined HST and conventional rail station location option at the site of the former Southern Pacific station. While some properties would need to be acquired to accommodate the expanded station, the visual impact would be low because the station would be at grade.

South of Merced, the BNSF alignment alternative would leave the UPRR N/S alignment alternative and curve east along McHenry Road to rejoin the BNSF railway just north of Le Grand. This alignment alternative would have no visual impact because it crosses a primarily agricultural landscape. The alignment alternative that keeps the HST on the BNSF line through Merced would require a curve to be eased as the line passes out of Merced along SR 140. This would require the acquisition and removal of some buildings, creating a low visual impact.

After passing the community of Le Grand, the HST alignment alternative would deviate from the BNSF alignment to the west to ease a curve north of the Chowchilla River. After passing the river, an alignment alternative to the Henry Miller (BNSF Connection) alignment alternative would curve to the west. The alignment alternative would end near Berenda Creek, where it would be met by the Henry Miller (UPRR Connection) alignment alternative.

Historic Buildings, Neighborhoods, Landscapes

There are few historic sites along the corridor. The UPRR alignment passes through the center of most of the towns and cities between Stockton and Fresno, many of which still exhibit the traditional small urban landscape of valley towns. Additionally, many of the railway stations along the corridor are historic in nature or replicas of original stations. Most of the HST would be at grade, adjacent to an existing railway, so the visual impacts would be low.

Affected Views from State Scenic Highways

There are no state scenic highways, designated or eligible, in the Central Valley corridor.

Short-Term Construction Impacts

Construction of the HST system would have short-term impacts on visual resources that vary with the type of alignment (at-grade, elevated, tunnel, etc.) selected. The construction process is similar to that of roadway construction. The following descriptions are not meant to exhaustively detail the HST construction process but rather discuss the major components of construction and their impact on the visual quality of the surrounding landscape during construction.

For all construction, the alignment is surveyed. For areas of cut and fill construction, the alignment is fenced, and heavy equipment excavates/fills soil to the grade of the future rail line while the drainage, swales, and culverts are constructed. The earthworks are compacted and allowed to settle in areas of fill. Slopes are seeded to prevent erosion. The visual impact of this type of construction is greatest when excavation/fill activities take place; the fresh soil contrasts with the surrounding landscape. The level of overall activity from the construction equipment is greater than rail operations. Activity during construction is not limited to the trackway area; it is spread across the entire right-of-way. As the cut and fill earthworks are completed, the area would be planted with appropriate native flora. As time passes, it is assumed that the landscape outside the immediate HST trackway would revegetate to visually blend with the surrounding landscape.

At-grade construction would commence where there is already a level path for the HST or along areas where the path for the HST was created through cuts and fills, as described above. If building on level ground, the existing topsoil and any vegetation is removed. Utilities are relocated and drainage is constructed. Soil is brought to the site, deposited along the line, and carefully compacted. The trackway is built by depositing layers of crushed stone (sub ballast) covered by a geo-textile fleece, which is covered with gravel and topped with a layer of asphalt. This portion of the construction is very similar to highway construction, with similar construction methods.

There are two potential types of rail systems that can be used for HSTs. One is the familiar concrete crosstie to hold the rails, the other is embedded slab track, a continuous concrete base to which the rails are attached. Each is constructed using a highly mechanized system.

Additional trackway construction includes the installation of cable ducts, catenary pole foundations and the poles atop them, installation of the catenary wires and fencing, soundwalls, and crash barriers where the HST runs in a constrained right-of-way near other rail systems or highways. The final step would be to plant the areas outside the trackway with appropriate native plants and grasses, or ornamental landscaping in urbanized areas.

The HST trackway must be separated from roadway crossings, highways, and freight railway lines. Grade separations, overpasses and underpasses, and short sections of tunnel would need to be constructed. The short-term visual impacts from these activities would include increased truck traffic on local streets and the presence of construction machinery in the immediate area of the separations. Temporary detours of streets and adjacent rail lines (rail detours are known as shooflies) have the potential for high visual impacts, especially if the existing rail line must be placed on a shoofly that runs outside a constrained right-of-way.

In areas where the HST would be on an elevated alignment, the construction requires placing piles and excavating foundations for the support columns, erecting formwork for the columns that would support the structure, delivering concrete to the site by truck, and constructing the elevated spans, either by lifting prefabricated concrete or steel spans into place with cranes, or building falsework to cast concrete spans in place. Either method requires large construction machinery, which would be a high visual impact in most locations during the span of construction. Once the elevated structure is complete, the trackway would be constructed upon it.

Retained fill sections would require the removal of the existing topsoil and vegetation in the immediate construction area. Additional excavation below the existing grade could be necessary in areas with poor soil conditions. This initial phase of construction would resemble the at-grade construction. To support the retaining walls, pile-supported concrete foundation beams would be built along the line of the wall. Pre-cast interlocking panels would be placed atop the beam, and soil would be deposited behind the walls and compacted. This would require constant operation of compacting vehicles. As the walls rise, so would the soil behind them. Truck traffic would be increased in the project area as the soil and other materials are brought to the site. The visual impact of the truck traffic would vary, from low to high, depending on the general traffic conditions in the area. In areas of low traffic, the short-term construction traffic would be a medium visual impact. In busier areas, the construction traffic would blend in with the existing traffic, with a low visual impact.

Once the retained fill and walls reach the final height, the remaining construction activities associated with trackway construction would take place atop the completed retained fill section. A final activity would be to landscape the area on and at the base of the walls.

Construction of retained cut sections would begin with the removal of vegetation in the project area and the erection of safety fencing around the project perimeter. Underground utilities in the area would be relocated. Steel sheet piles would be driven down each side of the excavation area to shore up the adjacent soils. This would be done with tall pile-driving machinery, and would be a high visual impact during the construction period. Detours would take roadways around the construction of permanent bridges to carry traffic over the completed cut section. Heavy machinery would excavate the area and trucks would haul the excavated soil away from the site. As the cut deepens, the activity would fall from the view of adjacent properties, but the truck traffic leaving the site would create a visual impact, especially in areas where truck traffic is normally low. As the cut is completed, the walls would be finished in concrete and the trackway at the bottom of the cut would be finished as discussed above. Final steps would be to return the detoured roadways to the new overcrossings, build permanent fencing along the cut, and establish landscaping where appropriate. As noted previously, the level of visual impact from the construction traffic would vary with the level of other traffic in the project area.

Cut and cover tunnels would be constructed much like the open cut described above, but the entire cut would be bridged over when complete. Soil would be deposited atop the roof of the cut and streets would be rebuilt at grade. To minimize costs, it is desirable to store the excavated soil that would be re-used on site somewhere near the site. Depending on conditions that would affect the volume of soil to be stored, this temporary stockpile could create a medium to high visual impact, the level of which would depend on the adjacent uses and the amount of material stored. When the tunnel was backfilled with soil, the remaining surfaces would be landscaped.

As is the case with long-term visual impacts, the short-term visual impacts of bored tunnel construction would be constrained to the tunnel portals and any possible vent shafts. Depending on tunnel length, the short term visual impacts can be high. Support facilities for tunneling include concrete plants, soil transfer stations (to take soil excavated from the tunnel and load it onto vehicles to take it off-site for disposal), and construction offices. Tunnel vent shaft locations are less intrusive, yet the short term visual impact from construction is far greater than the long term. Once the tunnel is complete, the area at the portal can be returned to its previous state, eliminating the visual impacts from the construction period.

For all above-grade construction activities and cut and cover tunnels, staging areas with construction materials, signage, and night lighting would be visible from adjacent properties and roadways during the construction period. For tunneled sections, the construction activity would be limited to portal and potential vent shaft locations. Additional systemwide construction activity includes a central location for rail and ballast deliveries. These impacts can vary from low to high, depending on the surrounding land uses. Sites in industrial landscapes would experience a low visual impact from staging areas. Rural locations would most likely experience high visual impacts from staging activities.

3.9.4 Photo Simulations of Alternatives in Selected Scenic Areas

The photo simulations referenced above illustrate what the HST Alignment Alternatives or station location options may look like in typical landscapes, using existing conditions as the baseline. These simulations do not include potential changes to the existing landscapes that could occur between the time of this analysis and the year 2020 from other projects and urban development. These simulations are meant to illustrate how the existing dominant landscape features would be potentially changed with the implementation of the proposed alternatives.

3.9.5 Design Practices

It would be speculative to address specific aesthetic treatments at the conceptual level of design of this program-level study. However, the Authority is committed to working with local agencies and communities during subsequent project-level environmental review to develop systemwide design elements that draw from the best practices worldwide and work at the project-level of design and analysis to develop context-sensitive aesthetic designs and treatments for HST infrastructure (overcrossings, bridges, tunnel portals, soundwalls, walls and fencing, stations, support facilities, etc.).

Specific, systemwide elements include fencing, noise barriers, power substations, catenary system, rails, and roadbed. The visual impact of the railway as it passes through the landscape is discussed previously in this document. The systemwide elements that are present along the railway contribute to the overall visual impact, but they are secondary to the visual impact of the railway's alignment at most times.

The rails and roadbed are placed at grade or on the structure that makes up the trackway. Because the rails and roadbed are low in profile, their visual impact is almost none. The catenary system, which consists of the poles, cables, and wires that provide the electrical power to the railway, extends for up to 25 ft (8 m) above the trackway. The dominant component of the catenary is the poles that support the cables. The composition of the poles would determine their overall visual impact. Both steel and concrete poles are common. The steel poles can be solid or a steel lattice. They may be galvanized or painted. Concrete poles are typically round and a gray concrete color. Their primary visual impact is low, much like the powerpoles along a highway.

The entire HST would be fenced. The typical fence would be an 8 ft (2.5 m) chain-link fence. The fence would run along the edge of the right-of-way, which would usually place it 2 to 3 ft (0.7 to 1 m) below the level of the tracks. From a distance, the visual impact of the fence would be less than the catenary. Where the railway would run through populated areas, enhanced fencing may be used, including vinyl-coated chain-link fencing or decorative iron fencing. Specific decisions regarding fencing types would be made later in the design process.

Sound barriers would be built along the railway where the noise of the railway needs to be mitigated, due to the land uses along the line. Typical sound barriers are built from masonry or pre-cast concrete and are approximately 8 ft to 12 ft (2.5 to 3.8 m) tall, although other materials and heights are used, including low walls designed to conceal wheel noise and barriers made of prefabricated metal or wooden panels. Typically, the walls run close to the trackway, not at the edge of the right-of-way. The sound barriers would mask most of the HST from outside the right-of-way, becoming the dominant visual feature of the railway from a close vantage point. As with highway soundwalls, landscaping, or berming, the walls can reduce their visual impact.

Electrical substations to distribute power from the commercial power grid to the railway would be necessary about every 15 to 30 mi (24 to 48 km). The substations would be approximately 15,000 sq ft (1,560 m^2). The installation would be surrounded by fencing or noise barriers, depending on location, and would have the same visual impacts as the line fencing/sound barriers noted above.

3.9.6 CEQA Significance Conclusions and Mitigation Strategies

Based on the analysis above and summarized in Table 3.9.1, each of the alignment alternatives would have potentially significant impacts on aesthetics from the introduction of the HST system into the visual landscape in the study area. The station location options that would, at a programmatic level, present potentially significant impacts on aesthetics include Pleasanton (I-680/Bernal Road), Pleasanton (BART), Livermore (I-580), Livermore (I-580 Greenville Road), Tracy (Downtown), Tracy (ACE), Union City (Shinn), and San Jose (Diridon). The HST Alignment Alternatives and station location options would also create construction-related short-term visual changes that are not considered significant at the programmatic level.

Mitigation strategies, as well as the design practices discussed in Section 3.9.5, can be refined and applied at the project level to reduce these impacts. Refinement of mitigation strategies would take place in consultation with the appropriate local and regional agencies and with the public. Mitigation measures would be implemented as feasible. These strategies include:

- At the project level, design proposed facilities that are attractive in their own right and that would integrate well into landscape contexts so as to reduce potential view blockage, contrast with existing landscape settings, light and shadow effects, and other potential visual impacts.
- Design bridges and elevated guideways with graceful lines and minimal apparent bulk and shading effects.
- Design elevated guideways, stations, and parking structures with sensitivity to the context, using exterior materials, colors, textures, and design details that are compatible with patterns in the surrounding natural and built environment and that minimize the contrast of the structures with their surroundings.
- Use neutral colors and dulled finishes that minimize reflectivity for catenary support structures, and design them to fit the context of the specific locale.
- Use aesthetically appropriate fencing along rights-of-way, including decorative fencing, where appropriate, and use dark and non-reflective colors for fencing to reduce visual contrast.
- Where at-grade or depressed route segments pass through or along the edge of residential areas or heavily traveled roadways, install landscape treatments along the edge of the right-of-way to provide partial screening and to visually integrate the right-of-way into the residential context.
- Use the minimum amount of night lighting consistent with that necessary for operations and safety.
- Use shielded and hooded outdoor lighting directed to the area where the lighting is required, and use sensors and timers for lights not required to be on all of the time.
- Design stations to minimize potential shadow impacts on adjacent pedestrian areas, parks, and residential areas, and site all structures in a way that minimizes shadow effects on sensitive portions of the surrounding area.
- Seed and plant areas outside the operating rail trackbed that are disturbed by cut, fill, or grading to blend with surrounding vegetated areas where the land will support plants. Use native vegetation in appropriate locations and densities.
- Use strategic plantings of fast-growing trees to provide partial or full screening of elevated guideways where they are close to residential areas, parks, and public open spaces.

- Where elevated guideways are located down the median strips or along the edge of freeways or major roadways, use appropriate landscaping of the area under the guideway to provide a high level of visual interest. Landscaping in these areas should use attractive shrubs and groundcovers, and emphasize the use of low-growing species to minimize any additional shadow effects or blockage of views.
- Plan hours of construction operations and locate staging sites to minimize impacts to adjacent residents and businesses.
- Screen construction sites, as appropriate, to minimize visual construction impacts.

While the mitigation strategies described above would substantially lessen impacts to aesthetics and visual resources, it is uncertain at this program level that these impacts can be mitigated to a less-than-significant level for each of the alternative alignments or station location options. This is of greatest concern in areas where changes in scenic open space and mountain crossing areas are anticipated. As part of site-specific designs, many of the impacts on aesthetics and visual resources can be avoided or substantially mitigated. However, because of the size of the project and the variety of types of terrain it affects in the study area, there is insufficient evidence to make that determination at this stage of design. Therefore, for purposes of this Program EIR/EIS, this impact is considered significant and unavoidable. Additional environmental assessment would allow a more precise evaluation in the second tier project-level environmental analyses.

3.9.7 Subsequent Analysis

Specific analyses that would be appropriate for project-level environmental evaluation are discussed below.

- Detailed analyses should be performed, particularly in areas with elevated structures, to identify potential visual intrusions into residential and park and open space areas. These analyses should focus on identifying the potential for blockage of valued views; the areas where shadows would be cast on residential and open space lands; and the areas where the scale, form, line, and color of project facilities would substantially alter the existing character and quality of the setting. In addition to producing a detailed inventory of site-specific impacts, this analysis would serve as the basis for identifying areas where project siting adjustments, design modifications, landscaping, and other mitigation measures may be incorporated to reduce potentially considerable impacts to a low level.
- Review of local urban design plans and policies should be conducted to take into account local design objectives. The analyses would provide a basis for considering specific design measures that would modify the impacts of the project in ways that would make the project design more consistent with local urban design goals.
- An analysis should focus on the portions of alignment that would be located adjacent to and down the median strip of freeways.
- For each of the proposed station location options, further analyses should be conducted in consultation with local agencies to develop an understanding of the relationship of the proposed station architecture, parking lots, lighting systems, and other features to the surrounding natural and built setting and surrounding historic context. The analyses should identify the potential for blockage of valued views; the areas where shadows would be cast; and the areas where the scale, form, line, and color of project facilities could be designed to blend with the surrounding landscape. The analyses would be used to provide a basis for considering specific measures that could be integrated into the final station designs to reduce the visual impacts of the stations on their surroundings.

3.10 Public Utilities

This section describes certain representative public utilities in study area and identifies the potential for impacts on utility systems for the various HST Alignment Alternatives[1]. The public utilities evaluated in this section are electrical transmission lines, natural gas facilities, and wastewater treatment facilities. A *potential utility impact* is any potential conflict between an alignment alternative or station location option and a utility, including crossings, regardless of depth or height.

3.10.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

U.S. Environmental Protection Agency

Under the CWA, the EPA was granted authority to implement pollution control programs, such as setting wastewater standards for industry. The CWA established the basic structure for regulating discharges of pollutants into the waters of the United States; in addition, it contains requirements to set water quality standards for all contaminants in surface waters. The CWA created the National Pollution Discharge Elimination System (NPDES) permit program to regulate the discharge of any pollutant from a point source into navigable waters by requiring those point sources to obtain a permit if their discharges go directly to surface waters.

Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation

The Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, is responsible for carrying out the duties regarding pipeline safety set forth in 49 U.S.C. § 60101 *et seq.* and 49 C.F.R. § 190.1. The regulations apply to the owners and operators of the facilities and cover the design, installation, inspection, emergency plans and procedures, testing, construction, extension, operation, replacement, and maintenance of pipeline facilities transporting oil, gas, and hazardous liquid. The regulations require operators of gas pipelines to participate in a public safety program, such as a one-call system that would notify the operator of any proposed demolition, excavation, tunneling, or construction that would take place near or affect the facility.

California State Water Resources Control Board

The California State Water Resources Control Board (State Water Board) and the nine California Regional Water Quality Control Boards (RWQCBs) are responsible for developing and enforcing water quality objectives and implementation plans that best protect the beneficial uses of the state's waters. Both the state and regional agencies regulate wastewater through the issuance of wastewater discharge standards that are implemented through NPDES permits and waste discharge requirements issued by the RWQCBs.

California Public Utilities Commission

The California Public Utilities Commission (CPUC) regulates the provision of privately owned utilities in California. These utilities include privately owned telecommunications, electric, natural gas, water, railroad, rail transit, and passenger transportation companies. The CPUC is responsible for ensuring that California utility customers have safe, reliable utility services at reasonable rates; protecting utility customers from fraud; and promoting the health of California's economy. The CPUC does not issue permits for proposed projects that would cross utility lines. The CPUC does, however, regulate at-grade rail crossings.

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

Office of the State Fire Marshall

The Office of the State Fire Marshall, Pipeline Safety Division, regulates the safety of approximately 5,500 mi (8,851 km) of intrastate hazardous liquid (e.g., oil, gas) transportation pipelines and acts as an agent of the Federal Office of Pipeline Safety concerning the inspection of more than 2,000 mi (3,219 km) of interstate pipelines. Pipeline safety staff inspect, test, and investigate to ensure compliance with federal and state pipeline safety laws and regulations. Spills, ruptures, fires, and similar incidents are responded to immediately; all such accidents are investigated for cause.

B. METHOD OF EVALUATION OF IMPACTS

The following methods were used to gather information for each area or subarea within the broadly defined study area.

- Review of the project's GIS to identify cities and counties in the study area.
- Review of the general plans for potentially affected communities in each subregion of the corridor in which proposed alternatives are being studied, as well as maps from the Thomas Bros. *California Atlas* and from the California State Automobile Association.
- Review of project alignments/proposed improvements against GIS information of electrical transmission lines and gas and oil pipelines compiled using MapSearch.
- Exploration of Web sites of the GIS-identified cities and counties in the study area to gather appropriate setting information.
- Examination of applicable utility system maps and Web sites to gain a better understanding of facility distribution.
- Contact with public utility providers via mail to obtain or confirm the locations of their current and planned services and facilities in the study area.

Public utilities generally include a range of services, such as water, power, sewage, and communications systems. For the purposes of this analysis, three of the most common major facilities that may pose construction challenges were identified to best represent potential utility impacts. These facilities not only provide critical services, but they also are likely to create a hazard if damaged during construction operations.

- Electrical facilities are defined as major transmission lines and substations that meet or exceed a power rating of 230 kV.
- Natural gas facilities are defined as high-pressure gas pipelines and facilities of various sizes.
- Wastewater treatment facilities are defined as wastewater pipelines with a minimum 36-in (91-centimeter [cm]) diameter and any treatment facilities located in the project corridor.

The methods used to assess potential conflicts (any crossing or longitudinal encroachment of an existing utility by a portion of the HST system) included overlaying the available utility maps with the alignment alternatives and identifying facilities within 100 ft (30 m) of the centerline of the proposed alignment alternatives. The tally of representative utility conflicts generally indicates degree of difficulty in construction or level of expense related to avoiding or relocating utilities. Because public utilities are prevalent throughout the study area, it was not practical to assess each potential conflict. Rather, the relative impact for purposes of comparing the alignment alternatives was determined by quantifying the number and type of potential conflicts for each alternative. In addition, a qualitative ranking of high, medium, or low was assigned to describe the potential severity of the conflict, as described below and summarized in Table 3.10-1. Low- and medium-ranking conflicts would be considered less than significant in nature, and those conflicts ranked high would be considered significant.

Electric transmission lines, telecommunications lines, natural gas pipelines, and wastewater pipelines likely would be affected little by an HST Alignment Alternative because, with relatively minimal disruption or construction impacts, they could be avoided, minimized, or mitigated by routing either the public utility or the transportation improvement around, over, or under the facility. Where unavoidable, relocations of the utilities would not pose adverse environmental risks, based on current construction practices. However, they do represent additional project-related costs.

Fixed facilities, such as electrical substations or power stations and wastewater treatment plants, would be more likely to be affected by an HST Alignment Alternative because they could require more considerable engineering, design, and construction to avoid, minimize, or mitigate potential conflicts. These types of fixed facilities have more significant constraints regarding any potential conflict, such as routing the transportation improvement around, over, or under the facility or relocating the fixed facility to another location.

Table 3.10-1
Rankings for Potential Public Utilities Impacts/Conflicts

	Electrical Facilities	Natural Gas Lines	Waste Treatment Facilities
Low	No 230-kV or greater facility within study area	1 to 15 total gas lines within study area	No wastewater pipelines of 36-in (91-cm) diameter or greater or treatment facilities within study area
Medium	N/A	16 to 30 total gas lines within study area	N/A
High	One or more 230-kV substation, power station, or greater facility within study area	31 or more total gas lines within study area	Wastewater pipelines of 36-in (91-cm) diameter or greater or treatment facilities within study area

N/A = not available. There is no medium rating for this category; impacts are either low (no facilities in the alignment alternative) or high (one facility or more in the alignment alternative).

The analysis indicated that, with regard to potential conflicts with utilities, there are differences among the HST Alignment Alternatives. The greatest number of potential conflicts can be found in the East Bay to Central Valley corridor. A high-impact level of severity also can occur in the alignment alternatives of the Oakland to San Jose, San Jose to Central Valley, and Central Valley corridors. The alignment alternatives in both the San Francisco Bay Crossings corridor and San Francisco to San Jose Alignment corridor are considered to have a low-impact level of severity because of the lower number of potential conflicts. Although there are differences among the alternative alignments, the overall assessment of impacts on utility systems is considered similar for all alternative alignments because utilities generally do not present significant potential impacts that cannot be avoided, minimized, or mitigated through conventional design and construction processes. For instance, most potential conflicts typically would be identified during the design or construction stage of a project, and standard measures would be taken to minimize costs and disruption of service.

C. CEQA SIGNIFICANCE CRITERIA

For purposes of this discussion, an HST Alignment Alternative would be considered to result in a significant effect on utilities and service systems if it would result in a high-impact conflict. A high-impact conflict would occur where an alignment alternative would cross or conflict with a fixed facility such as an electrical substation or wastewater treatment plant. Low-impact conflicts would occur if an alignment alternative would cross or conflict with pipelines or transmission lines, which are easier to avoid or relocate. Low-impact conflicts are considered less-than-significant impacts on utilities and service systems.

According to the State CEQA Guidelines Appendix G, a project would also have a significant impact on utilities and service systems if it would:

- Exceed wastewater treatment requirements of the applicable RWQCB.
- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.
- Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.
- Need new or expanded entitlements to supply water to the project.
- Result in a determination by the wastewater treatment provider that serves or may serve the project that it does not have adequate capacity to serve the project's projected demand in addition to its existing commitments.
- Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs.
- Not comply with federal, state, and local statutes and regulations related to solid waste.

These Appendix G significance criteria address the issue of utilities' capacity. These criteria have been used to evaluate impacts of the HST Alignment Alternatives in the areas of energy, land use and planning, hazardous materials and wastes, and hydrology and water resources. The discussion of these areas can be found in Sections 3.5, 3.7, 3.11, and 3.14. Potential indirect effects associated with growth accompanying the implementation of an HST system alternative are addressed in Chapter 7.

3.10.2 Affected Environment

A. STUDY AREA DEFINED

The study area for public utilities is the area within 100 ft (30 m) of the centerline of each alignment, and 100 ft (30 m) around stations. The study area is located generally within developed and urbanized areas throughout the Bay Area and Central Valley. These areas typically include various underground, at-grade, and elevated utilities that provide water, power, natural gas, communications, and sewage service for residential, business, and manufacturing uses and for agricultural practices. The following section provides additional information on utility resources.

B. PUBLIC UTILITIES BY PROVIDERS AND RESOURCES

The key service providers of the representative utility services in the study area are summarized below. A complete description of these providers and resources is provided in Appendix 3.10-A.

- Electrical facilities—Providers include PG&E, Silicon Valley Power, and City of Palo Alto Utilities (CPAU). There are two power-generating facilities in the region (Santa Clara power plant and Gilroy Cogeneration Plant LP).
- Natural gas facilities—Provided by PG&E except in the city of Palo Alto. In Palo Alto, CPAU gas is purchased from commodity suppliers and transported via PG&E's system to CPAU's distribution system.

- Wastewater treatment and water—Wastewater treatment services are provided by cities, counties, and special agencies along alignments in the study area. Water and reclaimed water pipelines are owned and operated by numerous jurisdictions throughout the study area with more lines found in the more urbanized areas.

3.10.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

The existing conditions assume the continued operation of the transportation and public utilities infrastructure described above. The No Project Alternative assumes that, in addition to existing conditions, other transportation and utility improvements would be developed and operational by 2030. The transportation improvements include projects that are programmed or funded to 2030 (as described in Chapter 2).

It was not possible as part of this study to identify or quantify the utility improvements expected to occur by 2030. Rather, it is assumed that utility development would occur to meet projected demand and growth characteristics near proposed HST Alignment Alternatives and station location options. For existing transportation facilities, conflicts with electrical transmission lines, natural gas pipelines, oil pipelines, wastewater and water utilities, and other utilities have been addressed previously, and few additional or increased impacts are expected from the future transportation improvement included in the No Project Alternative. In addition, it is assumed that measures would be taken to avoid these potential conflicts to the extent feasible and practical and to greatly limit any potential additional costs or disruption of service. It is common practice to coordinate on site with utility representatives during construction in the vicinity of critical infrastructure, such as high-voltage overhead/underground transmission lines, high-pressure gas pipelines, and aqueduct canals. Also, future transportation or utility improvements would be expected to be analyzed in a project-level environmental document, which would incorporate feasible measures to mitigate potentially significant adverse environmental impacts.

Based on the above assumptions, the existing conditions of the No Project Alternative are used to provide the baseline for analysis of potential conflicts with utilities.

B. HIGH-SPEED TRAIN SYSTEM ALIGNMENT ALTERNATIVES

Existing conditions from the No Project Alternative provide the baseline condition. Improvements associated with the proposed HST Alignment Alternatives and station location options would result in potential impacts in addition to those resulting from the No Project Alternative. For the purposes of this analysis, the existing conditions are treated as representative of the No Project Alternative, and the analysis summarizes the relative differences between the existing conditions and HST Alignment Alternatives. Table 3.10-2 shows the number of potential utility conflicts for the alignment alternatives, by corridor, of the proposed HST routes.

Table 3.10-2. Public Utilities Summary Data Table for Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Number of Electrical Transmission Lines	Number of Electrical Substations or Power Stations	Number of Natural Gas Pipelines
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	0	0	22
	1 of 1	Dumbarton to San Jose	0	0	8
Station Location Options					
Transbay Transit Center			0	0	0
4th and King (Caltrain)			0	0	0
Millbrae/SFO			0	0	0
Redwood City (Caltrain)			0	0	0
Palo Alto (Caltrain)			0	0	0
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	0	0	12
		12th Street/City Center to Niles Junction	0	0	13
	1 of 2	Niles Junction to San Jose via Trimble	0	0	14
		Niles Junction to San Jose via I-880	0	1	11
Station Location Options					
West Oakland/7th Street			0	0	0
12th Street/City Center			0	0	0
Coliseum/Airport			0	0	0
Union City (BART)			0	0	0
Fremont (Warm Springs)			0	0	0
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	2	0	14
	1 of 3	Henry Miller (UPRR Connection)	1	0	8
		Henry Miller (BNSF Connection)	2	0	6
		GEA North	1	0	14

Corridor	Possible Alignments	Alignment Alternative	Number of Electrical Transmission Lines	Number of Electrical Substations or Power Stations	Number of Natural Gas Pipelines
Station Location Options					
San Jose (Diridon)			0	0	0
Morgan Hill (Caltrain)			0	0	0
Gilroy (Caltrain)			0	0	0
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	1	1	6
		I-580/ UPRR	1	1	7
		Patterson Pass/UPRR	1	0	6
		UPRR	1	0	6
	1 of 4	Tracy Downtown (BNSF Connection)	1	0	13
		Tracy ACE Station (BNSF Connection)	1	1	12
		Tracy ACE Station (UPRR Connection)	1	1	12
		Tracy Downtown (UPRR Connection)	1	0	15
	2 of 2	East Bay Connections	0	0	0
Station Location Options					
Pleasanton (I-680/Bernal Rd)			0	0	0
Pleasanton (BART)			0	0	0
Livermore (Downtown)			0	0	0
Livermore (I-580)			0	0	0
Livermore (Greenville Road/UPRR)			0	0	0
Livermore (Greenville Road/I-580)			0	0	0
Tracy (Downtown)			0	0	0
Tracy (ACE)			0	0	0

Corridor	Possible Alignments	Alignment Alternative	Number of Electrical Transmission Lines	Number of Electrical Substations or Power Stations	Number of Natural Gas Pipelines
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing—Transbay Transit Center	0	0	1
		Trans Bay Crossing—4th & King	0	0	3
	1 of 6	Dumbarton (High Bridge)	0	0	1
		Dumbarton (Low Bridge)	0	0	1
		Dumbarton (Tube)	0	0	1
		Fremont Central Park (High Bridge)	0	0	5
		Fremont Central Park (Low Bridge)	0	0	5
		Fremont Central Park (Tube)	0	0	5
Station Location Options					
Union City (Shinn)			0	0	0
Central Valley	1 of 6	BNSF—UPRR	0	1	7
		BNSF	2	1	7
		UPRR N/S	0	1	23
		BNSF Castle	3	1	7
		UPRR—BNSF Castle	3	1	18
		UPRR—BNSF	0	1	18
Station Location Options					
Modesto (Downtown)			0	0	0
Briggsmore (Amtrak)			0	0	0
Merced (Downtown)			0	0	0
Castle AFB			0	0	0

The key findings of the utilities analysis by corridor and alignment alternative are summarized below. For a complete summary of all utility conflicts by segment see Appendix 3.10-B.

San Francisco to San Jose

- No conflicts with electrical transmission lines or electrical substations or power stations.

- Thirty potential conflicts with natural gas pipelines along the corridor, with half of these conflicts occurring in the area between the station at 4th and Townsend Streets and the Millbrae/San Francisco International Airport station. The total number of conflicts for this corridor is considered a low-impact level of severity.
- No potential utility conflicts associated with the proposed stations in this corridor.

Oakland to San Jose

- Thirty potential conflicts with natural gas pipelines in this corridor. The total number of conflicts for this corridor would be considered a low-impact level of severity.
- One potential conflict is noted with the PG&E San Jose Substation B, which is located immediately adjacent to the proposed HST tracks on the I-880 alignment alternative between Trimble Road and Diridon Station (Niles/I-880 7A). This potential conflict is considered a high-impact level of severity.
- No potential utility conflicts associated with the proposed stations in this corridor.

San Jose to Central Valley

- A maximum of 28 natural gas pipeline conflicts and four electrical transmission line conflicts throughout the San Jose to Central Valley corridor. The total number of conflicts for this corridor is considered a high-impact level of severity.
- The Pacheco Pass alignment alternative has the most conflicts in the corridor, with 14 natural gas pipeline conflicts and two transmission line conflicts.
- Of the two east/west alignment alternatives, the GEA North alignment alternative has more total conflicts than the Henry Miller with 14 natural gas pipeline and one electrical transmission line conflicts.
- No potential utility conflicts associated with the proposed stations in this corridor.

East Bay to Central Valley

- A maximum of 22 potential natural gas pipeline conflicts, two transmission line conflicts, and two electrical substation/power station conflicts. The total number of conflicts would be considered a high-impact level of severity.
- Tracy Downtown alignment alternative has the most utility conflicts, with a maximum of 16.
- Two substations located in the vicinity of the proposed alignments—the Kaiser PG&E substation just east of Dublin and the Clavo PG&E substation located east of Tracy.
- No potential utility conflicts associated with the proposed stations in this corridor.

San Francisco Bay Crossings

- A maximum of eight natural gas pipeline conflicts associated with this corridor. This number of conflicts would be considered a low-impact level of severity.
- No potential utility conflicts associated with the proposed stations in this corridor.

Central Valley

- A maximum of 23 natural gas pipeline conflicts, one electrical substation/power station potential conflict, and three electrical transmission line conflicts throughout the Central Valley corridor. The total number of conflicts in this corridor would be considered a high-impact level of severity.

- UPRR N/S alignment alternative has the most conflicts with 23 natural gas pipeline conflicts and one substation conflict.
- No potential utility conflicts associated with the proposed stations in this corridor.

3.10.4 Role of Design Practices in Avoiding and Minimizing Effects

The public utilities impact analysis is programmatic and addresses only representative utilities; it does not address all utilities and does not address local details. Project-level analysis would address all utilities and local issues once the alignments are more defined. The Authority plans to avoid potential conflicts to the extent feasible and practical and to greatly limit any potential additional costs or disruption. It is common practice to coordinate on site with utility representatives during construction in the vicinity of critical infrastructure, such as high-voltage overhead/underground transmission lines, high-pressure gas pipelines, and aqueduct canals. Also, future transportation or utility improvements would be analyzed at the project-level environmental review, along with feasible measures to mitigate potentially significant adverse environmental impacts.

Design features to avoid the potential utility conflicts associated with the HST Alignment Alternatives include (i.e., are not limited to) the following features.

- During final design, adjustments could be made to the HST alignments and profiles to avoid major utility lines or facilities.
- The Authority could relocate transmission lines or substations.

3.10.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, most of the HST Alignment Alternatives would result in high-impact conflicts and would therefore have significant impacts on utilities and service systems. All the alignment alternatives would also result in low-impact conflicts, which are considered less-than-significant impacts on utilities and service systems. All potential conflicts will be reviewed during the more detailed project-level environmental analysis and during final design. The Authority will consult with the various utility providers during the detailed project-level analysis to minimize potential conflicts.

Proposed general mitigation strategies for potential utility conflicts first focus on avoidance of potential conflicts. If conflicts are unavoidable, the next strategy focuses on reducing and minimizing the potential impact. The mitigation strategies are similar for all alignment alternatives and would be refined during subsequent project-specific review.

For large utilities, such as wastewater treatment facilities, electrical substations, and pipelines, the strategy would be first to avoid crossing or using any of the utility right-of-way or facility footprint as the project-specific review proceeds and as engineering designs are refined. Avoidance opportunities include consideration of modifying both the horizontal and vertical profiles of the proposed transportation improvements.

During final design, the Authority will consult with each utility provider/owner to avoid or reduce potential impacts on existing and planned utilities through design refinements. If avoidance is not feasible and adjustment of alignments has not removed the potential conflict, relocation/reconstruction/restoration of the utility would be considered, in close consultation and coordination with the utility owner, as a second mitigation strategy. This type of mitigation could include combining several utilities into a single utility corridor, relocation, or reconstruction. Where feasible and cost-effective, consolidating several utilities, primarily underground electrical and communications utilities, into one conduit should be considered during utility relocation planning. The co-lead agencies will comply with the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 in the acquisition of all property necessary for the proposed HST system.

Based on the program-level analysis, and in accordance with the CEQA Appendix G thresholds of significance for public utilities and service systems, the HST system alternative would result in a significant impact on utilities and utility services in the study region, although implementation of the above design features and mitigation strategies is expected to reduce impacts on utilities and service systems to a less-than-significant level at the program-level. Additional environmental assessment will allow more precise evaluation in the second-tier, project-level of environmental analysis.

Based on the review of the Appendix G thresholds at the program level in this analysis, the proposed HST system would not result in a significant increase in demand for, or significant impacts on, public utility services, and thus would have a less-than-significant impact on utility services and utility capacities. This conclusion is based on consideration of the areas enumerated in the Appendix G thresholds and a number of factors. These factors include the phased implementation and long construction period projected for the HST system, the expectation that the HST system would not generate such significant growth as to result in great demand increases for utility services, and the expectation that such growth and the indirect effects of such growth would be distributed across various communities. In general, growth would be reflected in infill development and increased development densities near HST stations and would occur over a time frame consistent with the planning horizons for, and within the purview of, the local and regional agencies that provide such services.

3.10.6 Subsequent Analysis

As previously mentioned, the public utilities impact analysis is programmatic and addresses only representative utilities; it does not address all utilities and does not address local details. Project-level analysis would address all utilities and local issues once the alternative alignment for the Bay Area to Central Valley corridor is selected. Project-level environmental documentation and subsequent planning documents will identify precise utility locations and will analyze in more detail conflicts between the HST system and the following utilities:

- Water supply lines.
- Wastewater conveyance lines.
- Wastewater and water pump stations.
- Storm drains.
- Fiber-optic lines.
- Telecommunication lines.
- Other utilities and pipelines likely to be crossed or conflict with the various alignment alternatives, including liquid petroleum and crude oil pipelines.

Project-level environmental documentation will also include a more detailed discussion of the capacity of existing utilities to serve the HST system's needs. The energy supply needs from the electricity grid will be considered segment by segment in order to ensure that demand from the HST system is managed and that adequate capacity will be available to serve the system. The project level analysis will also consider the utility services of the proposed HST stations and in the station area planning, where growth patterns, infill densities, and services for the both the HST system and community will be addressed.

3.11 Hazardous Materials and Wastes

This section describes the issues associated with hazardous materials and wastes in the project area and the potential for impacts in areas that may be contaminated with hazardous materials or wastes. According to Title 22 of the California Code of Regulations (CCR) § 66261, waste is considered hazardous if it exhibits at least one of the four characteristics of ignitability, corrosivity, reactivity, or toxicity, or if it is a "listed waste." Waste can be liquid, semisolid, or gaseous. Known areas containing significant hazardous materials and wastes resulting in contaminated sites have been identified on the list of California's high-priority Annual Work Plan (AWP) sites, list of solid waste landfill (SWLF) sites, and the National Priorities List (NPL)/Superfund. For this document, these lists are the basis for identifying major contaminated sites within the program region and evaluating potential impacts on humans and the natural environment from exposure to hazardous materials or wastes.

Potential impacts associated with the No Project Alternative, the HST Alignment Alternatives, and station location and maintenance facility options are described[1]. Construction and operation of the HST system could cause impacts to existing hazardous materials or waste sites. For this programmatic analysis, a potential hazardous waste impact is considered wherever the route of a proposed alignment or location of an HST station or maintenance facility conflicts with a known contaminated site or construction or when maintenance activities associated with a project alternative causes an increase in transportation and/or storage of hazardous materials or waste. The sites that pose the greatest concern are those with soil or groundwater contamination within or adjacent to the right-of-way for a proposed alignment or a station location option, and those with groundwater contamination near areas where excavation down to groundwater would be necessary. An overview of hazardous material/waste impacts is presented below. An analysis of the potential impacts by alignment alternative is presented in Section 3.11.3.

Potential HST hazardous material and waste impacts that could occur in the study area are listed below.

- An HST Alignment Alternative could cause ground disturbance (including disturbance of groundwater or surface water) near a known contaminated site during construction, operation, or maintenance activities and expose workers or the public to hazards from a known hazardous materials/waste site.
- An HST Alignment Alternative could cause ground disturbance (including disturbance of groundwater or surface water) where contamination could exist (e.g., aerially deposited lead [ADL], lead-based paint [LBP], petroleum hydrocarbon–affected soil and groundwater, and naturally occurring asbestos [NOA]) during construction, operation, or maintenance activities.
- An HST Alignment Alternative could increase transport, use, storage, or disposal of hazardous materials that is not in accordance with state and federal hazardous materials or waste regulation during construction, operation, or maintenance activities.

3.11.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY

California's hazardous materials regulations for the discovery of hazardous substances in the subsurface during construction and the disposal of hazardous materials and cleanup of the hazards area incorporate most federal hazardous materials regulations. The most relevant federal regulations are described below.

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

Resource Conservation and Recovery Act (RCRA)

RCRA governs the disposal of solid and hazardous waste. Congress passed RCRA on October 21, 1976, to address the national problem with the growing volume of municipal and industrial waste. RCRA, which amended the Solid Waste Disposal Act of 1965, set national goals for protecting human health and the environment from the potential hazards of waste disposal, conserving energy and natural resources, reducing the amount of waste generated, and ensuring that wastes would be managed in an environmentally sound manner. The hazardous waste program, under RCRA Subtitle C, establishes a system for controlling hazardous waste from the time it is generated until its ultimate disposal—in effect, from "cradle to grave." The underground storage tank (UST) program, under RCRA Subtitle I, regulates underground storage tanks containing hazardous substances and petroleum products. The EPA has primary responsibility for implementing RCRA, but individual states are encouraged to seek authorization to implement some or all RCRA provisions. California received authorization to implement RCRA in August 1992.

Comprehensive Environmental Response and Liability Act (CERCLA)

CERCLA, also known as Superfund, was enacted by Congress on December 11, 1980. CERCLA provided a basis for taxing chemical and petroleum manufacturers and provided federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites, and established a trust fund using collected taxes to provide for cleanup when no responsible party could be identified. Two types of response actions were authorized under CERCLA: short-term removal actions and long-term remedial response actions, although these actions can be conducted only at sites listed on EPA's NPL.

CERCLA also enabled the revision of the National Contingency Plan (NCP). The NCP provided the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants. The NCP also established the NPL. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) on October 17, 1986.

Lead-Based Paint Poisoning Prevention Act, Title 42—The Public Health and Welfare, Chapter 63—Lead-Based Paint Poisoning Prevention

This federal law prohibited the use of lead-based paint after 1971. For projects involving construction of transportation corridors, contamination resulting from LBP is a frequent hazardous waste issue and may be unknown until testing is performed. Lead was used historically as a pigment and drying agent in oil-based paint. Although the legal limit for lead concentrations in paint was lowered to 0.06% (a trace amount) in 1978 by the U.S. Consumer Product Safety Commission and was lowered voluntarily by some manufacturers prior to that, many structures built prior to the 1980s may still contain undercoats of LBP. Additionally, weathering and routine maintenance of paint on buildings may contaminate nearby soils with lead. Leaded gasoline was used as a vehicle fuel in the United States from the 1920s until the late 1980s. Although lead is no longer used in gasoline formulations, lead emissions from automobiles are a recognized source of contamination in soils along roadways. Surface and near-surface soils along heavily used roadways have the potential to contain elevated concentrations of lead of several hundred milligrams per kilogram.

California's statutes and regulations on hazardous materials are described below.

Health and Safety Code §25100 to §25250.28 and Title 22 C.C.R., Div. 4.5

These codes contain regulations adopted and administered by the California Environmental Protection Agency's (CalEPA's) Department of Toxic Substances Control (DTSC). Both the California Health and

Safety Code and Title 22 C.C.R. require that hazardous waste be managed according to applicable regulations, which include worker operational safety procedures as identified in Title 8 C.C.R.; handling, storage, and exposure requirements; transportation and disposal requirements under a uniform hazardous waste manifest; and documentation procedures. In California, waste disposal facilities are classified in three categories: Class I, Class II, and Class III. A Class I disposal facility may accept federal and state hazardous waste. Class II and Class III facilities are permitted only to accept nonhazardous waste at facility-specific acceptance threshold levels established by the RWQCB, which is the permitting agency.

Additional federal and state regulations address worker exposure to safety and health hazards. The federal regulations are identified in Title 29 CFR, and the state regulations are in Title 8 C.C.R. The federal and California Occupational Safety and Health Administrations are the primary agencies responsible for enforcing these regulations.

The DTSC is responsible for implementing RCRA. The DTSC is also responsible for implementing and enforcing California's own hazardous waste laws, which are known collectively as the Hazardous Waste Control Law. The Hazardous Waste Control Law and its associated regulations are similar to RCRA but regulate more chemicals because they define hazardous waste more broadly. Hazardous wastes regulated by California but not by EPA are called non-RCRA hazardous wastes.

Chapter 6.95, §25503(a), of the California Health and Safety Code and Title 19 of the C.C.R. §2729, *et seq.*

This code requires any business that handles a hazardous material or mixture containing a hazardous material in reportable quantities to establish and implement a Hazardous Materials Business Plan for emergency response to a release or threatened release of a hazardous material. The state's minimum reportable quantities are 500 pounds for a solid, 55 gallons for a liquid, and 200 cubic ft for a gas at standard temperature and pressure. Some acutely hazardous materials are reportable at much lower quantities. Counties in California have different requirements and often require businesses to complete a short form of the Hazardous Materials Business Plan even if they handle hazardous materials below the state's reportable quantities. Businesses typically submit their plans to local administering agencies (e.g., the county's Environmental Health Services Department). The business plan must identify the type of business, location, emergency contacts, emergency procedures, mitigation plans, and chemical inventory at each location.

California's Accidental Release Prevention Law

Certain chemicals that could be released to the environment and affect surrounding communities are regulated by California's Accidental Release Prevention Law. This state law and federal laws with similar provisions (i.e., the Emergency Preparedness and Community Right-to-Know Act [EPCRA] and the Clean Air Act) allow local oversight of both the state and federal programs. The state and federal laws are similar in their requirements; however, the California threshold planning quantities for regulated substances are lower than the federal values. Local agencies may set lower reporting thresholds or add chemicals to the program. Beginning in 1997, the Accidental Release Prevention Law has been implemented by the state's Certified Unified Program Agencies (CUPA). Any business where the maximum quantity of a regulated substance exceeds the specified threshold quantities must register with the county health department as a manager of regulated substances.

To operate in California, all hazardous waste transporters must be registered with the DTSC. Unless specifically exempted, hazardous waste transporters must comply with the California Highway Patrol Regulations, the California State Fire Marshal Regulations, and the United States Department of Transportation Regulations. In addition, hazardous waste transporters must comply with Division 20, Chapter 6.5, Article 6 and 13 of the California Health and Safety Code and the Title 22, Division 4.5, Chapter 13, of the California Code of Regulations, which are administered by DTSC.

B. METHODS OF EVALUATION OF IMPACTS

Identification of Hazardous Sites

Impacts from hazardous waste or material sites are an important consideration in the planning and development of any major transportation improvement project. Because remediation of contaminated soil and groundwater from contaminated sites can dramatically increase the overall cost of a project, it is important to identify the location of these sites early during the environmental analysis process. With this information, contaminated sites can be avoided during the project planning phase. Where contaminated sites cannot be avoided, early identification of these sites can help mitigate impacts that would have resulted in increased project costs, schedule delays, and public and worker safety issues.

At this program level of analysis, only federal and state published databases containing lists of known and significant hazardous materials/hazardous waste sites were reviewed for potential hazardous materials risks. Once an HST Alignment Alternative is selected and the project-level EIR/EIS is prepared, these databases would be supplemented with a more detailed database search of hazardous materials/waste sites (e.g., the Hazardous Waste and Substances Sites [Cortese] List, Government Code 65962.5), including local databases, as required by CEQA. During preparation of the project-level EIR/EIS, the database review would also include Leaking Underground Fuel Tank (LUFT) site list; Leaking Underground Storage Tank (LUST) site list; and Spill, Leak, Investigations, and Cleanup (SLIC) Lists. Additionally, there would be:

- Review of historical land use for the selected alignments and corridors carried forward for detailed analysis.
- Site reconnaissance.
- Review of agency records and agency consultation.
- Environmental data analysis and report preparation.

For this Program EIR/EIS, the following databases were reviewed.

Federal National Priorities List/Superfund

This EPA-developed database lists sites that pose an immediate public health hazard and where an immediate response to the hazard is necessary. This database is also found in the CERCLA database, also known as CERCLIS (Title 42 USC Chapter 103).

State Priority List

Sites listed in this DTSC and RWQCB database are priority sites that were compiled from AWP and CAL-SITES databases, and sites where Preliminary Endangerment Assessments were conducted by Cal-EPA. The CAL-SITES database (often referred to as the Historical Calsites Database) is a database identifying past confirmed or potential hazardous substances releases. The CAL-SITES database is maintained by the DTSC. The AWP database lists contaminated sites authorized for cleanup under the Bond Expenditure Plan developed by the California Department of Health Services as a site-specific expenditure plan to support appropriation of Hazardous Substance Cleanup Bond Act funds.

State of California Solid Waste Landfills

The landfill sites listed in this database generally have been identified by the state as accepting solid wastes. This database includes open, closed, and inactive solid waste disposal facilities and transfer stations pursuant to the Solid Waste Management and Resource Recovery Act of 1972 and is maintained by the California Integrated Waste Management Board. The locations of the disposal facilities are primarily identified through permit applications and local enforcement agencies.

Methods of Analysis

The hazardous materials and wastes analysis for this Program EIR/EIS entailed a qualitative comparison of potential impacts on humans and the natural environment from exposure to hazardous materials or wastes at known priority hazard sites. Exposure impacts are those that could result from proximity to or potential disturbance of sites containing these materials as a result of the No Project Alternative or HST Alignment Alternatives.

As described above, the analysis was based on the results of searches of three specific databases. These database searches included hazardous materials/waste site location data from two different record searches. The first record search was conducted in 2003 by Parsons-Brinckerhoff as part of the Bay Area-Merced Hazardous Materials/Wastes Technical Evaluation. The second record search was conducted in 2006 by Parsons-Brinckerhoff as part of this Program EIR/EIS and included a search of alignment alternatives that had not been previously evaluated in 2003. The hazardous material/waste site data included in Appendix 3.11-A of this document include data from both the 2003 and 2006 record searches.

For this program-level analysis of potential impacts, the analysis was limited to known and major hazardous materials sites and hazardous waste sites that are listed on the NPL, State Priority List (SPL), and SWLF databases. Other types of sites, such as sites with LUSTs or small or unknown sites can also present significant impacts from hazardous materials and waste, but the degree of impact cannot be determined without a site-specific environmental assessment and investigation. These site-specific investigations to address LUSTs and small or unknown contaminated sites would be considered in the project-level EIR/EIS and predesign evaluations that would be tied to more detailed planning efforts for alignment plans and profiles.

Potential impacts for HST Alignment Alternatives were compared to conditions under the No Project Alternative. This assessment assumes that impacts related to hazardous materials/hazardous waste exposure could occur both during project construction and during project operation. Impacts are evaluated based on the anticipated difference between the No Project conditions and conditions under the HST Alignment Alternatives. These different conditions, in terms of the estimated area of the proposed improvements, are discussed more fully in Chapter 2, "Alternatives," which guided the identification of study area boundaries. Particular attention was paid to the extent of improvements that would occur outside existing rights-of-way. This analysis focused on the number of identified NPL, SPL, and SWLF sites in the study area. The program-level comparison of alternatives in this section assesses the relative degree to which known hazardous material and waste sites could constrain the alternatives by requiring costly disposal conditions and site cleanup and remediation. The number of sites gives some indication of an overall level of potential impact; more sites generally imply more potential impacts. In this comparative analysis, each type of listing (NPL, SPL, and SWLF) was given equal weight.

This program-level analysis does not include a detailed assessment of the nature or extent of any hazardous materials or wastes that may be present at identified sites, or the degree or specific nature of potential impacts under the various alternatives. The analysis and identification of potential hazards in the study area is useful in comparing alternatives and in identifying areas where avoidance may be possible in subsequent project-level review.

C. CEQA SIGNIFICANCE CRITERIA

The primary potential hazardous waste issues for HST Alignment Alternatives include short-term construction-related impacts on construction personnel or the public from contamination from known hazardous waste sites and storage and/or transportation of hazardous materials; long-term impacts on operation and maintenance personnel or the public from known hazardous waste sites and storage and/or transportation of hazardous materials; and impacts on construction or maintenance personnel or the public from unknown but potentially existing contamination (e.g., ADL, LBP, petroleum hydrocarbon–affected soil and groundwater, and NOA).

During the scoping process for this EIR/EIS, no comments were received suggesting that the EIR/EIS should use analysis methods and significance thresholds that were different from CEQA Appendix G thresholds of significance, or analysis methods different from those discussed in Section 3.11.1. Based on the potential impacts of the HST Alignment Alternatives analyzed in this EIR/EIS, the significance criteria described below were examined as to whether they would be appropriate thresholds for this analysis.

Significance Thresholds

An alternative may result in a hazard to the public or the environment (significant impact) if there was an affirmative response to one of the questions below. With respect to this program evaluation, the thresholds of significance from Appendix G of the State CEQA Guidelines that can be evaluated at this time are:

- Would the HST Alignment Alternative cause ground disturbance (including disturbance of groundwater or surface water) near a contaminated site during construction, operation, or maintenance activities and expose workers or the public to hazards from a known hazardous waste site? The point of significance would be such ground disturbance occurring within a 500-ft-wide (152-m-wide) corridor (i.e., 250 ft [76 m] on either side of the centerline or the facility) along each alignment alternative and a 250-ft (76-m) radius around each station and maintenance facility.
- Would the HST Alignment Alternative cause ground disturbance (including disturbance of groundwater or surface water) where contamination could exist (e.g., ADL, LBP, petroleum hydrocarbon–affected soil and groundwater, and NOA) during construction, operation, or maintenance activities? The point of significance would be such ground disturbance occurring in the 500-ft-wide (152-m-wide) corridor (i.e., 250 ft [76 m] on either side of the centerline or the facility) along each alignment alternative and in the 250-ft (76-m) radius around each station location or maintenance facility option.

3.11.2 Affected Environment

Detailed analysis and comparison of the number of hazardous materials/waste sites in the study area is presented in Table 3.11.1. Identification of hazardous materials/waste sites for each segment is presented in Appendix 3.11-A. Figure 3.11-1 shows the location of the identified hazardous materials/waste sites.

A. STUDY AREA DEFINED

The HST Alignment Alternatives would result in substantial improvements to existing infrastructure in or adjacent to existing rights-of-way, in addition to the No Project Alternative transportation improvements. Therefore, the study area for the presence of hazardous materials and wastes includes existing transportation corridors adjacent to HST alignments, the HST alignments, and areas where passenger stations and HST storage and maintenance facilities are being considered. The study area consisted of a 500-ft-wide (152-m-wide) corridor (i.e., 250 ft [76 m] on either side of the centerline or the facility) along each alignment alternative and a 250-ft (76-m) radius around each station and maintenance facility. The study area boundaries were based on the distance within which a hazardous material or waste site could impact the possible location of a transportation improvement under different HST alignment alternatives.

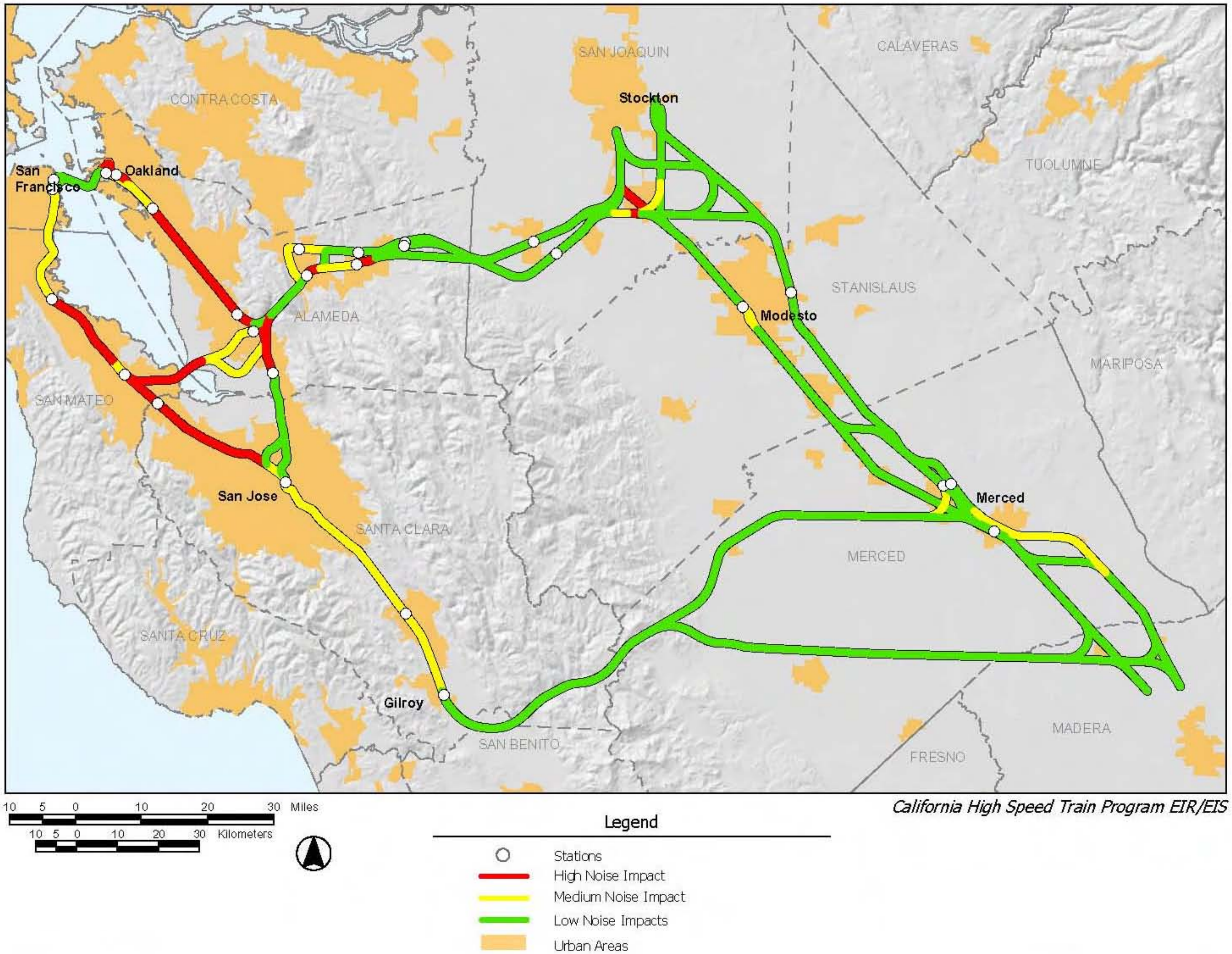


Figure 3.11-1
Potential Vibration Impact Levels

B. GENERAL DISCUSSION OF HAZARDOUS MATERIALS AND WASTE SITES

Contaminated sites are more often found in commercial and industrial areas; however, NPL and SLWF sites are also known to occur in rural areas. Common impacts of dealing with contaminated sites during development of transportation projects include unanticipated costs associated with excavating (or pumping), transporting, disposing, or treating on site contaminated soil, groundwater, and hazardous materials; schedule delays associated with sampling, removing, treating, and/or disposing of contaminated media; and worker safety issues.

If unanticipated contaminated soil is encountered during excavation in a project site, it not only poses a worker safety concern but also causes additional work associated with determining the type of chemical contamination and the limits of contamination in terms of its aerial and vertical extent. Unanticipated costs and construction delays frequently arise from mitigation measures, including the required regulatory agency coordination, soil sampling to characterize chemical concentrations, and onsite or offsite treatment and/or disposal costs.

Adverse impacts could also result if contaminated groundwater from an unknown nearby contaminated site is caused to migrate farther in the groundwater or is actually pumped from an aquifer to the surface during construction-related dewatering activities. This scenario is possible if dewatering activities (e.g., for trenches and tunnels) intercepts the contaminated groundwater or causes a change in the local hydraulic gradient, thereby drawing contaminated groundwater from some offsite source. For contaminated groundwater, common problems would be the unanticipated costs and construction delays associated with regulatory coordination, groundwater sampling, possible onsite pretreatment of pumped groundwater, and/or offsite treatment and disposal of contaminated groundwater.

Potential adverse impacts in the short-term (during construction) or long-term (during transit facility operation) would be the human health and the natural environment impacts if project activities cause existing fuel or chemical vapors to emanate from contaminated soil or groundwater or directly from leaks or spills of hazardous materials. These vapors could move through the vadose zone and potentially affect excavated areas or underground structures associated with the rail line (e.g., vaults and manholes).

Materials and wastes that exhibit hazardous properties require special handling and management. Their treatment, storage, transport, and disposal are highly regulated by federal, state, and local governments, minimizing the risk to the public presented by these potential hazards.

Asbestos, a known carcinogen, causes cancers of the lung and the lining of internal organs, as well as asbestosis and other diseases that inhibit lung function. Asbestos-Containing Materials (ACM) are commonly found in structures built prior to the 1980s. Typical ACM includes resilient floor covering, siding, asphalt roofing products, gaskets, and cement products (e.g., stucco). Current federal and state laws and regulations require that specific work practices be followed to abate the hazard associated with exposure to ACM during demolitions and renovations of all structures, installations, and buildings (excluding residential buildings that have four or fewer dwelling units). In addition, the regulations require that the owner of the building and/or the contractor notify applicable state and local agencies and/or EPA Regional Offices before all demolitions or before renovations of buildings that contain certain threshold amounts of asbestos.

NOA found in serpentine rock is also a potential contamination issue. NOA is a fibrous mineral and is often in the form of long, thin fibers, but it can degrade from weathering or excavation activities into microscopic fibers and easily become airborne. There is no health threat if NOA does not become airborne, but, when suspended in the air and inhaled, these thin fibers irritate tissues and resist the body's natural defenses.

C. HAZARDOUS MATERIALS AND WASTE IN THE BAY AREA TO CENTRAL VALLEY REGION

Figure 3.11-1 shows the general locations of the hazardous materials and hazardous waste sites identified in the Bay Area to Central Valley Region through the database searches. Additional information on the results of the database search is presented by segment in Appendix 3.11-A and in the hazardous materials and hazardous wastes technical evaluation documents prepared for each region (Environmental Data Resources 2003). More specific information regarding these sites is provided in Subsection 3.11.3B.

Based on the results of the database searches, the hazardous materials and hazardous waste sites in the Bay Area to Central Valley Region are fairly limited in extent and could be effectively mitigated by incorporating avoidance features or engineering controls into the transportation design and/or implementing accepted hazardous-materials avoidance practices during construction activities. Such measures could substantially decrease costly remediation efforts and time associated with regulatory agency coordination.

3.11.3 Environmental Consequences

Most of the hazardous materials and hazardous waste sites in the study area are relatively minor in extent and could be effectively mitigated through typical design and construction practices. Figure 3.11-1 shows the general locations of hazardous materials and hazardous waste sites identified through the database searches.

The potential severity of impacts from hazardous material or waste releases on the construction, operations, and maintenance of the proposed HST Alignment Alternatives would depend on two factors: the nature and severity of contamination and the construction and operations/maintenance activities that would be likely to occur near the sites. The sites that pose the greatest concern are those with soil or groundwater contamination in or adjacent to the right-of-way, and those with groundwater contamination near areas where excavation down to groundwater would be necessary. For example, dewatering during excavation, trenching, or tunneling could alter local subsurface hydraulic gradients and draw groundwater contamination into excavated areas, trenches, or tunnels. In addition, fuel or chemical vapors could move through the vadose zone[2] to excavated areas (during construction) or to underground structures associated with the rail line, such as vaults and manholes (during project operation). These same impacts could occur near a NPL, SPL, SWLF, or LUFT site or near a small or unknown contaminated site, depending on the nature and extent of the contamination.

A. NO-PROJECT ALTERNATIVE

The No Project Alternative assumes that transportation needs are satisfied with the existing and future statewide intercity transportation system based on programmed and funded (already in funded programs/financially constrained plans) improvements to the intercity transportation system through 2030, according to the following sources of information:

- STIP.
- RTPs for all modes of travel.
- Airport plans.
- Intercity passenger rail plans (California Rail Plan 2001–2010, Amtrak Five- and Twenty-Year Plans).

[2] The *vadose zone* is the partially saturated soil between the ground surface and an underlying groundwater aquifer. Pollutants can travel downward from the ground surface through the vadose zone before entering groundwater or vise versa in some cases which could impact excavations at ground surface.

The No Project Alternative also assumes that others would complete these projects, including the local, state, and interstate transportation system and airport improvements designated in existing plans and programs. It is assumed that no additional hazardous materials/waste impacts would occur beyond those addressed in the environmental documents for those projects and that any hazardous material/waste impacts would be mitigated as part of those projects. Therefore, the No Project Alternative is assumed to have no hazardous materials/waste impacts.

For the purpose of this analysis, existing hazardous materials sites and hazardous waste sites identified in the available databases were treated as the baseline for comparison. Although the future conditions for the No Project Alternative may result in some additional hazardous materials/waste impacts, they cannot be predicted or estimated for purposes of this program-level analysis. Similarly, it can be presumed that during the next 24 years, some of the existing hazardous waste sites would be cleaned up or remediated as part of Cal-EPA and RWQCB efforts.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

As described above, the No Project Alternative was used as a proxy for the baseline 2030 condition; the impact from any improvements associated with the HST Alignment Alternatives would be in addition to the impacts from the 2030 No Project Alternative.

The extent of cleanup or remediation associated with having a hazardous materials/waste site in the study area could translate into additional costs for construction, which could make a major difference in practicality or feasibility of an alternative. As described above, this analysis was limited to searches of three databases listing known significant sites and did not incorporate information on other smaller or unknown sites that could contribute to risk on a local basis and would be studied at the project-specific level. In addition, because neither site-specific investigations nor onsite fieldwork was performed, little or no information is available about the nature or severity of contamination at the sites identified or the schedule or program for cleanup, if any. The comparison below, therefore, represents a *site-count* approximation and may not fully divulge potential risk levels. Finally, most of the HST Alignment Alternatives would be within existing rights-of-way, and these alignments have a land-use history under which additional unknown contamination (e.g., spills and accidental releases) would be a possibility. Consequently, some unavoidable hazardous materials and hazardous waste impacts are expected under the HST Alignment Alternatives.

Summary of Hazardous Materials/Waste Sites

Based on the database searches, five NPL sites, four SPL sites, and eight SWLF sites were identified in the study area. Table 3.11-1 lists the number of hazardous materials/waste sites in the study area for each alignment alternative. Following the table, a brief description and discussion of the potential impacts of these sites is provided for each alignment alternative within a corridor. More detailed data are provided in Table 3.11-A-1 in Appendix 3.11-A. Dashes on the table mean that the segment contained no listings on the database used.

Table 3.11-1. Hazardous Materials Summary Data Table for Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Number of Hazardous Materials/Waste Sites
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	2
	1 of 1	Dumbarton to San Jose	3
Station Location Options			
Transbay Transit Center			--
4th and King (Caltrain)			--
Millbrae/SFO			--
Redwood City (Caltrain)			--
Palo Alto (Caltrain)			--
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	4
		12th Street/City Center to Niles Junction	3
	1 of 2	Niles Junction to San Jose via Trimble	--
		Niles Junction to San Jose via I-880	--
Station Location Options			
West Oakland/7th Street			--
12th Street/City Center			--
Coliseum/Airport			2
Union City (BART)			--
Fremont (Warm Springs)			
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	--
	1 of 3	Henry Miller (UPRR Connection)	--
		Henry Miller (BNSF Connection)	--
		GEA North	1
Station Location Options			
San Jose (Diridon)			--
Morgan Hill (Caltrain)			--
Gilroy (Caltrain)			--
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	--
		I-580/ UPRR	--
		Patterson Pass/UPRR	--
		UPRR	--
	1 of 4	Tracy Downtown (BNSF Connection)	--

Corridor	Possible Alignments	Alignment Alternative	Number of Hazardous Materials/Waste Sites
		Tracy ACE Station (BNSF Connection)	--
		Tracy ACE Station (UPRR Connection)	--
		Tracy Downtown (UPRR Connection)	--
	2 of 2	East Bay Connections	
Station Location Options			
Pleasanton (I-680/Bernal Rd)			--
Pleasanton (BART)			--
Livermore (Downtown)			--
Livermore (I-580)			--
Livermore (Greenville Road/UPRR)			--
Livermore (Greenville Road/I-580)			--
Tracy (Downtown)			--
Tracy (ACE)			--
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	--
		Trans Bay Crossing – 4^{th} & King	--
	1 of 6	Dumbarton (High Bridge)	--
		Dumbarton (Low Bridge)	--
		Dumbarton (Tube)	--
		Fremont Central Park (High Bridge)	--
		Fremont Central Park (Low Bridge)	--
		Fremont Central Park (Tube)	--
Station Location Options			
Union City (Shinn Station)			--
Central Valley	1 of 6	BNSF – UPRR	--
		BNSF	
		UPRR N/S	
		BNSF Castle	
		UPRR – BNSF Castle	
		UPRR – BNSF	
Station Location Options			

Corridor	Possible Alignments	Alignment Alternative	Number of Hazardous Materials/Waste Sites
Modesto (Downtown)			--
Briggsmore (Amtrak)			--
Merced (Downtown)			--
Castle AFB			1

San Francisco to San Jose

In the San Francisco to San Jose corridor, three NPL sites, no SPL sites, and two SWLF sites were identified. The distribution of hazardous materials/waste sites among alternative alignments is presented in Table 3.11.1.

Along the alignments, at least six tunnels are proposed (Caltrain station to downtown San Francisco, Paul Avenue to Tunnel Avenue in San Francisco, Oak Grove Avenue in Burlingame to 9th Avenue in San Mateo, Sunnyvale Avenue in Redwood City to Cambridge Avenue in Palo Alto, Pettis Avenue in Mountain View to Waverly Street in Sunnyvale, and Scott Boulevard to Lenzen Avenue in San Jose) as part of the design option for this corridor. The southern portal to the Paul Avenue/Tunnel Avenue tunnel would be constructed near the San Francisco Household Hazardous Waste Facility and San Bruno Transfer Station. There is some potential for hazardous materials/wastes to be present in these areas, and, if so, they could be encountered during construction.

The alignment in this corridor is also adjacent to the Northrop Grumman Marine Systems NPL site. The site reported as *Northrop Grumman Marine System* appears to be the NPL site referred to as *Westinghouse Electric Corporation (Sunnyvale Plant)* on the EPA's Superfund website, based on the EPA Identification Number provided in the database search (CAD001864081) (U.S. Environmental Protection Agency 2003). The 75-acre Westinghouse Electric Corporation (Sunnyvale Plant) site was formerly used to manufacture electrical transformers. It is currently used to manufacture steam generators, marine propulsion systems, and missile launching systems for the U.S. Department of Defense. Groundwater contamination is believed to have resulted from a leaking polychlorinated biphenyls (PCBs) storage tank and from localized spills. Most of the contaminated areas on site have been removed or have been paved over. Access to the site is restricted (U.S. Environmental Protection Agency 2003).

The Jasco Chemical Company is also adjacent to the alignment in the corridor. According to the EPA (USEPA Region 9, site EPA ID# CAD009103318, 2006), bulk solvents used at the site were received by tankers and stored in eight underground storage tanks. Prior to 1985, pentachlorophenol (PCP) was stored at the site, which was an ingredient of a wood preservative formerly produced by Jasco. Elevated levels of volatile organic compounds (VOCs) were detected in soils from a swale area located behind the building and in the shallow groundwater. Past waste disposal practices, and possibly leakage from an underground storage tank and surface water, may have contributed to soil and groundwater contamination near this site. According to the EPA, the removal of contaminated soil, the operation of the groundwater extraction system, and the use of the DVE/SVE system have reduced the potential of exposure at the Jasco Chemical Company site. Results from soil confirmation samples collected on February 26, 2002, showed that the site has reached cleanup goals.

The alignment also passes through areas along part of its route that have been commercial/industrial use areas since the mid 1800s and earlier. Therefore, the route has some potential to encounter hazardous materials/wastes sites not included here.

Oakland to San Jose

In the Oakland to San Jose corridor, no NPL sites, four SPL sites, and no SWLF sites were identified. The distribution of hazardous materials/waste sites among alternative alignments is presented in Table 3.11.1.

The alternative alignments for the corridor include two locations for the Oakland station (West Oakland/7th Street and 12th Street/City Center) that would include subsurface tunneling by boring and cut-and-cover in the vicinity of downtown Oakland to construct the station. Although no NPL or SWLF sites were identified in this area, it is an older commercial/industrial area where historical releases of hazardous materials/wastes are likely and, thus, there is some potential that hazardous materials/wastes could be encountered during construction in this area. Only one SPL site was identified in the downtown Oakland area, Cole Auto Wreckers, along Niles/I-880 for the West Oakland alignment. Potential impacts to the proposed station location options from hazardous materials incidences would be further evaluated when the project-level environmental site assessments were prepared.

The alternative alignments in this corridor would pass by the three SPL sites located near the proposed Oakland Coliseum Station. The two sites closest to the Oakland Coliseum Station are Aero Quality Plating and Union Pacific Oakland Coliseum. The third site, K & L Plating, is located south of the Oakland Coliseum. South of the Coliseum, the databases did not identify hazardous material/waste sites located along either the Trimble Road or I-880 alignment alternatives.

The alignment alternatives in this corridor also pass through areas along part of their route that have been commercial/industrial use areas since the mid 1800s and earlier. Therefore, the route has some potential to encounter hazardous materials/wastes sites not included here. An environmental assessment would be performed as part of the design process to better identify impacts from contaminated sites. The assessment would also consider ADL and NOA.

San Jose to Central Valley

In the San Jose to Central Valley corridor, no NPL sites, no SPL sites, and one SWLF site were identified. The distribution of hazardous materials/waste sites among alternative alignments is presented in Table 3.11.1.

There are three alignment alternatives for the San Jose to Central Valley corridor. From the San Jose Diridon Station south to Morgan Hill and Gilroy stations and through Pacheco Pass, there is a single alignment. Although significant portions of this route are urban/commercial, the databases did not identify any hazardous materials/waste sites. East of Gilroy and through the Pacheco Pass area, most of the surrounding land use is open space or agricultural, and no hazardous sites were identified by the databases in this area either.

East of Pacheco Pass, there are two different alignment alternatives: GEA North, which extends from Pacheco Pass to Merced and Atwater, and Henry Miller, which extends from Pacheco Pass to Chowchilla. Among these alignment alternatives, only one SWLF site, Winton Tire and Automotive Center in the town of Winton, was identified.

Based on the occurrence of the SWLF site on the GEA North alignment, there is a slightly greater potential for hazardous materials/waste impacts along this alignment compared to the other alignments in this corridor. The alignment alternatives in this corridor would pass through largely agricultural and open space and to a lesser extent commercial/industrial areas. Therefore, the rural route options have less potential to encounter hazardous materials/wastes as compared with the more urban route options. An environmental assessment would be performed during the design phase to better determine impacts from contamination. The assessment would consider ADL and NOA.

East Bay to Central Valley

In the East Bay to Central Valley corridor, no NPL sites, no SPL sites, and no SWLF sites were identified. The alignment alternatives would pass through both urban/commercial/industrial and agricultural/rural areas—the former being among the cities and communities along the alignments (e.g., Niles, Pleasanton, Dublin, Livermore, Tracey, Manteca, and Stockton) and the later through the Altamont Pass area and portions of the Central Valley.

Alignment alternatives through rural and agricultural areas have less potential to encounter hazardous materials/wastes as compared with the more urban areas. An environmental assessment would be performed during the design phase to better determine impacts from contamination. The assessment would consider ADL and NOA.

San Francisco Bay Crossings

In the San Francisco Bay Crossings corridor, no NPL sites, no SPL sites, and no SWLF sites were identified. The alignment alternatives would connect west Oakland and San Francisco via a tube under the bay. Three options exist for the Dumbarton Rail crossing: an improved (low-level) Dumbarton rail bridge, a new high-level rail bridge, and a new transbay tube.

Portions of the San Francisco Bay crossings pass through areas along part of its route that have been commercial/industrial use areas since the mid 1800s and earlier. Therefore, the route has some potential to encounter hazardous materials/wastes sites not included here. An environmental assessment would be performed during the design phase to better determine impacts from contamination. The assessment would consider ADL and NOA. The project-level environmental assessment work, which would include a review of Cortese-listed sites, would be important, given the potential for dewatering activities in the vicinity of the high groundwater areas near the Bay.

Central Valley Alignment

In the Central Valley corridor, two NPL sites, no SPL sites, and six SWLF sites were identified. The distribution of hazardous materials/waste sites among alignments is presented in Table 3.11.1. This corridor includes alignment alternatives consisting of various combinations of the BNSF and UPRR rail lines. Alignment alternatives are discussed according to the number of hazardous materials/waste sites that occur in the alignment.

The BNSF Castle alignment alternative has the least number of hazardous materials/waste sites, with one site along its segments at the former Castle Air Force Base (NPL site). According to the EPA, contamination at the 2,777-acre Castle Air Force Base occurred from the mid-1940s to the mid-1970s as a result of aircraft maintenance, fuel management, and fire training activities. Wastes primarily consist of waste fuels, oils, solvents, and cleaners and lesser amounts of paints and plating wastes. Investigations have been completed or are proceeding at multiple areas of contamination, including landfills, discharge areas, chemical disposal areas, fire training areas, fuel spill areas, and PCB spill areas (Environmental Protection Agency 2006).

The BNSF alignment has two hazardous materials/waste sites along its segments: the former Castle Air Force Base and Winton Tire and Automotive Center (SWLF site) along the UPRR/BNSF connector to Atwater.

The UPRR N/S alignment alternative has eight hazardous materials/waste sites. Valley Wood Preserving (NPL site) is along one segment, Larry's Tire Mart (SWLF site) is along two segments, Mercer Property (CHP Site) (SWLF site) is along two segments, Golden State Auto Wrecking (SWLF site) is along one segment, Southwest Tire Shop (SWLF site) is along one segment, and G & S Tires (SWLF site) is on one segment. According to the EPA, Valley Wood Preserving, which operated a 14-acre site near Turlock from 1973 to 1979, pressure treated lumber with an aqueous chromated copper arsenate (CCA) solution. This solution was mixed in an aboveground tank near the site boundary and was stored in three adjacent aboveground tanks. Water was piped to the mixing tanks from a well. After the treatment cycle, the wood-treatment solution was drained into sumps and pumped back to the mixing tank for reuse. In 1979, the RWQCB identified toxic wood-treating chemicals in an onsite storage pond, monitoring wells, and on- and offsite soils.

The UPRR—BNSF Castle alignment has 10 hazardous materials/waste sites along its segments: Valley Wood Preserving (NPL site) is along one segment, Larry's Tire Mart (SWLF site) is along two segments, Mercer Property (CHP Site) (SWLF site) is along two segments, Golden State Auto Wrecking (SWLF site) is along one segment, Southwest Tire Shop (SWLF site) is along one segment, G & S Tires (SWLF site) is on one segment, and Castle Air Force Base is along two segments.

The 6 alignment has 11 sites along its segments: Valley Wood Preserving (NPL site) is along one segment, Larry's Tire Mart (SWLF site) is along two segments, Mercer Property (CHP Site) (SWLF site) is along two segments, Golden State Auto Wrecking (SWLF site) is along one segment, Southwest Tire Shop (SWLF site) is along one segment, G & S Tires (SWLF site) is on one segment, the former Castle Air Force Base is along two segments, and Winton Tire and Automotive Center (SWLF site) along one segment.

An environmental assessment would be performed during the design phase to better determine impacts from contamination, as well as examine the Cortese-listed sites. The assessment would also consider ADL and NOA.

3.11.4 Role of Design Practices in Avoiding and Minimizing Effects

At this programmatic level of study, it is not possible to identify specific hazardous material impacts, the nature and severity of contamination, or the construction and operations/maintenance activities that are likely to occur near specific sites. However, the Authority is committed to avoiding and minimizing potential impacts through design refinement at the project level as well as the use of best management practices (BMP) to avoid potential impacts during construction.

3.11.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, each of the HST Alignment Alternatives except for the Altamont Pass and the San Francisco Bay Crossings could result in ground disturbance at or near a contaminated site that could potentially expose workers or the public to hazardous wastes. No hazardous material sites were identified in the vicinity of the Altamont Pass and San Francisco Bay Crossings, and for this reason, these two alignments are considered less than significant at the programmatic level. However, because the Altamont Pass and San Francisco Bay Crossings pass though urban areas, it is anticipated that they may be in proximity to hazardous materials sites that could be revealed during future more comprehensive environmental database searches performed during the project pre-design phase.

Based on results of the hazardous material site database search, station location options at the Oakland Coliseum/Airport and Castle Air Force Base could also potentially result in ground disturbance at or near a contaminated site that could potentially expose workers or the public to hazardous wastes. The impact at these station location options is considered significant at the programmatic level. Other station location option impacts are considered less than significant at the programmatic level because no hazardous material sites were identified during the database search. However, many of the other station options are located in urban areas (e.g. Oakland/7th Street and 12th Street/City Center), and a more comprehensive environmental database search of the vicinity of these stations (performed during the project predesign phase) could reveal additional hazardous materials sites.

Mitigation for impacts related to hazardous materials or hazardous wastes depends on detailed site-specific investigations (environmental site assessments) that have not been performed at this programmatic level of analysis. More-detailed analysis and specific mitigation measures would be included in subsequent project-level analysis. Mitigation strategies could include realignment of the HST corridor or relocation of associated features, such as stations, to avoid an identified site, and remediation of identified hazardous material/waste contamination.

In addition, potential mitigation strategies would include, but are not limited to, the following strategies:

- Investigate soils and groundwater for contamination and prepare environmental site assessments when necessary.
- Design realignment of the HST corridors to avoid identified sites.
- Relocate HST-associated facilities, such as stations, to avoid identified sites.
- Remediate identified hazardous materials and hazardous waste contamination.
- Prior to demolition of buildings for project construction, survey for LBP and ACM.
- Follow BMPs for testing, treating, and disposing of water and acquire necessary permits from the RWQCB if ground dewatering is required.
- When indicated by project-level environmental site assessments, perform Phase II environmental site assessments in conformance with the American Society for Testing and Materials (ASTM) Standards related to the Phase II Environmental Site Assessment Process to identify specific mitigation measures.
- Prepare a Site Management Program/Contingency Plan prior to construction to address known and potential hazardous material issues, including:
  - Measures to address management of contaminated soil and groundwater;
  - A site-specific Health and Safety Plan (HASP), including measures to protect construction workers and general public; and
  - Procedures to protect workers and the general public in the event that unknown contamination or buried hazards are encountered.
- As part of the second-tier environmental review, consider impacts to the environment on sites identified on the Cortese List (Government Code section 65962.4) at that time.

The above mitigation strategies are expected to reduce impacts related to hazardous materials and wastes to a less-than-significant level.

At this programmatic level of review, it is not possible to identify the nature and severity of contamination at specific sites on the different alignment alternatives. However, the co-lead agencies' commitment of using design practices to minimize impacts and the use of BMPs and mitigation strategies for remediation of hazardous sites are expected to substantially lessen or avoid impacts to hazardous materials and wastes. With the project-level review, including review of the Cortese-listed sites, specific impacts to sites with hazardous materials would be identified, and mitigation measures based on these mitigation strategies would be applied on a site-specific basis. Additional environmental assessments would allow evaluation that is more precise in the project-level environmental analyses.

3.11.6 Subsequent Analysis

For each project-specific environmental document that tiers off the Program EIR/EIS, a subsequent analysis consisting of an environmental site assessment would need to be conducted to further analyze the identified potential hazardous materials/waste sites and to further analyze and document the potential impacts related to the proposed project. This analysis will be prepared in conformance with the ASTM guidelines for preparing an environmental site assessment (E1527-05).

An environmental site assessment template would be provided to the Regional Analysis Teams when the project-specific environmental document stage of the project commences. Tasks to be performed for inclusion in the environmental site assessment are outlined in ASTM E 1527-05 and include:

- Task 1—Environmental Database Search.
- Task 2—Review of Historical Land Use.
- Task 3—Site Reconnaissance.
- Task 4—Agency Records Review/Interviews.
- Task 5—Data Analysis and Report Preparation.

Task 1 would involve performing a database search update, using the most recent NPL, SPL, and SWLF databases and the Cortese Database in Gov. Code 65962.5. The database search would also identify sites in other federal, state, and local hazardous materials/waste databases in accordance with the ASTM guidelines for preparing an environmental site assessment (E1527-00) and would also include a review of the United States Geological Survey Mineral Resource Data System for the presence of mining facilities that may have hazardous materials/wastes issues.

Task 2 involves an analysis within the project area of historical land uses in order to identify potential historical contaminant sources that may adversely affect the project area. Information sources that would be consulted include:

- Sanborn-Perris Maps, which were created for fire insurance purposes, and consist of detailed drawings of cities, including residential and business areas.
- Historical aerial photographs (such as those that can be accessed from the Fairchild Aerial Photograph Collection at Whittier College).

Task 3 involves performing a site reconnaissance for each identified site in the project area and surrounding vicinity. The site reconnaissance would be conducted to identify and confirm potential contaminant sources identified during Tasks 1 and 2, and to identify potential unreported contaminant sources that may adversely impact the area. The site reconnaissance would be conducted from public access areas and from within the project area, as feasible. Information would be recorded regarding the site location, the general upkeep of the site, and other observed conditions that might indicate a potential environmental concern.

Task 4 involves the gathering of information from the database search, the historic land use review, and the site reconnaissance. The list of potential contaminant sources would be assembled based on the type of site (e.g., database listing type), the distance from proposed project activities (see Task 1), and the information gathered during the site reconnaissance. A regulatory agency file review would then be conducted for the identified potential contaminant sources to develop additional site-specific information for the selected properties. The agency files would be reviewed for the most recent site status information, the nature and extent of contamination, pertinent land uses, and geologic, hydrogeologic, and other information that may be used to assess potential impacts to the project.

Task 5 involves screening the potential contaminant sources identified during Tasks 1 through 4. These potential sources would then be screened to determine their potential impact to the project based on the following criteria:

- The occurrence of a documented release, based on either public records or physical observation.
- The physical, chemical, and toxicological characteristics of suspected contaminants released from potential sources, and the media potentially affected (soil, water, and air).
- Distance from the project area/facility site.
- Nature of proposed design and construction activities in relation to the location and possible impact from a potential contaminant source.
- Estimated groundwater flow, direction, and depth.

These criteria would be used to eliminate potential sources that are unlikely to present an impact to the proposed project. The environmental site assessment does not constitute a definitive assessment regarding the actual presence or absence of contamination. The intent of the assessment is to identify reported and obvious potential hazardous conditions that would need to be addressed or considered before proceeding with project construction. The assessment is not performed to meet *innocent landowner* provisions provided under CERCLA, which establishes a defense for the purchase of real property. In addition, the assessment does not guarantee, imply, or assert that all potential contaminant sources have been located due to the possible presence of an unlisted or unidentified contaminant occurrence. Additional subjects that will need to be addressed in the assessment include ACM, ADL, LBP, yellow traffic stripe, pavement marking materials, yellow paint, radon, and NOA.

Based on the information presented in the project-level environmental site assessment, a determination will be made regarding any sites that will need to have a Phase II environmental site assessment performed (e.g., hydrogeologic investigation). This recommendation for a Phase II assessment, along with the implementation of any recommendations made in the document prepared in conjunction with the Phase II assessment, would be identified as a mitigation measure for addressing the potential contamination sites along the identified alignment that require further investigation regarding hazardous materials/waste. The assessment document would specify that the Phase II environmental assessment must be prepared in conformance with the ASTM *Standards Related to the Phase II Environmental Site Assessment Process (E1903-01)*.

The need for testing for ACM, ADL, LBP, yellow traffic stripe, pavement marking materials, yellow paint, radon, and NOA, as appropriate, would be addressed in the mitigation section of the environmental site assessment.

3.12 Cultural Resources and Paleontological Resources

Cultural resources include prehistoric archaeological sites, historic archaeological sites, traditional cultural properties, and historic structures. *Paleontological resources* are resources in the fossil record, such as prehistoric remains and other evidence of past life. This section discusses the applicable federal and state laws and regulations that protect cultural and paleontological resources, including Section 106 of the National Historic Preservation Act (NHPA) and California Public Resources Code Sections 5024.1 and 21084.1, and assesses the potential for the proposed HST system to have impacts on these resources[1].

3.12.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Cultural Resources

The NHPA (16 USC § 470 *et seq*.) established a national program to preserve the country's historical and cultural resources. Section 106 of the NHPA requires federal agencies to consider the effects of their actions on historic properties and provide the President's Advisory Council on Historic Preservation an opportunity to comment on a proposed action before it is implemented. Regulations for implementing the Section 106 process are provided in 36 CFR § 800. Both state and federal guidelines for cultural resources recognize that buildings, structures, objects, districts, and cultural landscapes can be historically significant. The NHPA refers to these significant resources as *historic properties*, while under CEQA, such highly sensitive resources are referred to as *historical resources*. Under NHPA Section 106 (36 CFR § 800.16), a historic property is "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places [NRHP]." Districts include the property types known as cultural landscapes (historic, rural, designed, etc.). To be eligible for the NRHP, these property types must meet at least one of the NRHP significance evaluation criteria (36 CFR § 60.4) to be considered a historic property, and the property must also possess integrity. NRHP historic properties meet one or more of the following evaluation criteria:

- The property is associated with events that have made a significant contribution to the broad patterns of our history (Criterion A).
- The property is associated with the lives of persons significant in our past (Criterion B).
- The property embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; possesses high artistic values; or represents a significant and distinguishable entity whose components may lack individual distinction (Criterion C).
- The property has yielded, or may be likely to yield, information important to prehistory or history (Criterion D).

Under CEQA, significant cultural resources are called *historical resources* whether they are of historic or prehistoric age. *Historical resources* are resources that are listed, or eligible for listing, in the California Register of Historical Resources (CRHR), or which are listed in the historical register of a local jurisdiction (county or city). NRHP historic properties located in California are considered historical resources for the purposes of CEQA and are also listed in the CRHR (PRC § 5024.1). Generally, a resource should be considered a historical resource for the purposes of CEQA if it has integrity and meets one or more of the criteria for listing in the CRHR (CEQA Guidelines §

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

15064.5[a][3]). These state criteria are based on, and are very similar to, federal significance criteria:

- The resource is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage (Criterion 1).
- The resource is associated with the lives of persons important in California's past (Criterion 2).
- The resource embodies the distinctive characteristics of a type, period, region, or method of construction; represents the work of an important creative individual; or possesses high artistic values (Criterion 3).
- The resource has yielded, or may be likely to yield, information important in prehistory or history (Criterion 4).

The NRHP and CRHR criteria are almost identical. Any resource determined eligible for NRHP is also automatically eligible for CRHR. However, the term historical resources under CEQA and CRHR is more inclusive because resources listed in local historical surveys that meet Office of Historic Preservation standards are encompassed.

Adverse changes to historic properties and historical resources caused by an undertaking are described as *adverse effect*s under Section 106, and as *adverse changes* or *adverse impacts* under CEQA. The definition of *effect* for the purposes of Section 106 of NHPA is contained within 36 CFR § 800.16 (i): "*Effect* means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." An *adverse effect* occurs "when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association…. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative."[2] Examples of adverse effects may include, but are not limited to, destruction, damage, alteration, or relocation of a historic property, as well as the introduction of elements that diminish the property's integrity, cause neglect of a property, or its transfer out of federal ownership.[3]

Impacts on historical resources listed in or eligible for the CRHR constitute a significant effect on the environment (significant impacts that must be disclosed in a CEQA environmental document) if the impact constitutes a substantial adverse change in the significance of a historical resource (PRC § 21084.1). Similar to the federal definition of adverse effect, a *substantial adverse change* to a historical resource under CEQA includes "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired" (CEQA Guidelines § 15064.5[b][1]). *Material impairment* includes changes to the physical characteristics that make a historical resource eligible for listing in the CRHR such that the resource would no longer be eligible for the CRHR or a local historical register (CEQA Guidelines § 15064.5[b][2]).

Paleontological Resources

The following United States statutes incorporate provisions for the protection of paleontological resources.

[2] 36 CFR 800.5(a)(1).

[3] 36 CFR 800.5(a)(2)(i through vii).

- Federal Antiquities Act of 1906 (16 USC § 431 *et seq.*): Establishes national monuments and preservation of lands that have historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal lands. Section 433 prohibits appropriation, excavation, injury, or destruction of any historic or prehistoric ruin or monument, or any object of antiquity on federal lands only.
- National Environmental Policy Act of 1969 (P.L. 91–190, 83 Stat. 852, 42 USC §§ 4321–4327): Mandates policies to "preserve important historic, cultural, and natural aspects of our national heritage" (§ 101.b4).

In California, fossil resources are considered a limited, nonrenewable, highly sensitive scientific resource. The following state statutes incorporate provisions for the protection of paleontological resources.

- CEQA (PRC § 21000 *et seq.*): Requires public agencies and private interests to identify the potential adverse impacts and/or environmental consequences of their proposed project(s) to any object or site that is historically or archaeologically significant or significant in the cultural or scientific annals of California (PRC § 5020.1). Under CEQA, archaeological resources are presumed nonunique unless they meet the definition of *unique archaeological resources* (PRC § 21083.2[g]). Under CEQA, an impact on a nonunique archaeological resource is not considered a significant environmental impact. An EIR need not discuss nonunique archaeological resources.
- CEQA Guidelines (14 C.C.R. § 15064.5 [a][3]): Provides that a lead agency may find that "any object, building, structure, site, area, place, record, or manuscript" is historically significant or significant in the "cultural annals of California." The section also provides that, generally, a resource may be considered historically significant if it has yielded or may be likely to yield information important in prehistory. Paleontological resources fall within this broad category and are included in the CEQA checklist under cultural resources.
- Public Resources Code Section 5097.5: Prohibits excavation or removal of any "vertebrate paleontological site...or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands." *Public lands* include lands owned by or under the jurisdiction of the state of California or any city, county, district, authority, or public corporation, or any agency thereof. This section provides that any unauthorized disturbance or removal of paleontologic, archaeological, and/or historic materials or sites located on public lands is a misdemeanor.
- Public Resources Code Section 30244: Requires reasonable mitigation of adverse impacts on paleontological resources resulting from development on public land in the coastal zone, as defined in Public Resources Code Section 30103.

B. METHOD OF EVALUATION OF IMPACTS TO CULTURAL RESOURCES

Archaeological Sites and Traditional Cultural Properties

As part of the Authority's and FRA's statewide HST Program EIR/EIS document (November 2005), the FRA initiated consultation with the State Historic Preservation Office (SHPO) under Section 106 of the NHPA in November 2002. SHPO concurred with a phased identification effort for historic properties as provided for in 36 CFR § 800.4 (b)(2). The phased identification effort would continue for this Program EIR/EIS. As with the statewide HST Program EIR/EIS, the area of potential effects (APE) for this undertaking was defined as 500 ft on either side of the HST Alignment Alternatives centerline in non-urban areas and 100 ft from the centerline in urban areas. Where stations or other HST facilities are proposed, the APE was 500 ft around the facility.

Cultural resources studies began with records searches obtained from the appropriate California Historical Resources Information System (CHRIS) Information Centers. The records searches identified the general locations of previously recorded archaeological sites in the APE. The number of known archaeological sites within the APE for each alternative was tabulated and used as an indicator of potential sensitivity for the comparison of the relative degree of potential impacts or effects for each alternative. For this program-level analysis, individual archaeological sites were not evaluated for eligibility. Instead, the archaeological sites identified as a result of the records searches were considered potentially eligible for listing in the CRHR or the NRHP, and the number of archaeological sites per linear mile identified in the APE for each alternative was used as an indicator of the relative degree of potential impacts on cultural resources from construction or operation of that alternative. Impacts on NRHP-eligible archaeological resources include physical destruction or damage. The total number of archaeological sites in the APE for the corridor was divided by the total length of the alignment alternative being evaluated to arrive at an average number of sites (or proportion of sites) per mile. That average was then translated to a qualitative rating of *low*, *medium*, and *high* impacts as follows.

- Low: 0.00–0.25 site per mile for the corridor.
- Medium: 0.26–0.75 site per mile.
- High: 0.76 or more sites per mile.

The cultural resource specialist's knowledge and background of regional prehistory supplemented the records search results. For example, if the cultural resource specialist had previous knowledge that several sites have been identified along a particular river drainage in the region, but the records search did not yield formally recorded sites in CHRIS within the APE for a particular alignment alternative, the cultural resource specialist documented the additional information and, based on it, increased the rating for that corridor. In addition to the records search, previous studies prepared for the statewide Program EIR/EIS were utilized and included the *Sacramento to Bakersfield, Cultural Resources Technical Evaluation* (Applied Earthworks 2004) and the *Bay Area to Merced, Cultural Resources, Archeology, Technical Evaluation* (Far Western Anthropological Research Group 2004).

Contemporary Native Americans often regard certain types of prehistoric sites and certain types of material sites as especially sensitive. These include habitation sites, shell mounds, and burials. If sites with these characteristics are present along an alignment alternative, that alignment alternative was automatically ranked high for archaeological resources, indicating that the potential sensitivity to impacts from construction disturbance would be greater in that corridor than in a corridor ranked as low or medium.

If the potential project impacts for each alignment alternative could not be differentiated after examining the average number of sites per linear mile (e.g. all corridors have the same rating), each alignment alternative was ranked qualitatively from highest to lowest impact, based on the total number of sites, number of human burial sites, number of habitation sites, and/or any additional documented findings from the cultural resource specialist.

The FRA and the Authority initiated consultation with the California Native American Heritage Commission (NAHC) and requested a search of their Sacred Lands file as part of the Statewide Program EIR/EIS to identify any traditional cultural properties that could be potentially impacted or affected by the project, and requested lists of Native Americans to contact for the areas that could be affected by the project, as required by 36 CFR § 800.4(1)(4). Information on traditional cultural properties would be more readily available during the project-level stage of environmental review during formal consultation when specific project locations and impact information can be shared.

As part of the statewide Program EIR/EIS, letters were sent to Native Americans on the contact lists provided by the NAHC. The letters provided information about the proposed project alternatives and requested information about any archaeological sites, traditional cultural properties, or sacred sites that could be affected by the project. Subsequently, as part of this Program EIR/EIS, Authority staff contacted tribal representatives to discuss the HST Alignment Alternatives under consideration for the Bay Area to Central Valley.

Historic-era Properties and Historical Resources

The SHPO was also consulted regarding the phased identification effort used in the statewide Program EIR/EIS for evaluating potential effects and impacts to historic-era properties and historical resources.

The method used to predict potential effects and impacts of the HST program on historic properties and historical resources is based upon estimating the amount of historic development that occurred along each proposed alignment alternative and the records search discussed above. These estimates were based upon review of existing documentation, including historical maps, aerial photographs, and local inventories, and the preparers' knowledge of the history of the region. New surveys of historic-period properties/resources were not conducted for this program-level analysis. Instead, the likelihood that a proposed HST route would affect or impact historic properties or historical resources was determined by estimating the linear miles of each alignment alternative that pass through historic development, i.e., buildings, structures, objects, sites, district, and/or landscapes that developed during specific historical time periods (before 1900, 1900 to 1929, and 1930 to 1958). The more area along each HST Alignment Alternative that developed historically, the more likely it is that there would be historic-era properties/historical resources along the route that could be affected or impacted by the HST program. If an alignment alternative traversed an area that was developed fifty or more years ago, there is a high possibility for numerous unrecorded architectural resources to be present within and/or immediately adjacent to the APE. This would result in a higher sensitivity rating as well. In addition to the records search, previous studies prepared for the statewide Program EIR/EIS were utilized and included the *Sacramento to Bakersfield, Cultural Resources Technical Evaluation* (Applied Earthworks 2004) and the *Bay Area to Merced, Cultural Resources: Historic Architecture Technical Evaluation* (JRP Historical Consulting Services 2004).

Paleontological Resources

Paleontological resources determined to be significant are fossils or assemblages of fossils that are unique, unusual, rare, uncommon, and diagnostically or stratigraphically (layers of the earth's surface) important, as well as those that add to an existing body of knowledge in specific areas—stratigraphically, taxonomically, and/or regionally.

The paleontological resources analysis is based on review of USGS (2006a) geologic maps and the *Bay Area to Merced Segment Paleontologic Resources Technical Evaluation* (Parsons 2004) and *Sacramento to Bakersfield Paleontologic Resources Technical Evaluation* (EIP Associates 2004). Literature research and institutional records searches or geologic maps and geographic data from the University of California Museum of Paleontology in Berkeley have resulted in the designation of areas along the HST Alignment Alternatives as having high or low paleontologic sensitivity, as follows.

- High: Sedimentary units with a high potential for containing significant nonrenewable paleontological resources. In these cases, the sedimentary rock unit contains a high density of recorded vertebrate fossil sites, has produced vertebrate fossil remains within the study area and/or vicinity, and is likely to yield additional remains within the study area.
- Low: The rock unit contains no or very low density of recorded resource localities, has produced little or no fossil remains within the study area and/or vicinity, and is not likely to yield any remains within the study area.

The number of rock units (formations) having high paleontologic sensitivity and the number of paleontological resource localities recorded within each study area were assessed to provide an interpretation of the overall ranking of high, medium, or low potential to impact paleontological resources. This evaluation was reached based on the likelihood of these rock units to contain paleontological resources. Taking the length of alignment segments into consideration and the paleontological sensitivity of those segments, a low overall ranking was determined for the alignment alternative if a majority has a low sensitivity. A medium overall ranking was determined if an alignment alternative has both low and high sensitivity equally. A high overall ranking was determined if a majority of the alignment alternative has a high sensitivity.

C. CEQA SIGNIFICANCE CRITERIA

Under CEQA, a project may have a significant impact on cultural resources if it would:

- Cause a substantial adverse change in the significance of a historical or archaeological resource.
- Directly or indirectly destroy a unique geologic feature or unique paleontological resource or site.
- Disturb any human remains, including those interred outside of formal cemeteries.

CEQA guidelines use the following definitions to analyze impacts on historical or archaeological resources:

- *Substantial adverse change* in the significance of a historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of a historical resource would be materially impaired (CEQA Guidelines Section 15064.5[b][1]).
- The significance of a historical resource would be *materially impaired* when a project demolishes or materially alters in an adverse manner those physical characteristics that convey its historic significance or justify its eligibility for inclusion in or eligibility for the NRHP, CRHR, or local registers. (CEQA Guidelines Section 15064.5[b][2][A–C]).

3.12.2 Affected Environment

A. STUDY AREA DEFINED

The study area for cultural resources is the APE as noted above. The APE for cultural resources at this program level of analysis was developed based on review of the records searches from the CHRIS Information Centers, as well as the cultural resource specialists' knowledge and experience in regional history and prehistory. It is important to note that the APE was specifically designed to aid in the program-level analysis, which provides a general comparison of the alternatives without new identification surveys. The size and width of the APE was selected to predict the existence and relative sensitivity of cultural resources in and near the proposed program alignment alternatives, including prehistoric archaeological sites; historic archaeological sites; traditional cultural properties; and historic buildings, structures, objects, districts, and cultural landscapes. The APE for cultural resources for the proposed HST alignment alternatives is as follows:

- 500 ft (152 m) on each side of the centerline of proposed new rail routes where additional right-of-way could be needed.
- 100 ft (30 m) on each side of the centerline for routes along existing highways and railroads where very little additional right-of-way would be needed.
- 500 ft (152 m) around station locations.

Locations of easements and construction-related facilities, such as equipment staging areas, borrow and disposal areas, access roads, and utilities, have not yet been identified. Locations for these would be identified as part of the construction design program for the alignment alternatives selected for more detailed analysis in the next phase of the project. Therefore, these items are not considered in the program-level (also known as Tier-1) analysis, but this information would be available for project-level (also known as Tier-2) site-specific EIR/EISs. The APE would be modified to include these items as part of the project-level analysis.

The study area for paleontological resources under the HSR alignment alternatives is 100 ft (30 m) on each side of the centerline of proposed rail routes (including station locations), in both nonurban and urban areas. The study area for paleontological resources is limited to the area that would potentially be disturbed by earthwork construction activities.

B. CULTURAL RESOURCE CATEGORIES

The following topics are covered in this section.

- Prehistoric archaeological sites.
- Historic archaeological sites.
- Historic-era properties and historical resources.
- Traditional cultural properties.
- Paleontological resources.

Following are brief descriptions of each cultural resource category.

<u>Prehistoric Archaeological Sites</u>

Prehistoric archaeological sites in California are places where Native Americans lived or carried out activities during the prehistoric period before 1769 AD. Prehistoric sites contain artifacts and subsistence remains, and they may contain human burials. Artifacts are objects made by people and include tools (such as projectile points, scrapers, and grinding implements), waste products from making flaked stone tools (debitage), and nonutilitarian artifacts (beads, ornaments, ceremonial items, and rock art). Subsistence remains include the inedible portions of foods, such as animal bone and shell, and edible parts that were lost and not consumed, such as charred seeds.

<u>Historic Archaeological Sites</u>

Historic archaeological sites in California are places where human activities were carried out during the historic period between 1769 AD and 50 years ago. Some of these sites may be the result of Native American activities during the historic period, but most are the result of Spanish, Mexican, Asian, African-American, or Anglo-American activities. Most historic archaeological sites are places where houses formerly existed and contain ceramic, metal, and glass refuse resulting from the transport, preparation, and consumption of food. Such sites can also contain house foundations and structural remnants, such as windowpane glass, lumber, and nails. Historical archaeological sites can also be nonresidential, resulting from ranching, farming, industrial, and other activities.

<u>Historic-era Properties / Historical Resources</u>

Historic-era properties (NRHP) and *historical resources* (CRHR) are historically significant elements of the built environment that are listed in or eligible for the NRHP and/or the CRHR. These elements reflect important aspects of local, state, and/or national history and can be buildings, structures, objects, sites, districts, and/or historic cultural landscapes. Examples of the types of historic-era properties or historical resources that are located in and near the APE for the HST program include dwellings, industrial buildings, commercial buildings, downtown districts, farms, canals, rural landscapes, dams, bridges, roads, and other facilities that were built, operated, and previously gained historical significance.

Traditional Cultural Properties

Traditional cultural properties are places associated with the cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. Examples include locations "associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world" and locations "where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice" (Parker and King 1990).

Paleontological Resources

Paleontological resources are the fossilized remains of animals and plants. They are typically found in sedimentary rock units, and they provide information about the evolution of life on earth over the past 500 million years or more.

Cultural resources within the Bay Area to Central Valley region are discussed below.

Archaeological Resources

As described above, information on the numbers, kinds, and locations of archaeological sites for this Program EIR/EIS was obtained from CHRIS Information Centers. For the most part, the data from CHRIS Information Centers provide cultural resources information only for areas that have been previously surveyed by archaeologists. No archaeological field surveys were conducted for this Program EIR/EIS. However, surveys would be a part of the next stage of environmental review in the project-level EIR/EIS (see Section 3.12-6, *Mitigation Strategies and CEQA Significance Conclusions*).

The study area includes central California from the San Francisco Bay Area (San Francisco and Oakland) south to the Santa Clara Valley and east across the Diablo Range to the Central Valley. The Central Valley portion of the APE spans from Stockton in the north to Madera County in the south.

Archaeological evidence places prehistoric people in California as early as 8,000 to 12,000 years ago; however, the last 2,000 to 4,000 years are best documented. The regional chronological sequence of time periods (PaleoIndian; Early, Middle, and Late Archaic; and Protohistoric) reflects changes in land use that were influenced by population growth (e.g., shift from small camps to village sites), technological innovation (e.g., shift from use of the spear to bow and arrow), and resource intensification (e.g., the intensive use of mortars and pestles and bedrock milling features for acorn processing). Change also resulted from population movements and displacements and from outside influences such as climatic changes. Environmental change and population increase are the two primary factors that have been identified as causal factors in prehistoric culture change.

The records search for the project APE identified 131 archaeological sites, including prehistoric and historic sites. There were 367 architectural resources with most occurring in urban areas. Several of the prehistoric sites are habitation sites—variously referred to as shell mounds, shell middens, and large flaked and ground stone scatters[4] with midden[5] accumulations but also including sites where house pits were noted. Many of these habitation sites (the shell mounds around San Francisco Bay in particular) contain Native American burials. Burials are noted on some of the site records within the APE. Other types of sites identified in the APE include bedrock mortars, lithic scatters, ground stone scatters, and fire-affected rock scatters. The historic archaeological sites identified within the APE

[4] *Ground stone scatter* refers to a site containing milling equipment, including handstones, mortars, and pestles.

[5] *Midden* refers to a mound or deposit containing shells, animal bones, and other refuse that indicates the site of a human settlement.

include debris and features associated with nineteenth and early twentieth-century housing developments, farm complexes, industrial activities, and the San Francisco earthquake of 1906. The first location of Mission Santa Clara de Asís, near the Santa Clara train station, has both prehistoric and historic components.

Historic-era Properties and Historical Resources

Historic buildings in and near the program route alternatives date from the eighteenth century to the twentieth century, although the vast majority date to the early twentieth century. These properties/resources were constructed during the major historic periods of California history, including the exploration and settlement of the Spanish and Mexican eras; the US-Mexican War, the Gold Rush, and statehood in the mid-nineteenth century; and subsequent settlement and development of California through the mid-twentieth century. The property types also vary widely, but most are dwellings, commercial buildings, or industrial facilities that date to the 1890s and after. Properties/resources dating to before 1890 largely consist of a few remaining adobe structures and sites dating to the Mexican period prior to 1848 and wood-frame dwellings and commercial buildings from the period between 1849 and 1890.

The oldest standing elements of the built environment in California date to the eighteenth century, during the period when California was a Spanish colony. Spanish exploration and settlement began in 1769 with the Portola Expedition and continued with the establishment of 21 missions and several presidios (forts) and pueblos (towns) near the coast between San Diego and Sonoma. One of the missions, Santa Clara, is located near the proposed project alignment alternative. The first location of Mission Santa Clara de Asís is an archaeological site with both prehistoric and historic components. It lies near an HST alignment alternative. (See Chapter 2, “Alternatives,” for maps of the routes).

The Spanish made land grants to retired soldiers and other Spanish citizens interested in settling the area. The Mexican government continued the land grant system after gaining independence from Spain in 1821 and dissolving the mission system in 1834. The presidios and pueblos founded during the Spanish/Mexican period, including San Francisco, San Jose, Los Angeles, and San Diego, grew slowly during the 1830s and 1840s, and relatively few properties/resources are predicted for the HST routes that pass through these cities.

The United States acquired California upon the ratification of the Treaty of Guadalupe-Hidalgo at the close of the Mexican War in 1848. The subsequent gold rush of 1849 lured immigrants to the west coast from across the United States and around the world. California became a state in 1850, and it continued to grow in population as completion of the transcontinental railroad in 1869 brought more settlers. New towns developed across the state in the nineteenth century but were especially clustered along the state’s railroad routes. Some of these properties/historical resources (such as dwellings, businesses, factories, and other buildings and structures from the Victorian era) remain along the various HST Alignment Alternatives.

The early twentieth century saw continued urban expansion in both northern and southern California, especially in conjunction with the first widespread use of automobiles. Popular residential architectural styles during this period included the Craftsman bungalow, the Spanish Colonial Revival, and other revival styles. The increasing use of automobiles also led to construction of linear commercial strips and other roadside development along arterials, although industry and major shipping facilities largely remained clustered along rail lines and maritime ports. By the late 1930s and during World War II, dwellings, commercial, industrial, and public buildings were often designed in the Art Deco Style (or the related Art, Zigzag, or Streamline Moderne styles). The construction boom of the post-war period brought residences in the Ranch style with an open plan and attached garage, often laid out in expansive suburbs of builders’ tract homes. Regional malls and shopping centers developed on the outskirts of communities, while the industrial and shipping facilities of the post-war period became more intermodal as trucking competed with rail and sea transportation. The areas along the HST Alignment Alternatives contain properties/resources of each of these types and from each decade of the twentieth century.

By far, the largest concentrations of historic buildings, structures, objects, sites, districts, and cultural landscapes (or potential historic properties/historical resources) in this region are in the urban centers of San Jose, San Francisco, and Oakland, but resources of all types appear throughout the region. A certain number of properties/resources appear in other towns, and to a lesser extent, in the rural countryside of the Santa Clara and Central valleys. Towns that were important local trade centers in the late nineteenth century, like Stockton and Merced, exhibit concentrations of historical resources along the project alignment alternatives. Rural historic properties and historical resources that appear along the HST Alignment Alternatives include farm and ranch complexes and infrastructure elements (such as water conveyance systems, bridges, industrial complexes, and rail stations).

Traditional Cultural Properties

Information regarding traditional cultural properties was derived from the NAHC's review of the Sacred Land files, the Native American Outreach Workshop, presentations at public hearings on the statewide Program EIR/EIS process, and formal comments received on the statewide Draft Program EIR/EIS.

Based on their review of the Sacred Lands file during the statewide Program EIR/EIS, the NAHC identified no traditional cultural properties near the project's APE. Letters were distributed to Native American contacts provided by the NAHC that asked for information identifying traditional cultural properties that could be affected by the project. No direct reply to the contact letters was received.

At Native American Outreach Workshops held for the statewide Program EIR/EIS, attendees provided information concerning potentially sensitive resources and concerns. At the San Luis Recreation Area workshop, concerns were raised about potential impacts on sensitive cultural resources along the HST Pacheco Pass alignment alternatives, both through the mountains and in the Santa Clara Valley between Gilroy and Morgan Hill. At public hearings held for the Statewide Program EIR/EIS, written comments were received representing tribal concerns and requesting continued involvement and consultation on subsequent planning and construction of the project. The comments also provided perspective on traditional tribal territories for the Amah Mutsun and Yokuts—tribes within the Bay Area to Central Valley project area.

Additional Native American consultation in the form of a request for review of the NAHC Sacred Lands file and additional letters to Native American potential contacts provided by the NAHC would be conducted as part of the formal consultation process during future project-level studies.

Paleontological Resources

California's rich geologic record and complex geologic history has resulted in exposure of many rock units with high paleontologic sensitivity at the surface. The fossil record in California is exceptionally prolific; abundant fossils representing a diverse range of organisms have been recovered from rocks as old as 1 billion years to as recent as 11,000 years. These fossils have provided key data for charting the course of the evolution and extinction of various types of life on the planet, both locally and globally, as well as for determining paleoenvironmental conditions, sequences and timing of sedimentary deposition, and other details of geologic history.

The major fossil-bearing units in the Bay Area to Central Valley region include the Irvington Gravels, Livermore Gravels, Merced Formation, Santa Clara Formation, Tulare Formation, Tehama Formation, Pinole Tuff, San Pablo Formation, Orinda Formation and Siesta Formation (Contra Costa Group), Briones Formation (San Pablo Group), Markley Sandstone, Nortonville Shale, Martinez Formation, Panoche Formation, Quinto Formation, Chico Formation, Franciscan Formation, Modesto-Riverbank Formations, and the Turlock Lake-Laguna Formations. The Pleistocene and Miocene age geologic units are units with a high potential for containing vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

3.12.3 Environmental Consequences

A. NO BUILD ALTERNATIVE

The No Project Alternative is composed of transportation projects other than the proposed HST system that are projected to be completed between the time of this Program EIR/EIS and 2020, including local, state, and interstate transportation system improvements designated in existing plans and programs. No additional impacts on cultural resources would occur under No Project beyond those addressed in environmental documents for those projects.

Because it was not realistically feasible for this Program EIR/EIS to identify or quantify all the impacts on or mitigation activities for cultural resources associated with all of the projects considered as part of the No Project Alternative, it is assumed that the existing condition is representative of No Project conditions. It is possible that other transportation projects (not including the HST Alignment Alternatives) may impact some existing cultural resources by 2020, and that these changes to the baseline would be described and quantified in subsequent environmental analysis and reflected in future database information. This Program EIR/EIS addresses the general potential for the proposed project to affect or impact cultural resources as they exist at present and uses this information to compare the potential for impacts from the alternatives evaluated.

HIGH SPEED TRAIN ALTERNATIVE

Table 3.12-1 reports a summary of the sensitivity ranking assigned to each alignment alternative and number of recorded cultural resources present within the APE. One apparent pattern in the data is that the alignment alternatives within the San Francisco to San Jose and Oakland to San Jose Corridors have overall higher sensitivity ratings than the alignment alternatives in the Central Valley Corridor that extend from Stockton to Madera. Urban areas in the Bay Area, such as San Francisco, Oakland, and San Jose, have a high density of cultural resources that includes prehistoric, historic, and architectural resources.

The potential for impacts to paleontologic resources for each of the HST Alignment Alternatives would be directly related to the sensitivity of geologic units crossed. Actual impacts would be related closely to the placement of major excavations (cuts, tunnels, borrow pits, and foundations) relative to the geographic positions of sensitive geologic units and known fossil localities. These factors would be addressed during subsequent analyses. Table 3.12-1 also reports the sensitivity rating for encountering paleontological resources.

Additional data related to cultural resources and paleontological resources is provided in Appendix 3.12-A.

Table 3.12-1. Cultural Resources Summary Data Table for Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment	Number of Recorded Archaeological Resources	Number of Recorded Architectural Resources	Traditional Cultural Properties	Cultural Resources Ranking (High, Medium, Low)	Paleontology Sensitivity (High, Medium, Low)
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	16	35	No	High	Low
	1 of 1	Dumbarton to San Jose	10	24	No	High (burials, Mission)	Low
Station Location Options							
Transbay Transit Center			0	2	No	High*	Low
4th and King (Caltrain)			0	0	No	High*	Low
Millbrae/SFO			0	1	No	High	Low
Redwood City (Caltrain)			0	0	No	Low	Low
Palo Alto (Caltrain)			0	1	No	Medium	Low
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	6	18	No	High	Medium
		12th Street/ City Center to Niles Junction	11	21	No	High	Medium
	1 of 2	Niles Junction to San Jose via Trimble	11	20	No	High (burials, Mission)	High
		Niles Junction to San Jose via I-880	2	2	No	Low	High
Station Location Options							
West Oakland/7th Street			0	0	No	Low	Low
12th Street/City Center			0	0	No	Medium*	Low
Coliseum/Airport			0	0	No	Low	Low
Union City (BART)			0	0	No	Low	High
Fremont (Warm Springs)			0	0	No	Low	High

Corridor	Possible Alignments	Alignment	Number of Recorded Archaeological Resources	Number of Recorded Architectural Resources	Traditional Cultural Properties	Cultural Resources Ranking (High, Medium, Low)	Paleontology Sensitivity (High, Medium, Low)
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	7	4	No	Medium	Low
	1 of 3	Henry Miller (UPRR Connection)	1	4	No	Medium	Low
		Henry Miller (BNSF Connection)	1	4	No	Medium	Low
		GEA North	4	5	No	Medium (burials)	Low
San Jose (Diridon)			0	1	No	Medium	Low
Morgan Hill (Caltrain)			0	0	No	Low	Low
Gilroy (Caltrain)			0	0	No	Low	Low
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	8	12	No	Medium	High
		I-580/ UPRR	6	11	No	Medium (multiple burials)	Medium
		Patterson Pass/UPRR	3	3	No	Low	Low
		UPRR	5	1	No	Low	Medium
	1 of 4	Tracy Downtown (BNSF Connection)	6	8	No	Low	Low
		Tracy ACE Station (BNSF Connection)	2	13	No	Low	Low
		Tracy ACE Station (UPRR Connection)	2	10	No	Low	Low
		Tracy Downtown (UPRR Connection)	6	5	No	Low	Low
	2 of 2	East Bay Connections	0	0	No	Low	High
Station Location Options							
Pleasanton (I-680/Bernal Rd)			0	0	No	Low	Low
Pleasanton (BART)			0	0	No	Low	Low

Corridor	Possible Alignments	Alignment	Number of Recorded Archaeological Resources	Number of Recorded Architectural Resources	Traditional Cultural Properties	Cultural Resources Ranking (High, Medium, Low)	Paleontology Sensitivity (High, Medium, Low)
Livermore (Downtown)			0	0	No	Low	Low
Livermore (I-580)			0	0	No	Low	High
Livermore (Greenville Road/UPRR)			0	0	No	Low	Low
Livermore (Greenville Road/I-580)			0	0	No	Low	High
Tracy (Downtown)			0	0	No	Low	Low
Tracy (ACE)			0	0	No	Low	Low
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	1	2	No	Low	Low
		Trans Bay Crossing – 4th & King	0	0	No	Low	Low
	1 of 6	Dumbarton (High Bridge)	0	0	No	Low	Low
		Dumbarton (Low Bridge)	0	0	No	Low	Low
		Dumbarton (Tube)	0	0	No	Low	Low
		Fremont Central Park (High Bridge)	0	0	No	Low	Low
		Fremont Central Park (Low Bridge)	0	0	No	Low	Low
		Fremont Central Park (Tube)	0	0	No	Low	Low
Union City (Shinn)			0	0	No	Low	Low
Central Valley	1 of 6	BNSF – UPRR	1	27	No	Low	Low
		BNSF	1	16	No	Low	Low
		UPRR N/S	4	63	No	Medium	Low
		BNSF Castle	1	20	No	Low	Low
		UPRR – BNSF Castle	4	20	No	Medium	Low
		UPRR – BNSF	4	27	No	Medium	Low

Corridor	Possible Alignments	Alignment	Number of Recorded Archaeological Resources	Number of Recorded Architectural Resources	Traditional Cultural Properties	Cultural Resources Ranking (High, Medium, Low)	Paleontology Sensitivity (High, Medium, Low)
Station Location Options							
Modesto (Downtown)			0	0	No	Medium*	Low
Briggsmore (Amtrak)			0	0	No	Low	Low
Merced (Downtown)			0	0	No	Medium*	Low
Castle AFB			0	0	No	Low	Low

Note: * Based on knowledge and experience in the area of the APE.

San Francisco to San Jose Corridor

San Francisco to Dumbarton Alignment Alternative

This alignment alternative has a high density of cultural resources within the city of San Francisco. In total, there are 16 archaeological resources and 35 recorded architectural resources. The area has been developed since the 1850s and therefore is rich in historical architecture as well as archaeological sites. The majority of prehistoric sites are shell middens, and many of the historical sites are deposits from various activities dating from the late 1800s as well as the earthquake in 1906. The alignment alternative in San Francisco goes through numerous historic districts, including the 2nd Street District, the Aronson District, and the Rincon Point/South Beach District (City and County of San Francisco Planning Department 2004). This portion of the alignment alternative includes the 1925 Army-Navy YMCA building, the 1950 Sailors Union of the Pacific building, the 1910 Commercial Block Building, the 1937 Metropolitan Electric building, the World War II era 3rd Street Retail Office Building, the China Basin Warehouse (ca. 1892), the Coal Gasification Facility (ca. 1900), and the Burlingame Commercial Building (ca. 1920s). This portion also contains the 1939 Transbay Terminal and Transbay Terminal Loop Ramp (URS 2006). The historic Transbay Terminal will be replaced with a new structure as part of the new Transbay Transit Center sometime between 2008 and 2014. This alignment alternative has a high sensitivity for prehistoric, historical, and architectural resources. No traditional cultural properties were identified within the APE.

The overall paleontological sensitivity within this alignment alternative is low. Nonsensitive Franciscan sandstone, Quaternary alluvium, and artificial bay fill underlies this alignment alternative. The existing Caltrain right-of–way extends across nonsensitive Quaternary alluvium.

Dumbarton to San Jose Alignment Alternative

This alignment alternative has a low density of previously recorded cultural resources until it reaches San Jose, where it has a high density of cultural resources. A total of 10 archaeological resources and 24 architectural resources are located within the APE. These include a 1927 commercial building, the 1941 Silver Springs Underpass, the 1898 Sunol Aqueduct, the 1861 Sanborn/Bunting House, segments of the San Francisco and San Jose Railroad (ca.1860s), and recorded residential properties from the 1890s to the 1940s. The alignment alternative also contains additional historic structures including the city of Mountain View adobe (ca. 1933), the FMC complex in San Jose (ca. 1948), the Union Pacific Rail yard Complex (ca. 1925), and recorded residential buildings dated from the 1880s to the 1940s. One archaeological site in San Jose, the Santa Clara de Asis Mission, includes both prehistoric and historic resources. The Mission was built by the Spanish in the late eighteenth century in order to convert local Native Americans to Christianity. Many of the neophyte converts lived in villages on the perimeter of the mission complex resulting in a mix of historical and prehistoric archaeological deposits, including burials. The portion of the Dumbarton to San Jose alignment alternative that traverses San Jose has a high sensitivity for prehistoric, historical, and architectural resources. No traditional cultural properties were identified within the APE.

Similar to the San Francisco to Dumbarton alignment alternative, this alignment alternative potentially has a low paleontological sensitivity.

San Francisco to San Jose Corridor Stations

Three of the station location options have recorded cultural resources that are within the APE. Millbrae Train Station was built in 1907 after a fire that destroyed the original station built in 1864. It is now a railroad museum located approximately 200 ft from the modern train station. The Palo Alto train station was built in 1941 and included on the NRHP in 1996. The Transbay Transit Center APE includes the Transbay Terminal and the Transbay Terminal Loop Ramp. The station location options within San Francisco also have a large number of unrecorded architectural resources adjacent to them.

The overall paleontological sensitivity for each of the station location options is low. Specific impacts to paleontologic resources associated with construction of the station location options requires additional information concerning exact locations and subsurface geology. Additional paleontologic resources assessment would take place at the project level after the station designs are more fully defined.

Oakland to San Jose Corridor

West Oakland to Niles Junction Alignment Alternative

In total, there are six recorded archaeological sites and 18 recorded architectural resources within the APE of this alignment alternative. The majority of resources are located within the city of Oakland. These include the 1924 Clorox Chemical Building, the 1926 PG&E Gas Compressor House, industrial complexes dating from the 1920s and 1940s, and 12 recorded residential properties dating from the 1880s to the 1940s. Prehistoric sites in this area tend to be shell middens and occupation sites. Historical sites as well as architectural resources are typically associated with the late 1800s to early 1900s. The alignment alternative also traverses the Old Oakland Historic District. Portions of the alignment alternative outside Oakland have a medium to low sensitivity. This alignment alternative has a high density of cultural resources and has a high sensitivity for prehistoric, historic, and architectural resources. No traditional cultural properties were identified within the APE.

About one third of this alignment alternative crosses high-sensitivity older Pleistocene alluvial deposits. The remaining length is underlain by low-sensitivity Quaternary alluvium. Overall, this alignment alternative would have a medium paleontological sensitivity.

12th Street/City Center to Niles Junction Alignment Alternative

This alignment alternative has the highest density of cultural resources within this corridor. In total, there are 11 recorded archaeological sites and 21 recorded architectural resources within the APE. As in the West Oakland to Niles Junction alignment alternative, the majority of resources are located within the city of Oakland. These include the White Brothers' Hardwood Store (ca. 1927), the Weld-Rite Company Building (ca. 1925), the Art Moderne Sales office building (ca. 1938), and 18 recorded residential properties dating from the 1880s to the 1920s. This alignment alternative has a high sensitivity for prehistoric, historical, and architectural resources. No traditional cultural properties were identified within the APE.

Similar to the West Oakland to Niles Junction alignment alternative, this alignment alternative potentially has a medium paleontological sensitivity.

Niles Junction to San Jose via Trimble Alignment Alternative

This alignment alternative has the second highest density of cultural resources within this corridor. In total, there are three recorded archaeological sites and eight recorded architectural resources within the APE. As in the Dumbarton to San Jose alignment alternative, the majority of resources are located within San Jose, which includes the Santa Clara de Asis Mission. This portion of the project includes the Kraft Foods plant (ca.1950), the Moderne Factory building (ca. 1940), and recorded residential properties. The portion of this alignment alternative that traverses San Jose has a high sensitivity for prehistoric, historical, and architectural resources. No traditional cultural properties were identified within the APE.

About one third of this alignment alternative crosses high-sensitivity older Pleistocene alluvial deposits east of the Hayward Fault. The exact alignment alternative could greatly influence impacts along this reach. The alignment alternative also crosses an area of Pleistocene alluvium and a short segment of Holocene intertidal deposits of low sensitivity. In the south part of the alignment alternative just north of West Trimble Road and the Mineta San Jose Airport, the remains of a Pleistocene mammoth were discovered in 2005. The area along the Guadalupe River would have a high paleontological sensitivity. (U.S. Geological Survey 2006b).

Niles Junction to San Jose via I-880 Alignment Alternative

This alignment alternative has two archaeological resources and two recorded architectural resources dating from 1928 and 1945. It has a medium sensitivity for archaeological and architectural resources. No traditional cultural properties were identified within the APE.

About one third of this segment crosses high-sensitivity older Pleistocene alluvial deposits east of the Hayward Fault. Elsewhere, the alignment alternative crosses an area of Pleistocene alluvium and a short segment of Holocene intertidal deposits of low sensitivity. Similar to the Niles Junction to San Jose via Trimble alignment alternative, this alignment alternative potentially has a high paleontological sensitivity along the Guadalupe River.

Oakland to San Jose Corridor Station Location Options

One of the station location options has recorded cultural resources that are within the APE or directly adjacent to the APE. Diridon Station was constructed in 1935 and added to the NRHP in 1993. The station location options within Oakland do not have recorded cultural resources within the APE but have a large number of unrecorded architectural resources adjacent to them. No traditional cultural properties were identified within the APE.

The overall paleontological sensitivity for the station location options in this corridor is low, except for the Union City (BART) and Fremont (Warm Springs) station location options, which is high. Specific impacts to paleontologic resources associated with construction of the station location options require additional information concerning exact locations and subsurface geology. Additional paleontologic resources assessment would take place at the project level after the station designs are more fully defined.

San Jose to Central Valley Corridor

Pacheco Alignment Alternative

This alignment alternative roughly follows Highway 152 through the Pacheco Pass. Little development has taken place in this area. In total, four recorded architectural resources were found to be located within the project APE. Of these, two are historic canals and one is a bridge. There are also likely historic resources in the Santa Clara Valley, including Morgan Hill and Gilroy. Seven previously recorded archaeological resources are located within the APE. Three of them are small prehistoric sites that typically include midden and lithic debitage. Though little archaeological work has been conducted in this area, it is known to be highly sensitive for prehistoric archaeological resources. Overall, this alignment alternative has medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

This alignment alternative extends through areas mapped as Franciscan ultramafic rocks and Quaternary terrace and alluvium, all ranking low in paleontological sensitivity. A portion of the alignment alternative near Gilroy passes through Plio-Pleistocene alluvial deposits similar to those which have yielded vertebrate fossils elsewhere and is assigned high sensitivity. The remaining portion falls on nonsensitive lower and upper Cretaceous marine rocks. Overall, this alignment alternative was identified to have a low sensitivity for paleontological resources.

Henry Miller (UPRR Connection) Alignment Alternative

The majority of this alignment alternative is in Merced County in the Central Valley. Much of the area has seen little development historically. Previously recorded resources present include one archaeological site and four architectural resources. Overall, this alignment alternative has a medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

In the vicinity of San Luis Reservoir, the alignment alternative crosses the Los Banos Alluvium, a sensitive unit that could include vertebrate fossils. The Pacheco and Modesto Formations along this alignment alternative warrant a medium sensitivity ranking. The remaining length of the alignment alternative to the UPRR connection falls within the Franciscan Group, San Luis Ranch Alluvium, Dos Palos Alluvium, and artificial fill, none of which are sensitive for paleontological resources. Overall, this alignment alternative was identified to have a low sensitivity for paleontological resources.

Henry Miller (BNSF Connection) Alignment Alternative

This alignment alternative would have the same known resources as identified for the Henry Miller (UPRR Connection) alignment alternative.

This alignment alternative would have similar paleontological sensitivity as the Henry Miller (UPRR Connection) alignment alternative.

GEA North Alignment Alternative

This alignment alternative is in Merced County in the Central Valley. Much of the area has seen little development historically. Previously recorded resources present include four archaeological sites and five architectural resources. All four of the archaeological resources are prehistoric sites, including a habitation site and human burials just west of the city of Merced. Overall, this alignment alternative has medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

In the vicinity of San Luis Reservoir, the alignment alternative crosses the Los Banos Alluvium, a sensitive unit that could include vertebrate fossils. The remaining length of the alignment alternative to the UPRR or BNSF connection falls within formations that are not sensitive for paleontological resources. Overall, this alignment alternative was identified to have a low sensitivity for paleontological resources.

San Jose to Central Valley Corridor Station Location Options

Only the San Jose Diridon station location option within this corridor has a recorded architectural resource that is within the APE or directly adjacent to the APE. No traditional cultural properties were identified within the APE.

The overall paleontological sensitivity for each of the station location options is low. Specific impacts to paleontologic resources associated with construction of the station location options requires additional information concerning exact locations and subsurface geology. Additional paleontologic resources assessment would take place at the project level after the station designs are more fully defined.

East Bay to Central Valley Corridor

I-680/580/UPRR Alignment Alternative

This alignment alternative spans from the eastern Bay Area to the Livermore Valley and has the highest density of cultural resources within this corridor. Much of the area has seen recent development. Along this alignment alternative, there are eight previously recorded archaeological sites. There are 12 recorded architectural resources, including the Western Pacific Railroad Buildings (ca. 1909), the Kennedy Ranch (ca. 1890), and 10 residential (mainly Craftsman) properties dating from 1910 to 1940. The archaeological resources are prehistoric sites. Overall, this alignment alternative has medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

This alignment alternative extends through approximately 7 miles of Pleistocene alluvium and sediments and approximately 2 miles of Miocene sedimentary rock, all of which may have a high sensitivity for paleontological resources. The remaining length of the alignment alternative falls within formations that are not sensitive for paleontological resources. Overall, this alignment alternative was identified to have a high sensitivity for paleontological resources.

I-580/UPRR Alignment Alternative

The Livermore Valley has seen little archaeological work until recently though it is known to be rich in prehistoric resources, including large habitation sites and burials. Several unrecorded burials are located immediately adjacent to the APE just west of the city of Livermore. Previously recorded resources within the alignment alternative include six archaeological sites and 11 architectural resources. Recorded resources include a 1947 industrial warehouse, the Quonset Warehouse (ca. 1950s), the West Altamont Underpass (ca. 1909), and eight recorded residential properties dating between 1890 and the 1930s. The archaeological resources are prehistoric sites. Overall, this alignment alternative has medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

This alignment alternative also extends through approximately 7 miles of Pleistocene alluvium and sediments and over 2 miles of Miocene sedimentary rock, all of which may have a high sensitivity for paleontological resources. Overall, this alignment alternative was identified to have a medium sensitivity for paleontological resources.

Patterson Pass/UPRR Alignment Alternative

This alignment alternative includes three previously recorded archaeological resources and three architectural resources. Overall, this alignment alternative has low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

This alignment alternative extends through approximately 2 miles of Pleistocene alluvium and sediments and over 9 miles of Miocene sedimentary deposits along Patterson Pass. Overall, this alignment alternative was identified to have a low sensitivity for paleontological resources.

UPRR Alignment Alternative

This alignment alternative includes five previously recorded archaeological resources and one architectural resource. Overall, this alignment alternative has low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

This alignment alternative extends through approximately 2.5 miles of Pleistocene alluvium and sediments and approximately 1 mile of Miocene sedimentary deposits. Overall, this alignment alternative was identified to have a medium sensitivity for paleontological resources.

Tracy Downtown (BNSF Connection) Alignment Alternative

This alignment alternative includes eight previously recorded archaeological resources and 10 architectural resources. Some of the archaeological sites are prehistoric and include midden sites with few to no artifacts or related materials. The majority of the architectural resources are located south of Tracy. Overall, this alignment alternative has a low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

The west end of this alignment alternative extends through more than 2 miles of Miocene sedimentary deposits. The remaining length of the alignment alternative falls within formations that are not sensitive for paleontological resources. Overall, this alignment alternative was identified to have a low sensitivity for paleontological resources.

Tracy ACE Station (BNSF Connection) Alignment Alternative

This alignment alternative includes two previously recorded archaeological resources and 13 architectural resources. Recorded resources include eight World War II era warehouses, a 1952 U.S. Army Depot flagpole, and four U.S. Army Depot buildings from the 1950s. Some of the archaeological sites are prehistoric and include midden sites with few to no artifacts or related materials. The majority of the architectural resources are located south of Lathrop. Overall, this alignment alternative has low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

The west end of this alignment alternative extends through approximately 6 miles of Miocene sedimentary deposits. The remaining length of the alignment alternative falls within formations that are not sensitive for paleontological resources. This alignment alternative, along with the Tracy ACE Station (UPRR Connection) alignment alternative, would have the highest potential to affect paleontological resources compared to the other alignment alternatives within this corridor. Overall, this alignment alternative was identified to have a low sensitivity for paleontological resources.

Tracy ACE Station (UPRR Connection) Alignment Alternative

This alignment alternative includes two previously recorded archaeological resources and 10 architectural resources. Similar to the other Tracy alignment alternatives, the archaeological resources include midden sites, and the majority of the architectural resources are located south of Lathrop. Overall, this alignment alternative has low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

The west end of this alignment alternative extends through approximately 6 miles of Miocene sedimentary deposits similar to the Tracy ACE Station (BNSF Connection) alignment alternative. Overall, this alignment alternative was identified to have a low sensitivity for paleontological resources.

Tracy Downtown (UPRR Connection) Alignment Alternative

This alignment alternative includes eight previously recorded archaeological resources and seven recorded architectural resources. These include an undated wooden Western Pacific Railroad trestle, two industrial warehouses from the 1950s, residential properties from the 1940s, and an undated farmstead property. Similar to the Tracy Downtown (BNSF Connection) alignment alternative, the archaeological resources include midden sites, and the majority of the architectural resources are located south of Tracy. Overall, this alignment alternative has a low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

The west end of this alignment alternative extends through approximately over 2 miles of Miocene sedimentary deposits similar to the Tracy Downtown (BNSF Connection) alignment alternative. Overall, this alignment alternative was identified to have a low sensitivity for paleontological resources.

East Bay Connections Alignment Alternative

The East Bay Connections alignment alternative is not known to have cultural resources that are within the APE or directly adjacent to the APE. No traditional cultural properties were identified within the APE.

This alignment alternative would extend through approximately 1,000 ft of Pleistocene alluvium deposits and about one mile of Miocene sedimentary deposits. These units may have a high sensitivity to paleontological resources.

East Bay to Central Valley Corridor Station Location Options

Based on the archival records search, none of the station location options have cultural resources that are within the APE or directly adjacent to the APE. The station location options were found to have a low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

The overall paleontological sensitivity for the stations in this corridor is low, except for the Livermore (I-580) and Livermore (Greenville Road/I-580) stations, which are high. Specific impacts to paleontologic resources associated with construction of the station location options require additional information concerning exact locations and subsurface geology. Additional paleontologic resources assessment would take place at the project level after the station designs are more fully defined.

San Francisco Bay Crossings Corridor

Trans Bay Crossing – Transbay Transit Center Alignment Alternative

Most of this alignment alternative is below the San Francisco Bay and therefore has very low sensitivity for archaeological resources. However, the terrestrial portions are highly sensitive for both historical archaeological deposits and architectural resources. One resource, the Transbay Terminal, was built in 1939 as a California Toll Bridge Authority facility in order to facilitate commuter rail travel across the lower portion of the San Francisco-Oakland Bay Bridge. The historic Transbay Terminal will be replaced along with the Transbay Terminal Loop Ramp with a new structure as part of the new Transbay Transit Center sometime between 2008 and 2014. Another resource within the APE is the Historic Ferry Building. Originally constructed in 1903, it was the second busiest transportation terminal in the world during the 1930s. Previous subsurface archaeological testing has revealed that much of the area is rich with historic artifacts from the Gold Rush period through the 1906 earthquake and resulting fire. This alignment alternative also traverses the Embarcadero Piers Historic District (City and County of San Francisco Planning Department 2004). No traditional cultural properties were identified within or adjacent to the APE.

This alignment alternative would extend through mud deposits and Quaternary dune sand deposits. Because of the low likelihood of these units containing significant paleontological resources, this alignment alternative has a low paleontological sensitivity.

Trans Bay Crossing – 4th and King Alignment Alternative

Like the Trans Bay Crossing – Transbay Transit Center alignment alternative, this alignment alternative is below the San Francisco Bay and therefore has very low sensitivity for archaeological resources. However, the terrestrial portions are highly sensitive for both historical archaeological deposits and architectural resources. Previous subsurface archaeological testing has revealed that much of the area is rich with historic artifacts from the Gold Rush period through the 1906 earthquake and resulting fire. No traditional cultural properties were identified within or adjacent to the APE.

This alignment alternative would have similar paleontological sensitivity as the Trans Bay Crossing – Transbay Transit Center alignment alternative.

Dumbarton Alignment Alternative (High Bridge, Low Bridge, Tube)

Four recorded archaeological resources were identified along this alignment alternative. The prehistoric sites include a habitation site associated with burials, while the historic sites resulted from early 1900s industrial activities. No recorded architectural resources were identified in the records search for this alignment alternative. The cultural resources sensitivity for this alignment alternative is low. No traditional cultural properties were identified within or adjacent to the APE.

This alignment alternative would extend through mud deposits and Quaternary dune sand deposits on the San Francisco and Oakland side of the Bay, which have low sensitivity for paleontological resources. The alignment alternative would also extend through a small portion of Pleistocene alluvium on the Oakland side of the Bay, which has a high sensitivity for paleontological resources. Overall, this alignment alternative has a low paleontological sensitivity.

Freemont Central Park Alignment Alternative (High Bridge, Low Bridge, Tube)

No recorded archaeological or architectural resources were identified in the records search for of this alignment alternative. No traditional cultural properties were identified within or adjacent to the APE.

This alignment alternative is generally similar in paleontological sensitivity as the Dumbarton alignment alternative except where the alignment alternative would extend through Pleistocene alluvium on the Oakland side of the Bay. This alignment alternative extends for about a mile through this unit, which has a high paleontological sensitivity. Overall, this alignment alternative has a low paleontological sensitivity.

Central Valley Corridor

BNSF/UPRR Alignment Alternative

This alignment alternative and all of those within this corridor trend north-south through the Central Valley beginning south of Stockton to just south of Chowchilla. This alignment alternative generally follows existing railroad lines. In total, there is one previously recorded archaeological resource and 27 architectural resources. These include a 1947 railroad trestle, a 1950 flatcar railroad bridge, Robertson Boulevard (ca. 1913); Redrock Winery (ca. 1920); Le Grand Canal (ca. 1910), and 22 recorded residential properties dating between 1920 and the 1940s. Most of the architectural resources are within the cities of Escalon and Chowchilla. Overall, this alignment alternative has low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

This alignment alternative would cross Quaternary dune sand deposits between Atwater and Merced. Because of the low likelihood of these units containing significant paleontological resources, this alignment alternative has a low potential to encounter paleontological deposits.

BNSF Alignment Alternative

Similar to the BNSF/UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. In total, there is one previously recorded archaeological resource and 16 recorded architectural resources. These include the 1912 Escalon Water and Auxiliary Water Systems; the 1935 Escalon Sanitary Sewer System; portions of the 1895 Atchison, Topeka, and Santa Fe Railroad; Bud's Frosties (ca. 1946); Farmer Bill's Produce (ca. 1940); and 11 recorded residential properties dating between 1910 and the 1940s. Most of the architectural resources are within or around the city of Escalon. Overall, this alignment alternative has low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

Similar to the BNSF/UPRR alignment alternative, this alignment alternative has a low potential to encounter paleontological deposits.

UPRR N/S Alignment Alternative

Similar to the BNSF/UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. In total, there are four previously recorded archaeological resources and 63 architectural resources. Some of the archaeological resources are prehistoric sites, including a habitation site associated with burials, while the historic sites resulted from early 1900s industrial activities. Most of the architectural resources are around the communities of Delhi, Livingston, Atwater, and Chowchilla. There is a series of historic canals recorded in this portion of the alignment alternative including the Ashe Lateral (ca. 1890s), the Fairfield Canal (ca. 1910), the 1920 Arena Canal, and seven other unnamed canals dating to ca. 1900. There are also four freeway bridges dating from the 1940s. This portion includes la Fuentes Market (ca.1940) and A.V. Produce (ca. 1925), as well as 43 recorded residential properties dating from the 1890s to the 1950s. Overall, this alignment alternative has medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

Similar to the BNSF/UPRR alignment alternative, this alignment alternative has a low potential to encounter paleontological deposits.

BNSF Castle Alignment Alternative

Similar to the BNSF/UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. In total, there is one previously recorded archaeological resource and 20 architectural resources. Most of the architectural resources are within the cities of Escalon and Chowchilla, such as the Escalon Motel (ca. 1940s), a 1926 Texaco Station, and Wright's Petroleum (ca.1918). Some of the architectural resources are single-family residences (11 recorded) built in the early 1900s. There are also features associated with the railroad such as a 1909 wooden railroad trestle and portions of the Tidewater Southern Railroad dating from 1912. Overall, this alignment alternative has low sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

Similar to the BNSF/UPRR alignment alternative, this alignment alternative has a low potential to encounter paleontological deposits.

UPRR-BNSF Castle Alignment Alternative

Similar to the BNSF/UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. In total, there are four previously recorded archaeological resources and 20 architectural resources. The recorded architectural resources include the Riverbank Library (ca. 1899), irrigation canals (ca. 1900), 1904 railroad bridge, 1910 farmstead, and numerous (13 recorded) residential properties dating between 1900 and 1950. This portion also contains segments of the 1895 Atchison, Topeka, and Santa Fe Railroads. Some of the archaeological resources are prehistoric sites, including a habitation site associated with burials, while the historic sites resulted from early 1900s industrial activities. Most of the architectural resources are around the cities of Modesto and Merced. Overall, this alignment alternative has medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

Similar to the BNSF/UPRR alignment alternative, this alignment alternative has a low potential to encounter paleontological deposits.

UPRR-BNSF Alignment Alternative

Similar to the BNSF/UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. There are four previously recorded archaeological resources within this alignment alternative and 27 recorded architectural resources, including three ca. 1940 highway bridges, abandoned segments of State Route 99 that are potentially historic, 1940s farms and associated structures, and numerous (19 recorded) residential properties dating between ca. 1900 and 1950. Some of the archaeological resources are prehistoric sites including a habitation site associated with burials, while others are historic sites resulting from early 1900s industrial activities. Most of the architectural resources are around Chowchilla. Overall, this alignment alternative has medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

Similar to the BNSF/UPRR alignment alternative, this alignment alternative has a low potential to encounter paleontological deposits.

Central Valley Corridor Station Location Options

Based on the archival records search, none of the station location options have known cultural resources that are within the APE or directly adjacent to the APE. Only the Modesto (Downtown) and Merced (Downtown) station location options were found to have a medium sensitivity for cultural resources. No traditional cultural properties were identified within the APE.

The station location options within this corridor would be located within formations with a low likelihood of containing significant paleontological resources; therefore, the station location options would have a low potential to encounter paleontological deposits.

3.12.4 Conclusion

One factor that contributes to the difference in density of cultural resources for the various alignment alternatives should be considered—no archaeological surveys have been conducted. Much of the Central Valley has not been subjected to formal archaeological survey. This is also true for many of the alignment alternative areas that span between urban centers in the Bay Area. Because of this, there is potential for numerous unrecorded (mostly prehistoric) cultural resources to be located within the project-level APEs. A formal, systematic survey should be conducted prior to any ground disturbing activities. All previously recorded resources within the project-level APEs need to be evaluated for inclusion on the CRHR.

3.12.5 Design Practices

The Authority and FRA are committed to avoiding potential impacts to cultural resources through careful alignment alternative design and selection. The Authority is committed to avoiding impacts to cultural resources to the extent feasible and practical.

The Authority would develop procedures for fieldwork, identification, evaluation, and determination of potential effects to cultural resources in consultation with SHPO and Native American tribes. Onsite monitoring is often incorporated in the fieldwork when sites are known or suspected of containing Native American human remains. The procedures need to comply with federal and state statutes concerning burials.

3.12.6 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the CEQA Appendix G thresholds of significance for cultural and historic resources, the HST Alignment Alternatives would have a potentially significant effect on cultural and historic resources when viewed on a systemwide basis. Although placing the alignment alternative for the HST system within or along existing transportation corridors reduces the potential for adverse effects to many resources, providing HST service to and placing potential station location options in metropolitan centers increases the potential for adverse impacts to cultural and historic resources. Additional avoidance and mitigation strategies would be applied in the project-level analyses. However, some cultural and historic resources would likely be adversely affected. At the program level of analysis, it is not possible to know precisely the location, extent, and particular characteristics of impacts to these resources. Because of this uncertainty, at the program-level of analysis the impact is considered significant. Mitigation strategies, as well as the design practices discussed in Section 3.12.7, Subsequent Analysis, would be applied to reduce these impacts.

General mitigation strategies are discussed in this section as part of this program-level evaluation. The Authority and FRA would consult with SHPO to define and describe general procedures to be applied in the future for fieldwork, methods of analysis, and the development of specific mitigation measures to address effect and impacts on cultural resources, which would be reflected in a programmatic agreement between the Authority, FRA, and SHPO. The Authority and FRA would also continue to consult with Native American tribes concerning the proposed undertaking, as required by federal and state laws concerning the management of historic properties/historical resources. Mitigation measures would be required for adverse effects (significant under CEQA) on cultural resources that are listed, determined eligible for, or that appear to be eligible for listing in the NRHP or CRHR. The mitigation measures ultimately selected for this undertaking would meet the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-44740), as well as standards and guidelines for historic preservation activities established by the California SHPO.

At the conclusion of the program-level environmental review process, the Authority and the FRA, in consultation with the SHPO, would develop a programmatic agreement (PA) to describe expectations for the next phase of fieldwork, eligibility determination, and documentation under Section 106 of NHPA and pursuant to CEQA. The PA may specify procedures for the identification and evaluation of impacts for future projects and the site-specific work that would be required during project-level environmental review.

These potential measures provide two levels of mitigation and are organized by resource type. One level of mitigation strategies are those that, when implemented as conditions of project approval, would enable the project to avoid an adverse effect or impact. The other level of mitigation includes measures that would lessen the degree of adverse effect or impact. No one measure presented in this section would mitigate all adverse effects or impacts; however, some combination of these measures and others agreed to during the project phases of the program would emerge as the mitigation for this project.

In general, there is a wide range of actions that can qualify as mitigation, depending on the type of project, the type of property, and impacts the project may have on cultural resources. The following list presents some of the principles that generally guide mitigation development in historic preservation practice.[6]

- Mitigation measures should correspond or be directly related to the resource being affected, rather than in a compensatory fashion that does not relate to the affected resource.
- Mitigation should be consistent with the significance of the historic property and correspond to the severity of project effects on the historic property.
- Mitigation must be relevant to the goals of historic preservation, rather than as an enhancement of the project to which it is related or as an enhancement to amenities unrelated to the affected properties.
- Mitigation measures that are chosen should be a worthwhile use of public funds and provide a high degree of public benefit relative to the cost.
- Mitigation measures should benefit the greatest number of people, particularly those members of the interested public rather than only those of a specialized audience or particular group.
- Historic properties that would be demolished or greatly altered should be documented in permanent forms.

At a program-level of analysis (as discussed above) it is not possible to know precisely the location, extent, and particular characteristics of impacts to cultural resources. Given that the impacts are considered significant, the following mitigation measures will be applied as appropriate.

A. ARCHAEOLOGICAL RESOURCES

The following are potential mitigation measures for eligible or listed archaeological sites:

- Avoid the impact, and when avoidance cannot be accommodated, consider minimizing the scale of the impact.
- Incorporate the site into parks or open space (PRC § 21083.2).
- Cap or cover the site before construction.
- Provide data recovery.
- Develop procedures for fieldwork, identification, evaluation, and determination of potential effects to cultural resources in consultation with SHPO and Native American tribes. Onsite monitoring is often incorporated in the fieldwork when sites are known or suspected of

[6] These factors are based on those presented in: Caltrans, "San Francisco-Oakland Bay Bridge East Span Seismic Safety Project, Consideration of Proposed Mitigation Measures," September 1999.

containing Native American human remains. The procedures need to comply with federal and state statutes concerning burials.

Avoidance is preferred, but if adjustments to the alignment alternative plan or profile are not feasible, data recovery may be provided. When impacts will destroy or affect the data potential of a property (NRHP Criterion D/CRHR Criterion 4), data recovery may consist of archaeological excavation of an adequate sample of site contents so that the research questions applicable to the site can be addressed. Recovery of important information from the site mitigates the information loss that will result from site destruction. If only part of a site is impacted by the project, data recovery will only be necessary for that portion of the site. Data recovery will not be required if the agency determines prior testing and studies have adequately recovered the scientifically consequential information from the resources (CEQA Guidelines, 14 C.C.R. § 15126.4[b]).

When other NRHP or CRHR criteria are relevant (e.g., Criterion A/1; Criterion B/2; Criterion C/3) or when a traditional cultural property is involved, it is often necessary to consider more diverse mitigation measures.

B. HISTORIC PROPERTIES/RESOURCES

Measures to avoid adverse effects will include steps taken in both the design and construction phases of the project. Avoidance has occurred and will occur during the design phase by not including components that could possibly effect or impact historic properties/resources. Avoidance will also occur by conducting construction activities in a manner to actively evade historic properties/resources.

The following are potential mitigation measures for historic properties/resources.

Stabilization/Monitoring during Construction. The lead agency will prepare a treatment plan that will present a detailed methodology for the protection of historic properties/resources, such as buildings, structures, objects, and sites, and cultural landscape elements that are in close proximity to construction activities. This treatment plan will describe methods for the preservation, stabilization, shoring/underpinning, and monitoring of buildings, structures, and objects. The treatment plan will also include provisions that high vibration construction techniques would be avoided in sensitive areas. Underpinning and/or other stabilization methods will be used at buildings located near project construction areas that may be susceptible to damage or inadvertent destruction.

Measures to Lessen Adverse Effects. Measures to minimize project impacts to historic properties/resources will occur in pre-construction, construction, and post-construction phases. Many of these mitigation measures will require careful agency review and may require stipulations in the contracts of the construction contractors to ensure appropriate preservation of cultural resources.

Recordation. The lead agency will ensure that cultural resources adversely affected by the project will be recorded and documented to the standards of the Historic American Building Survey (HABS) or Historic American Engineering Record (HAER). This will require coordination with the NPS HABS/HAER program to determine the appropriate level of recordation. This coordination will also address the adequacy of recordation previously conducted for historic properties/resources that may be adversely affected.

Design Guidelines. The lead agency will ensure that design guidelines are developed to ensure sympathetic, compatible, and appropriate designs for new construction. Aesthetic details can be considered mitigation, but there may be a limit to the amount of change possible in the design once important engineering and environmental considerations have been taken into account. It is most likely that the design guidelines mitigation will apply to the visual appearance of the project rather than specifics of alignment alternative, overall depth/width, or placement of supports. Design guidelines will be informed by the documentation prepared under HABS/HAER standards. It will be necessary for an architectural historian or a historical architect to advise the structural designers on appropriate architectural treatments that serve as mitigation. SHPO and other agencies will review draft design guidelines and provide comment on the guidelines as well as on proposed design changes.

Interpretive/Educational Materials and Popular Report. The lead agency will prepare interpretive and/or educational materials and programs regarding the affected historic properties/resources. The focus of this mitigation will be the historic themes related to these resources. Such materials and/or programs may include a popular report, documentary videos, booklets, interpretive signage, and additional interpretive information made available to state and local agencies. These materials may also include salvage items, historic drawings, interpretive drawings, current and historic photographs, models, and oral histories. Assistance will also be provided for archiving or digitizing the documentation of cultural resources affected, as well as for the dissemination of the material to appropriate repositories.

Relocation. Historic properties/resources that will be otherwise demolished because of the project may be relocated and rehabilitated. In consultation with the NPS, the lead agency will ensure that these buildings or structures are recorded to HABS standards prior to their removal. The lead agency/project proponent will be responsible for preparing a removal plan, including site plans for the new locations, and placing the resource on new foundations according to conditions consistent with those that existed prior to the move.

Monitoring (Architectural/Cultural Landscape). The project construction documents and new construction will be monitored to ensure they conform to the design guidelines and any other treatment procedures agreed to by the consulting parties. A professional architectural historian and a professional historical landscape architect who meet the Secretary of the Interior's *Professional Qualifications Standards* (48 FR 44738-9) will monitor construction to identify conditions that conflict with the mitigation measures. The lead agency will take steps to correct these conflicts.

Minor Repairs and Reconstruction. The lead agency will ensure that inadvertent damage to historic properties/resources is repaired in accordance with the Secretary of the Interior's *Standards for Treatment of Historic Properties*.

Salvage. The lead agency will ensure that selected decorative or architectural elements of the adversely affected historic properties/resources are reviewed for feasibility of salvage in order to mitigate their loss or destruction. Where possible, these elements will be retained and incorporated into the new construction. Where re-use is not possible, selected salvaged elements will be made available for use in interpretive displays either near the affected resources or at another appropriate venue, such as a museum.

C. PALEONTOLOGICAL RESOURCES

Mitigation measures for paleontological resources would be developed and implemented at the project level. The following measures may be included.

- Educate workers.
- Recover fossils identified during the field reconnaissance.
- Monitor construction.
- Develop protocols for handling fossils discovered during construction, likely including temporary diversion of construction equipment so that the fossils could be recovered; identified; and

prepared for dating, interpreting, and preserving at an established, permanent, accredited research facility.

The above mitigation strategies, including implementation of a PA addressing historic resources and continued consultation and coordination with tribal representatives, are expected to substantially lessen or avoid impacts to cultural and historic resources in most circumstances. At the project-level of review, it is expected that for proposed HST Alignment Alternatives that result in impacts to cultural and historic resources, most of the impacts will be mitigated to a less-than-significant level, but it is possible that for some alignment alternatives, impacts will be significant. Sufficient information is not available at the program level to conclude with certainty that the above mitigation strategies will reduce impacts to affected resources to a less-than-significant effect in all circumstances. Therefore, potential impacts to cultural and historic resources are considered significant at the program level even with the application of mitigation strategies. Additional environmental assessment will allow more precise evaluation in project-level environmental analyses.

3.12.7 Subsequent Analysis

The following paragraphs describe the procedures that would be necessary at the project-level stage of environmental review to determine appropriate and feasible mitigation measures in consultation with the SHPO, if a decision is ultimately made to go forward with the proposed HST system. These procedures would satisfy the NHPA and CEQA requirements.

As allowed under 36 CFR § 800.4(b)(2), a phased approach to identification of historic properties can be used when the proposed undertaking involves corridors. As indicated by the results of this study, FRA and the Authority have determined that historic properties likely exist along various corridor alignment alternatives through background research, consultation, and abbreviated field reconnaissance. Once alignment alternatives have been refined at the project level, full identification efforts may proceed. Under NHPA Section 106 and implementing regulations (36 CFR § 800), the procedures would include identifying resources with the potential to be affected, evaluating their significance under NRHP and CEQA, identifying any substantial adverse effects, and then evaluating potential mitigation.

In the interest of identifying archaeological sites within the project-level APE, a field survey should be completed which would identify those sites evident on the surface, geomorphological maps and studies should be reviewed to assess the potential for the project-level APE to contain significant buried sites, and historic maps and an historic overview or context should be developed in the interest of identifying potential historical archaeology sites within the project-level APE.

Additional efforts must also be made to consult with appropriate tribes and individuals knowledgeable about the nature and locations of potential traditional cultural properties.

Identifying potentially affected archaeological and historical properties/resources would require identification and evaluation within a more specifically defined project-level APE that would include the area where direct and indirect impacts from construction could occur (including locations of easements and construction-related facilities, such as equipment staging areas, borrow and disposal areas, access roads, and utilities) and the areas where the settings of any eligible historic buildings and structures, or the buildings and structures themselves, could be materially or significantly altered.

All identified resources would then be evaluated using NRHP and CRHR eligibility criteria. Evaluating archaeological sites may require preparing test plans for archaeological resources that contain regionally relevant research questions. The Authority and the FRA would consult with the SHPO on any test plans and determinations of eligibility for evaluated resources. The impacts of a proposed specific project on resources determined eligible would be analyzed. An impact analysis report may then be reviewed with the SHPO. Mitigation measures needed to address impacts on specific resources could then be developed and incorporated in MOAs between the SHPO, the Advisory Council on Historic Preservation, the FRA, and the Authority during the preparation of site-specific environmental evaluation. The mitigation measures in the MOAs would then be incorporated into site-specific environmental documentation and project approvals.

A paleontological resource assessment program would also be completed as part of the subsequent analysis for a project-level EIR/EIS. The assessment program would include field reconnaissance to identify exposed paleontological resources and more precisely determine potential paleontologic sensitivity for the project. A paleontological resources treatment plan would be prepared by a qualified paleontologist. The plan would be included in project approval and would address the treatment of paleontological resources discovered prior to and during construction.

Further consultation would also occur at the project level with the NAHC as necessary and with Native American groups when traditional territories may be close to project-level APEs for the project. Additionally, more specific information related to traditional cultural sites of concern would be obtained as necessary.

3.13 Geology and Soils

Active seismicity represents a key constraint on design and construction for the HST Alignment Alternatives[1]. Portions of HST Alignment Alternatives would require special design, including additional structural ductility and redundancy to withstand severe ground shaking, potential liquefaction, and other types of seismically induced ground failure. Conceptual HST Alignment Alternatives have been designed to cross major faults at grade wherever possible. However, design constraints along several of the alignment alternatives have resulted in crossing faults on aerial structures, and, in one case, in tunnel. In any case, active fault crossings would require special designs to minimize potential damage to the rail lines and other infrastructure as a result of surface fault rupture and surface disruption associated with fault creep.

Construction of mountain crossings for the HST Alignment Alternatives would be constrained by existing unstable slopes and areas of difficult excavation. The tunnels proposed in the alternative alignments would pose additional design and construction issues because of difficult excavation conditions.

Potential geologic impacts that are categorized as high or significant should not be regarded as precluding construction of an alignment alternative or segment, or as necessarily indicating that these would be potentially adverse impacts. Rather, they identify aspects of project design where additional study would be needed and where engineering and design effort would be required to avoid or mitigate the impacts.

3.13.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

A number of state regulations apply to geologic hazards and engineering geologic practice. The following paragraphs summarize key regulatory provisions; more detailed discussion is deferred to project-level environmental documentation because these regulations, if applicable, relate to site-specific conditions and thus would be applied as appropriate at the project level rather than the program level.

Principal state guidance relating to geologic hazards is contained in the Alquist-Priolo Act (P.R.C. § 2621 *et seq.*) and the Seismic Hazards Mapping Act of 1990 (P.R.C. § 2690–2699.6). The Alquist-Priolo Act prohibits the location of most types of structures for human occupancy across the active traces of faults in earthquake fault zones shown on maps prepared by the state geologist and regulates construction in the corridors along active faults (earthquake fault zones). The Seismic Hazards Mapping Act of 1990 focuses on hazards related to strong ground shaking, liquefaction, and seismically induced landslides. Under its provisions, the state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards. The maps are to be used by cities and counties in preparing their general plans and adopting land use policies to reduce and mitigate potential hazards to public health and safety.

Site-specific geotechnical investigations may be prepared to provide a geologic basis for the development of appropriate construction design for proposed projects, including mitigation/ remediation of geologic hazards where this is possible. Geotechnical investigations typically assess the bedrock and Quaternary geology, including soils; the previous history of excavation and fill placement on and in the vicinity of the site for a proposed project; and geologic structure, where relevant. They may also address the requirements of the Alquist-Priolo Act and the Seismic Hazards Mapping Act.

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

Pursuant to the Surface Mining and Reclamation Act (P.R.C. § 2710 *et seq.*), the State Mining and Geology Board identifies in adopted regulations areas of regional significance that are known to contain mineral deposits judged to be important in meeting the future needs of the area. (See P.R.C. § 2726 and 2790; Title 14 C.C.R. 3550, *et seq.*) The State Mining and Geology Board also adopts state policy for the reclamation of mined lands and certifies local ordinances for the approval of reclamation plans as being consistent with state policies (P.R.C. § 2755–2764, 2774 *et seq.*).

B. METHOD OF EVALUATION OF IMPACTS

To evaluate potential impacts related to geology and soils, each alignment alternative and each segment have been ranked for potential seismic hazards (ground shaking and ground failure potential), surface rupture hazard (number of active and potentially active fault crossings), slope instability, areas of difficult excavation, presence of oil/gas/geothermal fields (presence of the resource and/or production facilities), and presence of economic mineral resources. The analysis was performed generally on the basis of data available in geographic information systems GIS format, as opposed to detailed site investigations. The geologic data provided in this section are intended for planning purposes and are not intended to be definitive for specific sites. Alignments are evaluated as having high, medium, or low potential for geologic impacts based on the number of geologic constraints identified. Stations and other facilities are evaluated as having high or low potential for geologic impacts, based on the presence or absence of geologic constraints identified. These rankings made it possible to provide a rough comparison of the potential geologic constraints affecting the alternative alignments and station locations.

The following paragraphs describe the ranking process. Table 3.13-1 summarizes the ranking criteria for potential geologic and soils impacts.

Table 3.13-1
Ranking System for Comparing Impacts Related to Geology/Soils/Seismicity

Impact Ranking	Seismic Hazards (% of Length)	Active and Potentially Active Fault Crossings (Number of Crossings)	Slope Instability (% of Length)	Difficult Excavation (% of Length)	Oil and Gas Fields (% of Length)	Mineral Resource Sites (Present or Not Present)
Alignments						
High	>50	2+	>10	>25	>20	>20
Medium	10–50	1	5–10	10–25	10–20	10–20
Low	<10	0	<5	<10	<10	<10
Stations/Facilities						
High	Present	Present	Present	Present	Present	Present
Low	Not present	Not present	Not present	Not present	Not present	Not present

Seismic Hazards

Seismic hazards that potentially could constrain the design of proposed facilities were evaluated on the basis of potential for strong ground motion and potential for liquefaction. Areas potentially subject to strong ground motion are defined for this program-level study as areas where there is a 10% probability in 50 years that the peak horizontal ground accelerations in an earthquake will exceed 0.50 g (i.e., areas where peak horizontal ground acceleration may exceed 50% of the acceleration because of gravity) as mapped by the California Geological Survey (formerly the California Division of Mines and Geology) (State of California 1999). This acceleration is used to calculate the horizontal force a structure may be subjected to during an earthquake. For this analysis, liquefaction is conservatively assumed to be possible in all areas where peak ground accelerations could exceed 0.30g, except for areas mapped as underlain by bedrock. Where groundwater levels are not known from existing literature, they are conservatively assumed to be high, contributing to increased potential for liquefaction.

The ranking system for impacts related to seismic hazards used the percentage of each potential alignment within strong ground motion zones and/or potentially liquefiable zones. Station sites are compared by determining whether any portion of the proposed station site would be within a strong ground motion zone or potentially liquefiable zone.

- Alignments: High, medium, or low, based on percentage of alignment length in strong ground motion zones plus the percentage of length in potentially liquefiable zones.
- Stations: High if any part of the site would be within a strong ground motion zone or potentially liquefiable zone; otherwise, low.

Potential for Surface Rupture (Active and Potentially Active Fault Crossings)

Surface rupture hazard is evaluated based on whether any portion of a project alignment or facility would be located within 200 ft (62 m) of the mapped trace of any fault with known or inferred movement during Quaternary time (the past 1.6 million years), i.e., both active and potentially active faults. The State of California defines active faults as those that show evidence for movement in the last 11,000 years. Because of the extreme disruption of transit facilities that can result from surface fault rupture, this analysis deliberately adopted a conservative criterion for the assessment of surface rupture hazard and included potentially active faults, those with known or inferred movement over Quaternary time.

The ranking system for impacts related to surface rupture hazard is based on the number of active and potentially active fault crossings identified.

- Alignments: High, medium, or low, based on number of active and potentially active (Quaternary) fault crossings. Because the probability of fault rupture on potentially active faults is substantially lower than the probability of rupture of active faults, the impact is ranked as high or significant only when active faults are present. Crossing an active fault in tunnel is also ranked as High. If an alignment crosses two or more potentially active faults, but no active faults, the impact is ranked as medium.
- Stations: High if any part of the site is within 200 ft (60 m) of an active or potentially active (Quaternary) fault; otherwise, low.

Slope Instability

Slope stability is evaluated based on the slope gradient and geologic formations or units present along each alignment and at each facility site, as shown in statewide mapping compiled by Jennings (1977, 1991). Each mapped geologic units is assigned a rating for inferred slope stability, based primarily on lithology (physical characteristics of the rock formation) and age. This approach allows the identification of areas at risk for slope instability. A conservative 200-ft (60-m) buffer is included around each identified area of instability.

The ranking system for impacts related to slope instability is based on the percentage of each alignment in potentially unstable zones. Station sites are compared by determining whether any portion of the site is in an area of potential slope instability.

- Alignments: High, medium, or low, based on percentage of alignment length in a potentially unstable zone.
- Stations: High if any part of the site is in a potentially unstable zone; otherwise, low.

Difficult Excavation

Areas of potentially difficult excavation are identified based on bedrock geologic characteristics in combination with the presence of faults of any age, based on statewide mapping compiled by Jennings (1977, 1991) and information from selected 1:250,000-scale geologic map sheets for the study regions published by the California Geological Survey. Each fault crossing is conservatively assumed to be approximately 600 ft (185 m) wide.

The ranking system for impacts related to difficulty of excavation is based on the percentage of each alignment where excavation would be required in identified areas of difficult excavation. Station sites are compared by determining whether any portion of the site is in an identified area of difficult excavation.

- Alignments: High, medium, or low, based on percentage of surface segments in hard rock plus percentage of tunnel segments in fault zones.
- Stations: High if any part of the site is in a hard rock zone or fault zone; otherwise, low.

Oil, Gas, and Geothermal Fields

Areas where the presence of oil, gas, or geothermal resources could constrain project construction or operation are identified on the basis of published resource maps produced by the California Department of Conservation's Division of Oil, Gas, and Geothermal Resources (California Department of Conservation 2001a, 2001b).

The ranking system for impacts related to oil, gas, and geothermal fields is based on the percentage of each proposed alignment in identified oil and gas or geothermal field areas. Station sites are compared by determining whether any portion of the proposed site is in a mapped oil, gas, or geothermal field area.

- Alignment: High, medium, or low, based on percentage of alignment length in mapped oil, gas, or geothermal fields.
- Stations: High if any part of the site is in a mapped oil, gas, or geothermal field; otherwise, low.

Mineral Resources

Areas where the project could affect mineral resource extraction (primarily sand and gravel deposits) are identified on the basis of reports and published maps by the U.S. Geological Survey, and California Geological Survey.

The ranking system for mineral resources impacts is based on the number of mineral resources sites intersected by each alignment. Station sites are compared by determining whether any portion of the site is in a mineral resource area. The potential value of mineral resources varies with time with demand for the resource. Thus, evaluation of specific sites for relative importance will not be considered for this program-level study.

- Alignments: High, medium, or low, based on number of mapped resources within 200 ft (60 m) of a mineral resource area.
- Stations: High if any part of the site is within 200 ft (60 m) of a mineral resource area; otherwise, low.

C. CRITERIA FOR DETERMINING CEQA SIGNIFICANCE

A wide range of potential impacts is considered in the analysis of geology and soils, including seismic hazards, surface rupture hazards, slope instability, safety risks from difficulty in excavation, hazards related to oil and gas fields, and loss of accessibility to mineral resources. Each of these potential geologic and soils impacts is discussed in the following sections. Potential impacts associated with corrosive and expansive soils are difficult to quantify on a regional basis and consequently have not been ranked. However, the following sections briefly discuss the impacts and mitigation of corrosive and expansive soils.

Geologic conditions are evaluated with respect to the impacts the project may have on the local geology, as well as the impact that specific geologic hazards may have on the HST Alignment Alternatives. Impacts of the project related to the geologic environment are characterized on the basis of CEQA statutes and guidelines. Under CEQA guidelines (Appendix G), a project is considered significant if it:

- Exposes people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.
  - Strong seismic ground shaking.
  - Seismic-related ground failure, including liquefaction and lateral spreading.
  - iv) Landslides.
- Results in substantial soil erosion or the loss of topsoil.
- Is located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, subsidence, or collapse.
- Is located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.
- Results in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.
- Results in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

3.13.2 Affected Environment

A. STUDY AREA DEFINED

The study area for geology and soils is defined as the corridor extending 200 ft (60 m) on each side of the alignment centerlines, and a 200-ft (60-m) radius around each station site. This distance incorporates all cross sections except deep cuts and fills. As described in Method of Evaluation of Impacts above, alternatives were compared based on the number of sites with potential geologic or soils impacts per alternative, which depends on the length and location of the alignment; broadening the study area to include the entire width of deep cut-and-fill sections would not change the results of the comparison.

B. GENERAL DISCUSSION OF GEOLOGY AND SOILS

The following sections describe key project constraints related to geology and soils.

Seismic Hazards

Seismic hazards are generally classified in two categories: *primary seismic hazards* (surface fault rupture and ground shaking) and *secondary seismic hazards* (liquefaction and other types of seismically induced ground failure, including seismically induced landslides).

Primary: *Surface fault rupture*, or ground rupture, occurs when an active fault ruptures at depth to produce an earthquake, and the rupture propagates to the ground surface. Surface rupture can also occur as a result of slow, gradual motion referred to as *fault creep*. An area's potential for ground rupture is assessed based on the displacement history of the area's faults. Two categories of faults have been defined by the State of California in Special Publication 42 (Hart and Bryant 1997). *Active faults* are those that are known or inferred to have experienced movement in the past 11,000 years and are considered to have a high potential for future ground rupture. *Potentially active*[2] faults are those that are not known to have experienced movement in the past 11,000 years but have moved during Quaternary time (the past 1.6 million years). These faults may also pose a surface rupture hazard, but the hazard is more difficult to evaluate. For the purpose of this study, both active and potentially active faults were evaluated.

Ground shaking occurs in response to the release of energy during an earthquake. The energy released travels through subsurface rock, sediment, and soil materials as seismic waves, which result in motion experienced at the ground surface.

Secondary: *Liquefaction* and other types of seismically induced ground failure reflect loss of strength and/or cohesion when earth materials are subjected to strong seismic ground shaking. Earthquakes also can trigger landslides where slopes are prone to failure because of geologic conditions or because of modifications during construction.

Surface fault rupture, ground shaking, and seismically induced ground failure all can result in substantial damage to structures. Thorough assessment of the existing hazard combined with appropriate design and construction can reduce the potential for damage substantially.

Unstable Slopes

Slopes are considered unstable (prone to failure or landslides) when soil or rock strength is insufficient to resist gravitational forces or other loads. Slope instability can occur naturally as a result of a combination of factors such as bedrock bedding and/or fracture patterns, soil or rock strength, and groundwater levels, coupled with steep slopes. Slope failure also can be triggered by seismic activity or by improperly designed construction.

If slope instability is not adequately characterized and mitigated during design and construction, it can cause severe damage to surface and near-surface improvements as well as risks to public safety. However, slope instability generally can be addressed with planning and design.

Areas of Difficult Excavation

Subsurface geologic conditions will largely determine the ease or difficulty of excavation, which will in turn indicate the appropriate excavation technique for use in various areas. For instance, hard unfractured bedrock may be difficult to excavate using bulldozers and other earthmoving equipment, or too resistant to tunneling using a tunnel boring machine; in these areas, blasting may be required. On the other hand, fractured rock that contains groundwater also can be difficult to excavate using tunneling methods. Faulted material can pose an additional challenge by contributing to instability at the tunnel face.

[2] The term *potentially active* is under review for alternative nomenclature by California Geological Survey.

Geologic Resources

Geologic resources in California include oil and gas fields, geothermal fields, and a wide range of mineral resources. The principal constraint associated with oil, gas, geothermal, and mineral resources is the need for planning to ensure that construction of new facilities would not conflict with the removal of economically important resources and would avoid known problem areas to the extent feasible. In addition, the presence of even small (noneconomic) quantities of oil or gas in the subsurface can pose toxic or explosive hazards during construction, requiring specific precautions, and may also necessitate special designs and monitoring during the operation of subsurface structures such as tunnels. Similarly, certain mineral resources, such as serpentine (the source of natural asbestos) can result in hazardous working conditions if not properly managed.

Expansive and Corrosive Soil

Expansive soils shrink and swell as they lose and gain moisture during the local weather cycle. The resulting volumetric changes can heave and crack lightly loaded foundations and slabs. When expansive soils are identified during geotechnical design reports, their impact can be mitigated using standard geotechnical design practices, i.e., removal and replacement with engineered fill, the use of soil improvement techniques such as lime treatment, or by obtaining foundation support below the zone of seasonal moisture variation. Corrosive soils may adversely affect the long-term structural stability of steel and concrete. The impact of corrosive soils can be mitigated by using corrosion-resistant materials during construction.

C. GEOLOGY AND SOILS IN THE BAY AREA TO CENTRAL VALLEY REGION

The following paragraphs provide an overview of key geologic and geomorphologic features in the Bay Area to Central Valley Region, based on Norris and Webb's (1990) overview of California's geomorphic provinces and information from geologic and topographic maps published by the U.S. Geological Survey. The geology along the HST alignments is depicted on Figure 13.3-1.

The Bay Area to Central Valley Region comprises central California from the San Francisco Bay Area (San Francisco and Oakland) south to the Santa Clara Valley and east across the East Bay Hills, Livermore Valley, and Diablo Range to the Central Valley. The Bay Area to Central Valley Region spans two of California's geomorphic provinces: the Coast Ranges province and the Great Valley province.

The Coast Ranges province consists of generally northwest-trending ridges and valleys that form a rugged barrier between the Pacific Coast and inland California. The valley occupied by San Francisco Bay is bordered by the Diablo Range and East Bay Hills on the east and the Santa Cruz Mountains on the west. The Livermore Valley is located between the East Bay Hills and the Diablo Range. Other important valleys within the Coast Ranges province are the Salinas, Napa, and Sonoma Valleys.

The geology of the Diablo Range generally consists of a dense core of partially to completely metamorphosed rocks of the Franciscan Assemblage blanketed by sedimentary rocks of the Great Valley sequence with younger Tertiary Formations along the flanks of the range. The East Bay Hills typically comprise sedimentary rocks of the Great Valley Sequence and younger Tertiary Formations, with rocks of the Franciscan Assemblage along the western flank. In the intervening valleys, the bedrock is blanketed by Quaternary age alluvial deposits.

The Franciscan Assemblage typically consists of a mélange of coherent blocks (ranging in size from a few inches to several miles) of sandstone, siltstone, chert, and greenstone in a matrix of sheared shale and serpentinite. Slopes in the sheared shale and serpentinite often are unstable. The Great Valley Sequence consists of a series of non-metamorphosed sedimentary rocks ranging in age from Cretaceous to early Tertiary. They typically comprise marine sandstone and shale with occasional beds of conglomerate. The Tertiary Formations generally comprise poorly to moderately cemented claystone, shale, sandstone, and conglomerate. Slopes in the Tertiary units can be unstable, even at low angles, when the degree of compaction and cementation is low.

Along the margins of San Francisco Bay, the Quaternary sediments consist of intertidal deposits or organic rich bay mud, older alluvium, and alluvial fan deposits, locally blanketed by artificial fill. In the Livermore and Santa Clara Valleys, the Quaternary sediments typically comprise sand, gravel and clay. Locally the gravel in the Livermore Valley is mined as aggregate.

The Great Valley province comprises a large, elongated, north-trending valley situated between the Coast Ranges on the west and the Sierra Nevada on the east. Much of the Great Valley is at elevations near sea level (Norris and Webb 1990). The valley is a structurally controlled basin, with faults occurring at the boundaries between the valley and adjacent mountain ranges. Quaternary alluvium was deposited in the basin as it subsided. The Quaternary alluvium comprises fluvial, alluvial, and terrace deposits consisting of clay, silt, sand, gravel, and cobbles. The Quaternary sediments are generally finer-grained near the center of the valley and coarser-grained along the flanks of the valley. Individual geologic units include the Modesto, Riverbank, Dos Palos, Los Banos, San Luis Ranch, and Patterson Formations.

3.13.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

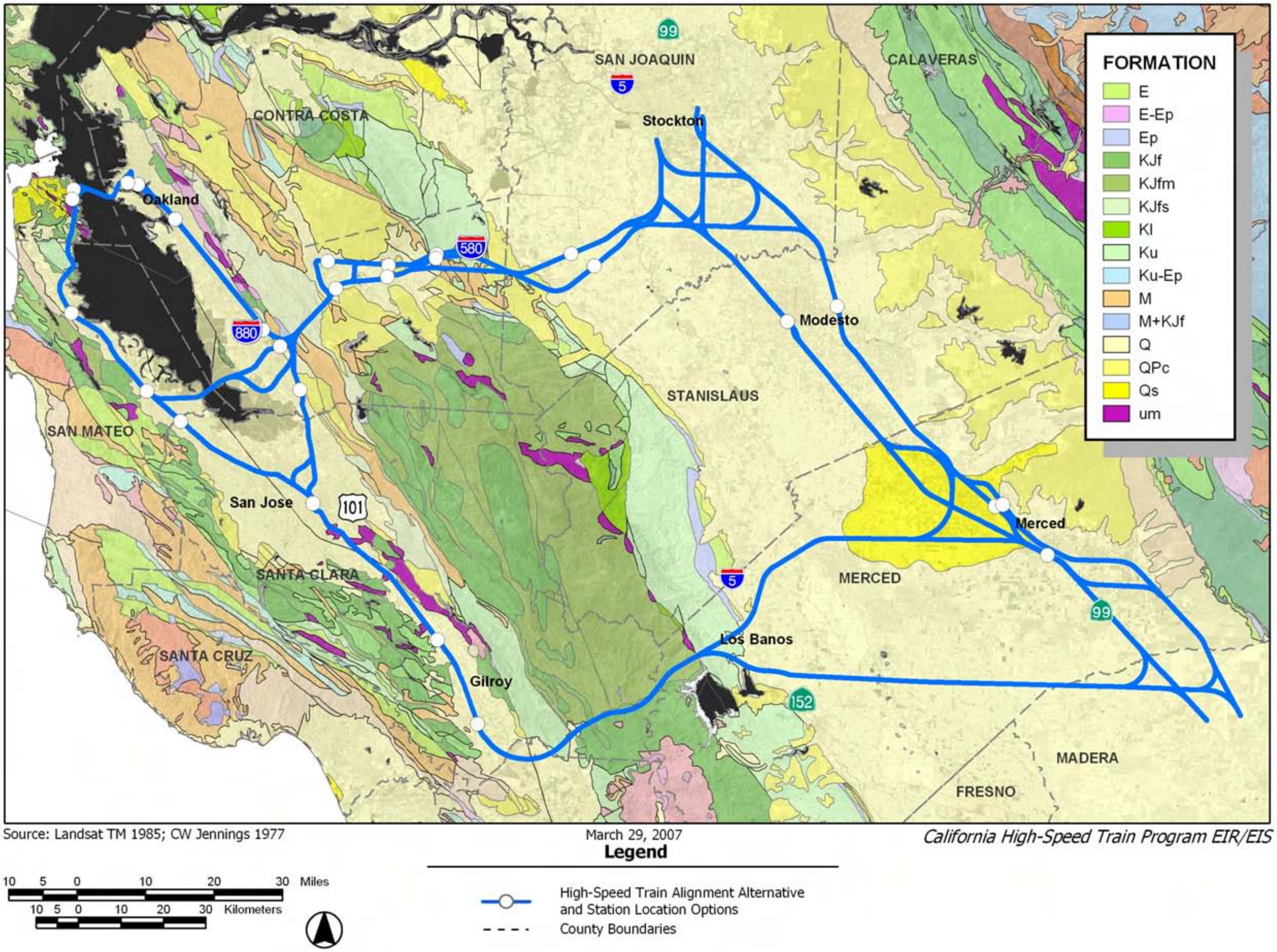
Existing conditions are as of 2006. The No Project Alternative includes existing transportation infrastructure plus all planned, approved, and funded projects that can reasonably be expected to be in operation by 2030. This analysis assumed that existing major infrastructure (bridges, for example) was designed, has been retrofitted, or is scheduled to be retrofitted to meet current design standards for seismic safety and other geologic constraints, and that future projects included in the No Project Alternative would incorporate similar safeguards as part of the development, design, and construction process. However, it is not possible to eliminate or mitigate all geologic hazards through design and construction. Some types of geologic hazards (seismic hazards in particular) are unpredictable. While it is difficult to evaluate the change in hazards (potential for geologic impacts) between existing conditions and No Project conditions, it can be assumed that some improvements in technology and materials as well as more stringent design codes will be implemented in the next 20 years to address seismic design of new structures. Thus the No Project Alternative would be somewhat improved from the existing conditions, but existing geologic risks were assumed to be representative of geologic risks under the No Project Alternative.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

Overall, the HST Alignment Alternatives would have the following impacts before mitigation: (1) ground shaking and ground failure, (2) ground rupture, (3) slope instability, (4) difficulty in excavation, and (5) hazards related to oil and gas fields.

Ground Shaking and Failure. Seismic hazards evaluated include ground shaking and ground failure. The HST Alignment Alternatives and facilities could cause risks to workers and public safety attributable to the collapse or toppling of facilities, either during construction or after completion, as a result of strong earthquakes. The HST Alignment Alternatives and facilities also could create risks to public safety from automobile accidents or the interruption of automobile circulation, if strong earthquakes cause a derailment. HST facilities could sustain damage from secondary hazards such as settlement over soft or filled ground.

Ground Rupture. The HST Alignment Alternatives and facilities could cause risks to workers and public safety as a result of ground rupture along active faults, either during construction or after completion. The HST Alignment Alternatives and facilities also could create secondary public safety


SAN JOAQUIN
CALAVERAS
CONTRA COSTA
Stockton
Oakland
Modesto
STANISLAUS
SAN MATEO
San Jose
Merced
MERCED
SANTA CLARA
Los Banos
SANTA CRUZ
Gilroy
MADERA
FRESNO
FORMATION
E
E-Ep
Ep
KJf
KJfm
KJfs
Kl
Ku
Ku-Ep
M
M+KJf
Q
QPc
Qs
um
Source: Landsat TM 1985; CW Jennings 1977
March 29, 2007
California High-Speed Train Program EIR/EIS
Legend
10 5 0 10 20 30 Miles
10 5 0 10 20 30 Kilometers
High-Speed Train Alignment Alternative and Station Location Options
County Boundaries

risks caused by damage to highways or interruption of these transportation services, in the event of train derailment caused by ground rupture along active faults.

Slope Instability. The HST Alignment Alternatives and facilities could cause risks to workers and public safety attributable to the failure of natural or construction cut slopes or retention structures.

Difficulty in Excavation. The HST Alignment Alternatives and facilities could cross areas with hard, unfractured bedrock that would be difficult to excavate using methods other than blasting, which may pose a safety risk. Faulted materials that may be present can result in instability in the face of a tunnel area, another potential hazard.

Hazards Related to Oil and Gas Fields. The HST could be adversely affected by the potential for migration of potentially explosive and/or toxic gases into subsurface facilities, such as tunnels or underground stations.

This analysis focused on comparing the difference in impacts anticipated with the various HST Alignment Alternatives compared to 2030 No Project conditions.

Table 3.13-2 shows geologic impact ratings for the HST Alignment Alternatives (an impact is a constraint to development) (see Table 3.13-A-1 in Appendix 3.13-A for more detail). They include:

- Seismic hazards and the potential for strong seismic ground shaking and liquefaction.
- Active and potentially active fault crossings.
- Unstable slopes.
- Difficult excavation of tunnels and deep cuts.
- Impacts on oil and gas fields.
- Impacts on mineral resources.

Table 3.13-2. Geology and Soils Summary Data Table for Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Seismic Hazards	Active and Potentially Active Fault Crossings	Slope Instability	Difficult Excavation	Oil and Gas Fields	Mineral Resources
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	H	M	L	L	L	L
	1 of 1	Dumbarton to San Jose	H	M	L	L	L	L
Station Location Options								
Transbay Transit Center			H	L	L	L	L	L
4th and King (Caltrain)			H	L	L	L	L	L
Millbrae/SFO			H	L	L	L	L	L
Redwood City (Caltrain)			H	L	L	L	L	L
Palo Alto (Caltrain)			H	L	L	L	L	L
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	H	M	L	L	L	L
		12th Street/City Center to Niles Junction	H	M	L	L	L	L
	1 of 2	Niles Junction to San Jose via Trimble	H	H	L	L	L	L
		Niles Junction to San Jose via I-880	H	H	L	L	L	L

Corridor	Possible Alignments	Alignment Alternative	Seismic Hazards	Active and Potentially Active Fault Crossings	Slope Instability	Difficult Excavation	Oil and Gas Fields	Mineral Resources
Station Location Options								
West Oakland/7th Street			H	L	L	L	L	L
12th Street/City Center			H	L	L	L	L	L
Coliseum/Airport			H	L	L	L	L	L
Union City (BART)			H	L	L	L	L	L
Fremont (Warm Springs)			H	L	L	L	L	L
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	H	H	M	M	L	L
	1 of 3	Henry Miller (UPRR Connection)	M	M	L	L	L	L
		Henry Miller (BNSF Connection)	M	M	L	L	L	L
		GEA North	M	M	L	L	L	L
Station Location Options								
San Jose (Diridon)			H	L	L	L	L	L
Morgan Hill (Caltrain)			H	L	L	L	L	L
Gilroy (Caltrain)			H	L	L	L	L	L
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	H	H	L	M	L	L
		I-580/ UPRR	H	H	L	M	L	L
		Patterson Pass/UPRR	H	H	M	H	L	L
		UPRR	H	H	L	M	L	L

Corridor	Possible Alignments	Alignment Alternative	Seismic Hazards	Active and Potentially Active Fault Crossings	Slope Instability	Difficult Excavation	Oil and Gas Fields	Mineral Resources
	1 of 4	Tracy Downtown (BNSF Connection)	M	M	L	L	L	L
		Tracy ACE Station (BNSF Connection)	M	H	L	L	L	L
		Tracy ACE Station (UPRR Connection)	M	H	L	L	L	L
		Tracy Downtown (UPRR Connection)	M	M	L	L	L	L
	2 of 2	East Bay Connections WPRR to UPRR	H	H	L	L	L	L
		East Bay Connections UP to UPRR	H	M	L	L	L	L
Station Location Options								
Pleasanton (I-680/Bernal Rd)			H	L	L	L	L	L
Pleasanton (BART)			H	L	L	L	L	L
Livermore (Downtown)			H	L	L	L	L	L
Livermore (I-580)			H	L	L	L	L	L
Livermore (Greenville Road/UPRR)			H	L	L	L	L	L
Livermore (Greenville Road/I-580)			H	L	L	L	L	L
Tracy (Downtown)			H	L	L	L	L	L
Tracy (ACE)			H	L	L	L	L	L

Corridor	Possible Alignments	Alignment Alternative	Seismic Hazards	Active and Potentially Active Fault Crossings	Slope Instability	Difficult Excavation	Oil and Gas Fields	Mineral Resources
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing—Transbay Transit Center	H	L	L	L	L	L
		Trans Bay Crossing—4th & King	H	L	L	L	L	L
	1 of 6	Dumbarton (High Bridge)	H	H	L	L	L	L
		Dumbarton (Low Bridge)	H	H	L	L	L	L
		Dumbarton (Tube)	H	H	L	L	L	L
		Fremont Central Park (High Bridge)	H	H	L	L	L	L
		Fremont Central Park (Low Bridge)	H	H	L	L	L	L
		Fremont Central Park (Tube)	H	H	L	L	L	L
Station Location Options								
Union City (Shinn)			H	H	L	L	L	L
Central Valley	1 of 6	BNSF—UPRR	L	L	L	L	L	L
		BNSF	L	L	L	L	L	L
		UPRR N/S	L	L	L	L	L	L
		BNSF Castle	L	L	L	L	L	L
		UPRR—BNSF Castle	L	L	L	L	L	L

Corridor	Possible Alignments	Alignment Alternative	Seismic Hazards	Active and Potentially Active Fault Crossings	Slope Instability	Difficult Excavation	Oil and Gas Fields	Mineral Resources
		UPRR—BNSF	L	L	L	L	L	L
Station Location Options								
Modesto (Downtown)			L	L	L	L	L	L
Briggsmore (Amtrak)			L	L	L	L	L	L
Merced (Downtown)			L	L	L	L	L	L
Castle AFB			L	L	L	L	L	L

Table 3.13-3 shows the actual fault crossing by alignment alternative.

Table 3.13-3. Fault Crossings by Alignment and Segment

Corridor	Possible Alignments	Alignment	Fault(s) Crossed	Active of Potentially Active?	Crossed above, at, or below Grade?
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	San Bruno Fault	Potentially Active	At Grade
	1 of 1	Dumbarton to San Jose	Buried Trace of Unnamed Fault	Potentially Active	At Grade
Transbay Transit Center			None		
4th and King (Caltrain)			None		
Millbrae/SFO			None		
Redwood City (Caltrain)			None		
Palo Alto (Caltrain)			None		
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	Hayward Fault	Active	At Grade
		12th Street/City Center to Niles Junction	Hayward Fault	Active	At Grade
	1 of 2	Niles Junction to San Jose via Trimble	Hayward Fault Silver Creek Fault	Active Potentially Active	At Grade Above Grade
		Niles Junction to San Jose via I-880	Hayward Fault Silver Creek Fault	Active Potentially Active	At Grade Above Grade
West Oakland/7th Street			None		
12th Street/City Center			None		
Coliseum/Airport			None		
Union City (BART)			None		
Fremont (Warm Springs)			None		
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	Silver Creek Fault Calaveras Fault	Potentially Active Active	At Grade At Grade
	1 of 3	Henry Miller (UPRR Connection)	Ortigalita Fault	Active	At Grade
		Henry Miller (BNSF Connection)	Ortigalita Fault	Active	At Grade
		GEA North	Ortigalita Fault	Active	At Grade Embankment

Corridor	Possible Alignments	Alignment	Fault(s) Crossed	Active of Potentially Active?	Crossed above, at, or below Grade?
San Jose (Diridon)			None		
Morgan Hill (Caltrain)			None		
Gilroy (Caltrain)			None		
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	Calaveras Fault Pleasanton Fault Livermore Fault Greenville Fault	Active Active Potentially Active Active	Tunnel[3] Above Grade Above Grade Above Grade
		I-580/ UPRR	Calaveras Fault Livermore Fault Greenville Fault	Active Potentially Active Active	Tunnel[3] At Grade Above Grade
		Patterson Pass/UPRR	Calaveras Fault Livermore Fault Greenville Fault Corral Hallow Fault	Active Potentially Active Active Potentially Active	Tunnel[3] At Grade Above Grade At Grade
		UPRR	Calaveras Fault Livermore Fault Greenville Fault	Active Potentially Active Active	Tunnel[3] At Grade Above Grade
	1 of 4	Tracy Downtown (BNSF Connection)	Vernalis Fault	Active	At Grade
		Tracy ACE Station (BNSF Connection)	Vernalis Fault San Joaquin Fault	Active Potentially Active	At Grade At Grade
		Tracy ACE Station (UPRR Connection)	Vernalis Fault San Joaquin Fault	Active Potentially Active	At Grade At Grade
		Tracy Downtown (UPRR Connection)	Vernalis Fault	Active	At Grade
	2 of 2	East Bay Connections (WPRR to UPRR)	Hayward Fault Mission Fault	Active Potentially Active	At Grade At Grade
		East Bay Connections (UP to UPRR)	Mission Fault	Potentially Active	At Grade
Pleasanton (I-680/Bernal Rd)			None		
Pleasanton (BART)			None		
Livermore (Downtown)			None		
Livermore (I-580)			None		

[3] Following circulation of the Draft Program EIR/EIS, FRA and the Authority discovered that the location of the Calaveras Fault was incorrectly shown on Figure 2.D-60, Appendix 2D. The correct location of the fault line is 1,500 feet to the west. As a result, this table and Figure 2.D-60 have been corrected to show that the HSR alignment would cross this fault in tunnel.

Corridor	Possible Alignments	Alignment	Fault(s) Crossed	Active of Potentially Active?	Crossed above, at, or below Grade?
Livermore (Greenville Road/UPRR)			None		
Livermore (Greenville Road/I-580)			None		
Tracy (Downtown)			None		
Tracy (ACE)			None		
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	None		
		Trans Bay Crossing – 4th & King	None		
	1 of 6	Dumbarton (High Bridge)	Buried Trace of Unnamed Fault Silver Creek Fault Hayward Fault Mission Fault	Potentially Active Potentially Active Active Potentially Active	At Grade At Grade Above Grade At Grade
		Dumbarton (Low Bridge)	Buried Trace of Unnamed Fault Silver Creek Fault Hayward Fault Mission Fault	Potentially Active Potentially Active Active Potentially Active	At Grade At Grade Above Grade At Grade
		Dumbarton (Tube)	Buried Trace of Unnamed Fault Silver Creek Fault Hayward Fault Mission Fault	Potentially Active Potentially Active Active Potentially Active	At Grade At Grade Above Grade At Grade
		Fremont Central Park (High Bridge)	Buried Trace of Unnamed Fault Silver Creek Fault Hayward Fault Mission Fault	Potentially Active Potentially Active Active Potentially Active	At Grade At Grade Above Grade At Grade
		Fremont Central Park (Low Bridge)	Buried Trace of Unnamed Fault Silver Creek Fault Hayward Fault Mission Fault	Potentially Active Potentially Active Active Potentially Active	At Grade At Grade Above Grade At Grade
		Fremont Central Park (Tube)	Buried Trace of Unnamed Fault Silver Creek Fault Hayward Fault Mission Fault	Potentially Active Potentially Active Active Potentially Active	At Grade At Grade Above Grade At Grade
Union City (Shinn)			Within AP Fault Hazard Zone for	Active	Above Grade

Corridor	Possible Alignments	Alignment	Fault(s) Crossed	Active of Potentially Active?	Crossed above, at, or below Grade?
			Hayward Fault		
Central Valley	1 of 6	BNSF—UPRR	None		
		BNSF	None		
		UPRR N/S	None		
		BNSF Castle	None		
		UPRR—BNSF Castle	None		
		UPRR—BNSF	None		
Station Location Options					
Modesto (Downtown)			None		
Briggsmore (Amtrak)			None		
Merced (Downtown)			None		
Castle AFB			None		

C. ALTERNATIVES BY CORRIDOR

San Francisco to San Jose Corridor

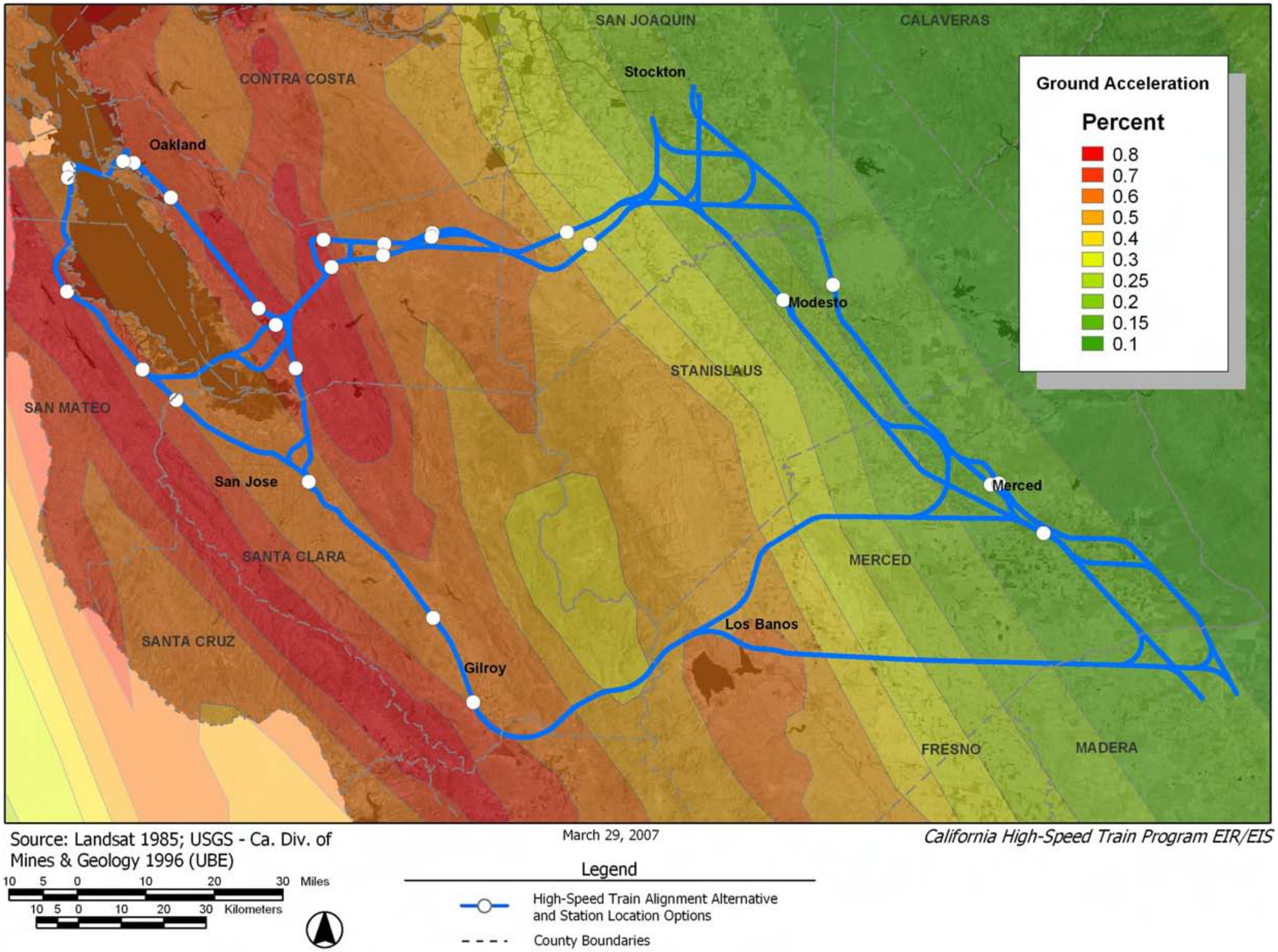
The San Francisco to San Jose alignment alternatives are located in an area of potentially strong ground motion and are potentially subject to liquefaction and/or other types of seismically induced ground failure (Figure 3.13-2, Areas Subject to Strong Ground Motion, and Figure 3.13-3, Areas of Potential Liquefaction). The alignment alternatives cross buried traces of two potentially active faults but do not cross any active faults (Figure 3.13-4a, Quaternary Faults and Alquist-Priolo Zoned Faults). Overall, the alignment alternatives ranked high with respect to seismic hazards and medium with respect to fault rupture.

Generally, the proposed alignment alternatives in the San Francisco to San Jose corridor cross the nearly flat topography of the San Francisco Bay margin and the Santa Clara Valley. Thus, there would be little to no concern about slope stability or difficult excavation along these alternatives. The alignments do not cross oil and gas fields or areas of significant mineral resources.

Oakland to San Jose Corridor

The alignment alternatives in the Oakland to San Jose corridor are located in areas of potentially strong ground motion, and to a lesser extent, areas potentially subject to liquefaction and/or other types of seismically induced ground failure (Figures 3.13-2 and 3.13-3). Multiple crossings of the active Hayward fault would also be a concern. The Union City to Niles Junction alignment segment crosses the Hayward fault north of Niles Junction, while the Niles Junction to Niles Wye segment crosses back over the Hayward fault, south of Niles Junction. In addition, both the Niles Junction to San Jose via Trimble alignment alternative and the Niles Junction to San Jose via I-880 alignment alternative cross a buried trace of the potentially active Silver Creek fault. Overall, the alignment alternatives in this corridor are ranked high with respect to both seismic hazards and fault rupture.

Generally, the proposed alignment alternatives in the Oakland to San Jose corridor cross the nearly flat topography of the Santa Clara Valley and the alluvial fans between the East Bay hills and San



FLY CALIFORNIA

U.S. Department of Transportation Federal Railroad Administration

Figure 3.13-2
Areas Subject to Strong Ground Motion in the Study Region

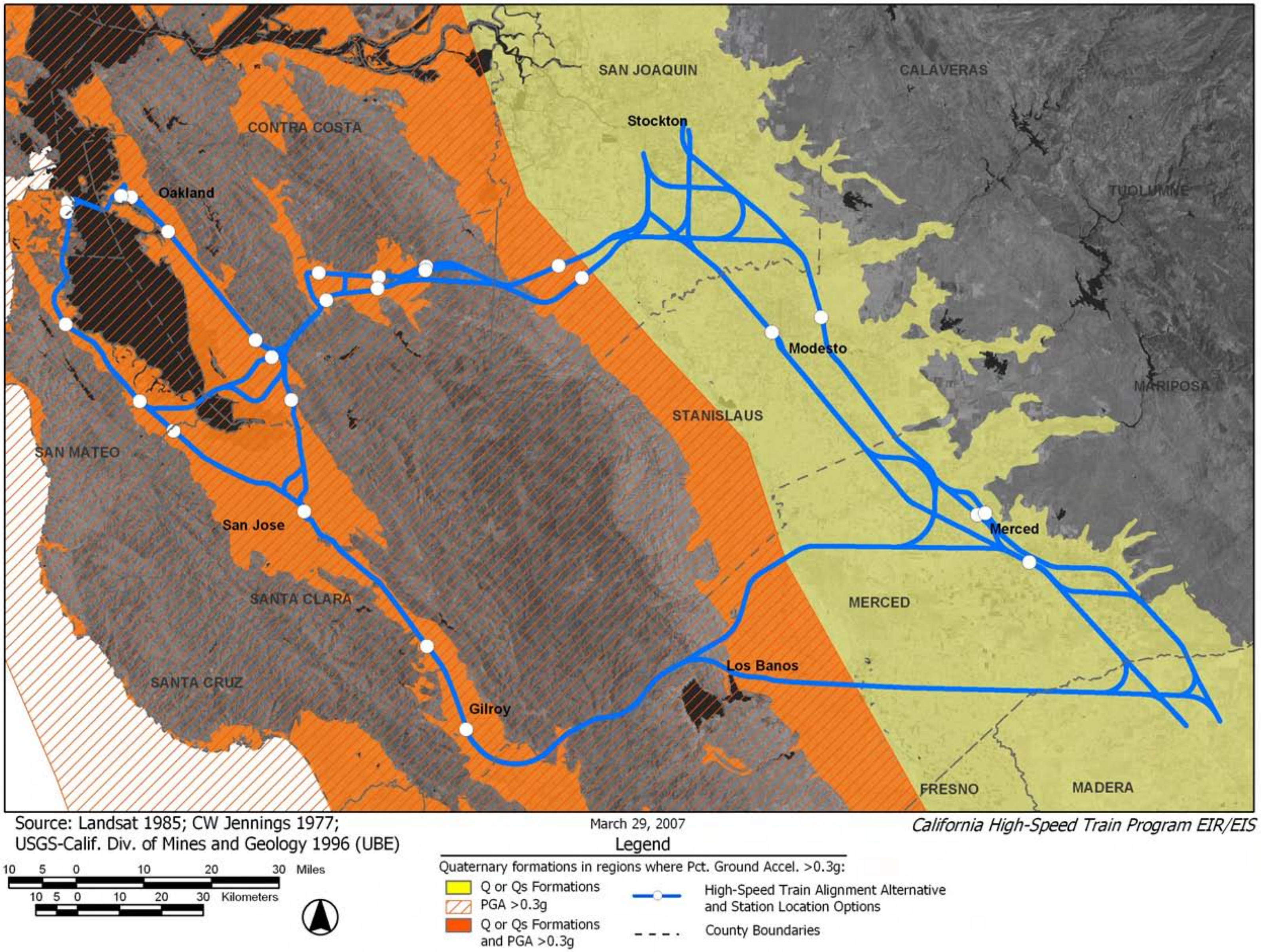


Figure 3.13-3
Areas of Potential Liquefaction in the Study Region

Francisco Bay margin. Thus, there would be little to no concern about slope stability or difficult excavation along these alignment alternatives. The alignment segments Union City to Niles Junction, Niles Junction to Niles Wye, and Niles Wye to Warm Springs traverse the Niles Cone, an area identified by the state as a potential sand and gravel resource. However, as part of an existing railroad right-of-way or immediately adjacent to the existing right-of-way, they are not expected to affect any current quarry operations. These alignment alternatives do not cross oil and gas fields (See Figure 13.3-5, Oil and Gas Fields).

San Jose to Central Valley Corridor

The Pacheco alignment is located in areas of potentially strong ground motion, and to a lesser extent, areas potentially subject to liquefaction and/or other types of seismically induced ground failure (Figures 3.13-2 and 3.13-3). The Henry Miller and GEA North alignment alternatives are generally located in areas of low to moderate ground motion and liquefaction potential. The Pacheco alignment alternative crosses the potentially active Silver Creek fault and the active Calaveras fault, while both the GEA North and Henry Miller alignment alternatives cross the active Ortigalita fault near San Luis Reservoir. Overall, the alignment alternatives in this corridor ranked medium to high with respect to both seismic hazards and fault rupture.

The proposed Gilroy to San Luis Reservoir alignment segment crosses the Diablo Range at grade and in a series of tunnels. Locally, steep slopes along this segment are potentially unstable. (See Figure 13.3-6, Areas of Unstable Slopes). There would be little to no concern about slope stability where the Pacheco alignment crosses the nearly flat topography of the Santa Clara Valley and the Central Valley or in the tunnels through the Diablo Range. Considering the length of the alignment, the potential for slope stability impacts is low along the Pacheco alignment.

The most likely areas of difficult excavation would be the proposed cut slopes and tunnels in the Diablo Range between Gilroy and the San Luis Reservoir. Rocks of the Franciscan Complex are highly variable and include some rock units that are typically hard, and fracture zones are common along this alignment segment. The Pacheco alignment alternatives between the Diridon and Morgan Hill stations also traverses an area identified by the state as a potential sand and gravel resource. These alignment alternatives do not cross oil and gas fields or areas of significant mineral resources.

East Bay to Central Valley Corridor

In the East Bay to Central Valley corridor the alignment alternatives are located in areas of potentially strong ground motion, and to a lesser extent, areas potentially subject to liquefaction and/or other types of seismically induced ground failure (Figures 3.13-2 and 3.13-3). The active Hayward, Calaveras, Greenville, Pleasanton, and Vernalis faults and the potentially active Mission, Livermore, Corral Hallow, and San Joaquin fault crossings would also be a concern along these alignment alternatives (Figures 3.13-4a, b, and c). During the development of the conceptual alignments, extensive efforts were made to cross all active faults at grade, or, if absolutely necessary, on an aerial structure. Special efforts were made to not to cross an active fault in a tunnel configuration, which is deemed a major design issue—a severe hazard.

Following circulation of the Draft Program EIR/EIS, FRA and the Authority discovered that the location of the Calaveras Fault was incorrectly shown on Figure 2.D-60, Appendix 2D of the Draft Program EIR/EIS. The correct location of the fault line is approximately 1,500 feet to the west. Figure 3.13-7 shows the prior incorrect location and the correct location of the Calaveras fault line. As shown on this figure and on the revised Figure 2.D-60, Appendix 2D, as proposed this HST alignment alternative would cross the corrected fault line in tunnel.

To cross this fault line in tunnel would require additional design and mitigation work to address safety issues. Alternatively, to meet the Authority's objective of crossing major fault zones at grade, as noted in Chapter 2, would require redesign and realignment of the Altamont Alignment alternatives and would result in increased environmental impacts, as well as increased travel times for the Altamont alignment alternatives. Overall, the alignment alternatives are ranked high in this corridor with respect to both seismic hazards and fault rupture.

All of the proposed alignment segments that cross the Diablo Range traverse steep and potentially unstable slopes. There would be little to no concern about slope stability where the alignments cross the nearly flat topography of the San Francisco Bay margin, the Livermore Valley, and the Central Valley or where they cross the East Bay hills in tunnel. In addition, considering the lengths of the alignments, the potential for slope stability impacts is low through the Diablo Range.

The most likely areas of difficult excavation would be the tunnel through the East Bay Hills and the Diablo Range crossings where rocks of the Franciscan Complex are highly variable and include some rock units that are typically hard, and fracture zones are common. In the Livermore Valley, the alignment alternatives between Livermore and Pleasanton traverse an area identified by the state as a potential sand and gravel resource. However, as part of an existing railroad or highway right-of-way or immediately adjacent to the railroad right-of-way, they are not expected to affect any current quarry operations. These alignment alternatives do not cross oil and gas fields.

San Francisco Bay Crossings

The San Francisco Bay Crossings are located in areas of potentially strong ground motion and are potentially subject to liquefaction and/or other types of seismically induced ground failure (Figures 3.13-2 and 3.13-3). The Transbay alignment alternative does not cross any known active or potentially active faults. However, the Dumbarton and Fremont Central Park alignment alternatives cross the potentially active Silver Creek fault, the active Hayward fault and the potentially active Mission fault. Overall, the alignment alternatives in the Bay Crossings are ranked high with respect to seismic hazards, and the potential for fault rupture is ranked low for the Transbay alignment alternative and high for the Dumbarton alignment alternative.

These alternative alignments do not traverse any steep and potentially unstable slopes or areas of difficult bedrock excavation and do not cross oil and gas fields. The eastern end of Dumbarton and Fremont Central Park alignment alternatives traverses the Niles Cone, an area identified by the state as a potential sand and gravel resource. However, this eastern section of both the Dumbarton and Fremont Central Park alignment alternatives pass through urban areas and/or are located along existing railroad right of ways and they are not expected to affect any current quarry operations.

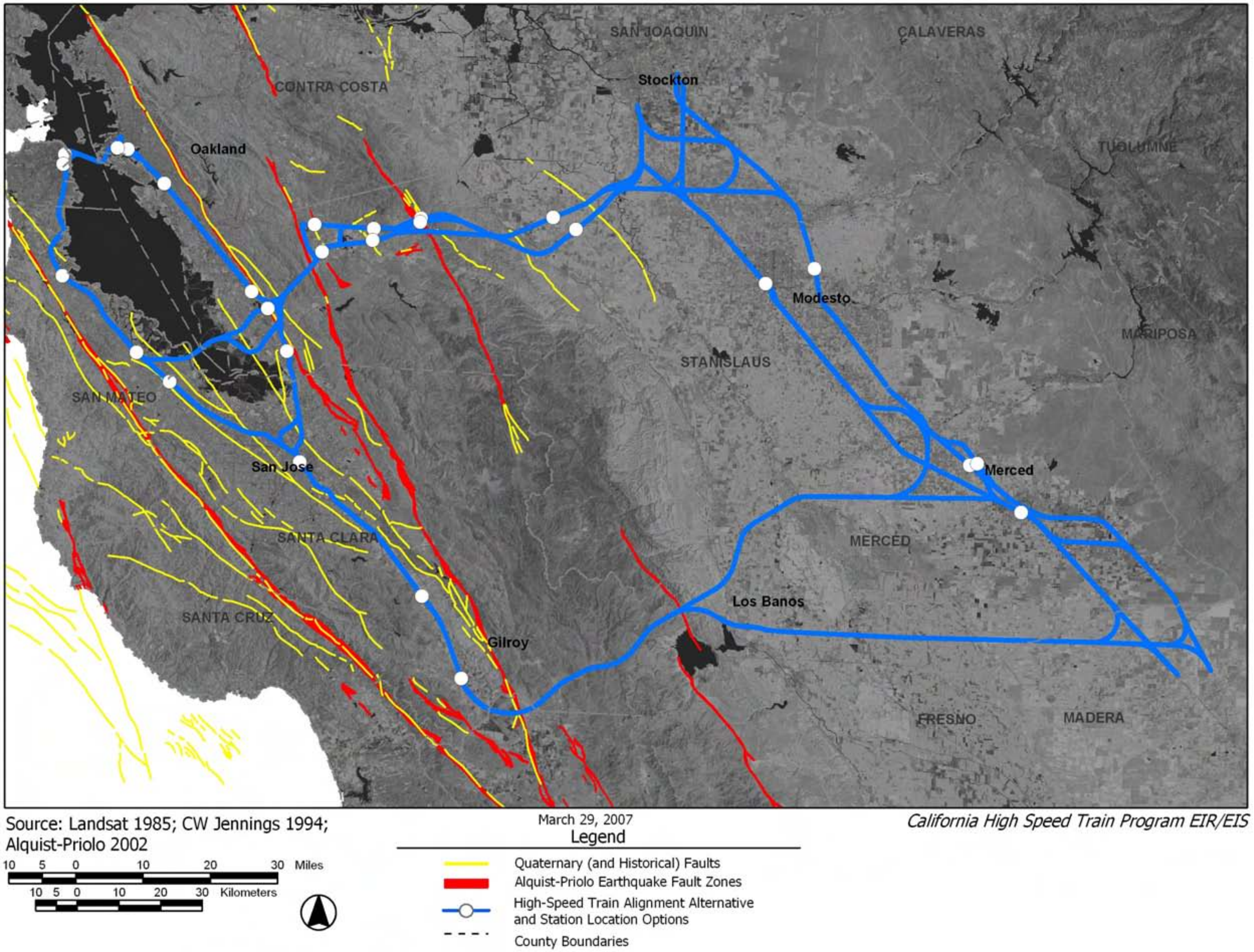
Central Valley Corridor

In the Central Valley corridor, the alignment alternatives are located in areas of potentially low to moderate ground motion and low potential for liquefaction and other types of seismically induced ground failure (Figures 3.13-2 and 3.13-3). Active fault crossings are not a concern along these alignments. Overall, the alignment alternatives in this corridor are ranked low in this region with respect to both seismic hazards and fault rupture.

There would be little to no concern about slope stability or difficult excavation in the Central Valley, and these alignment alternatives generally do not cross oil and gas fields or areas of significant mineral resources.

3.13.4 Role of Design Practices in Avoiding and Minimizing Effects

The Authority has avoided and minimized to the extent possible potential effects related to major geologic hazards such as major fault crossings, oil fields, and landslide areas throughout extensive alignment studies completed prior to and as part of the prior HST system program EIR/EIS process. The Authority's objective is to avoid fault crossings in tunnel and to avoid fault crossings on aerial sections,



Source: Landsat 1985; CW Jennings 1994; Alquist-Priolo 2002

California High Speed Train Program EIR/EIS

Figure 3.13-4a
Quaternary Faults and Alquist-Priolo Zoned Faults in the Study Region

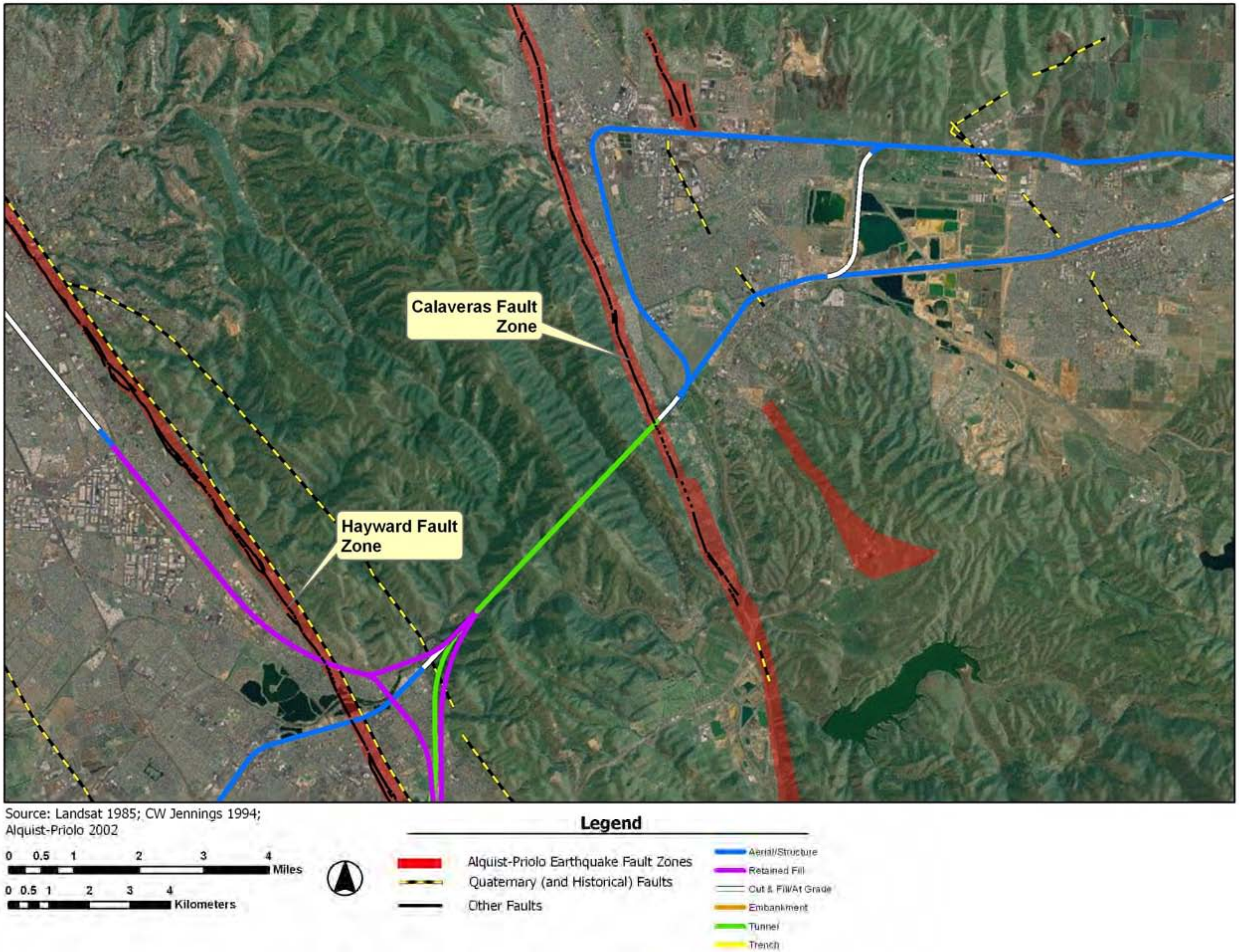
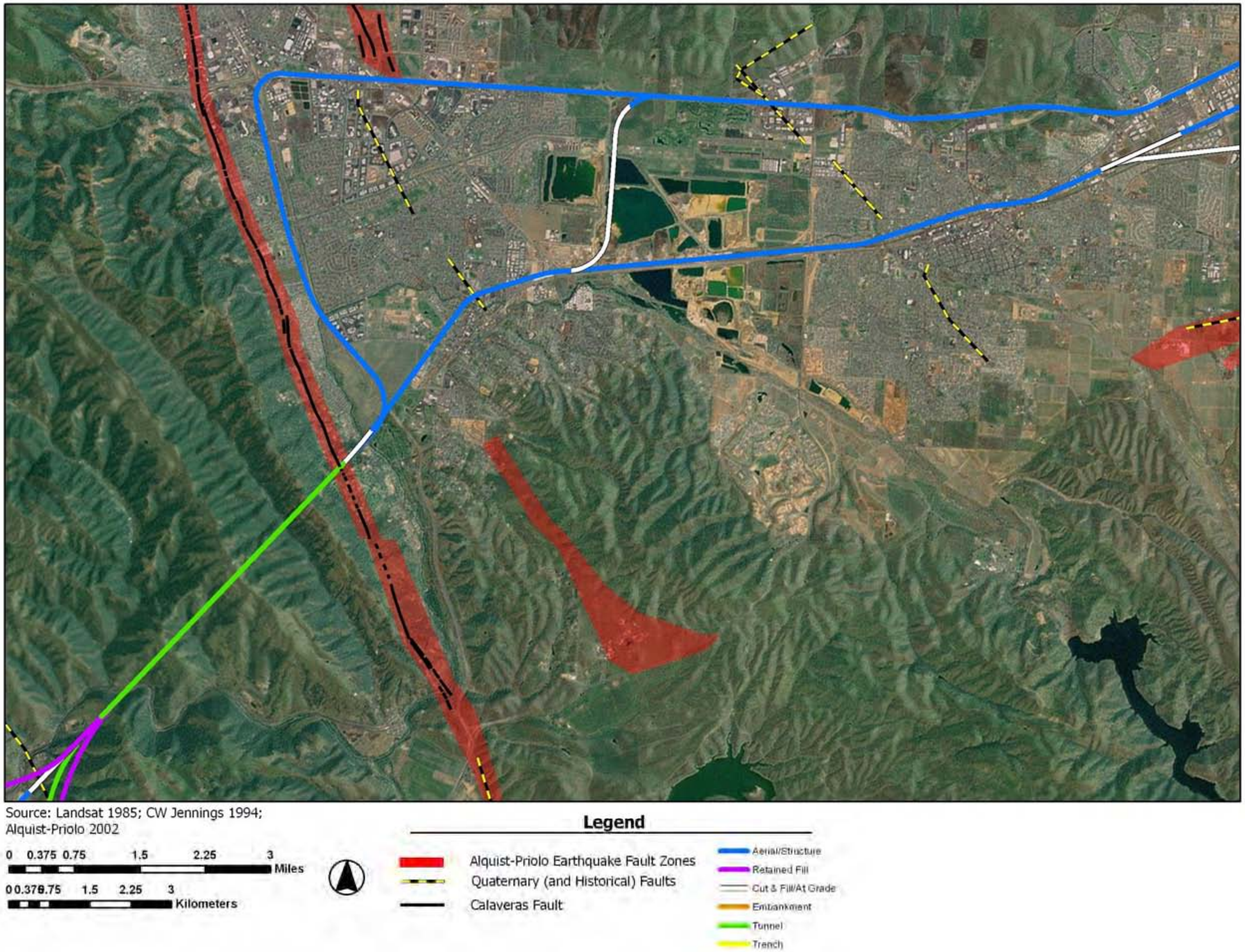
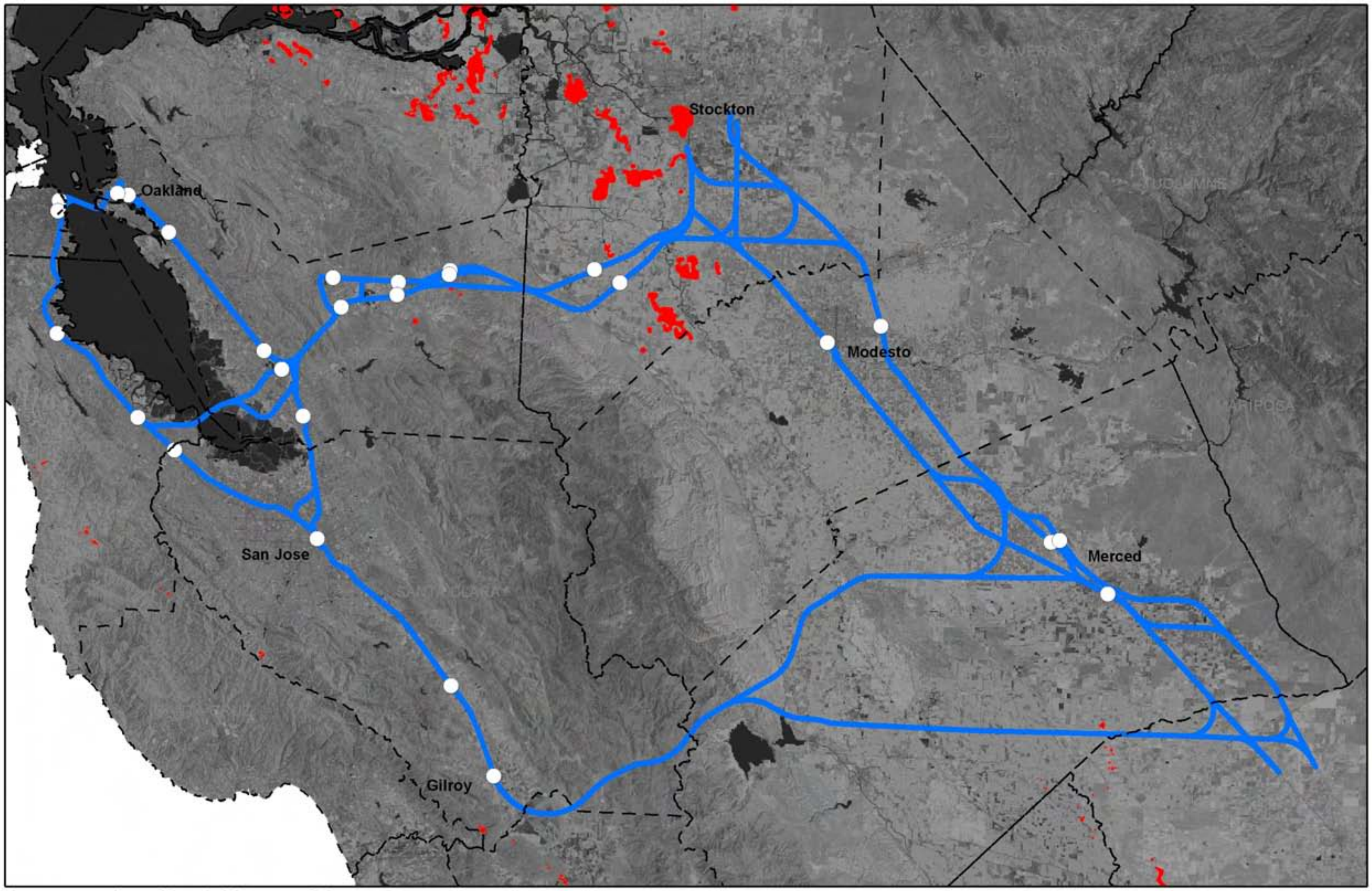


Figure 3.13-4b
Quaternary Faults and Alquist-Priolo Zoned Faults in the East Bay Area



U.S. Department of Transportation Federal Railroad Administration

Figure 3.13-4c
Quaternary Faults and Alquist-Priolo Zoned Faults in the Calaveras Fault Area



Source: Landsat 1985; Calif. Dept. of Conservation, Div. of Oil, Gas & Geothermal Resources

March 29, 2007

California High-Speed Train Program EIR/EIS

10 5 0 10 20 30 Miles

10 5 0 10 20 30 Kilometers

Legend

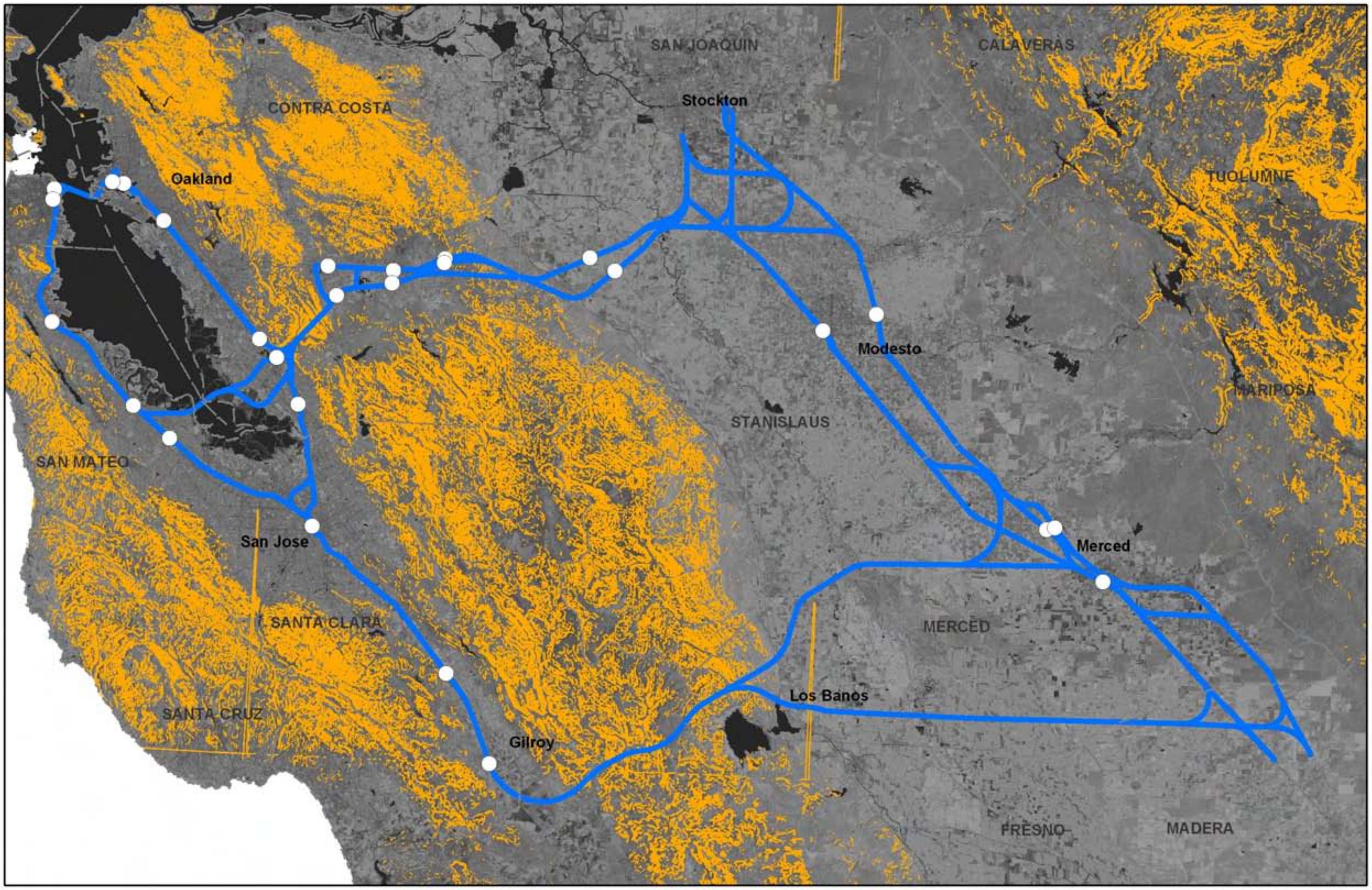
Oil and Gas Fields - California Production Limits

High-Speed Train Alignment Alternative and Station Location Options

County Boundaries

U.S. Department of Transportation Federal Railroad Administration

Figure 3.13-5
Oil and Gas Fields in the Study Region



Source: Landsat 1985; USGS Digital Elevation Model (DEM)

10 5 0 10 20 30 Miles

10 5 0 10 20 30 Kilometers

March 29, 2007

Legend

Slopes steeper than 33% (within study area)

High-Speed Train Alignment Alternative and Station Location Options

County Boundaries

California High-Speed Train Program EIR/EIS

FLY CALIFORNIA

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Figure 3.13-6
Areas of Unstable Slopes in the Study Region

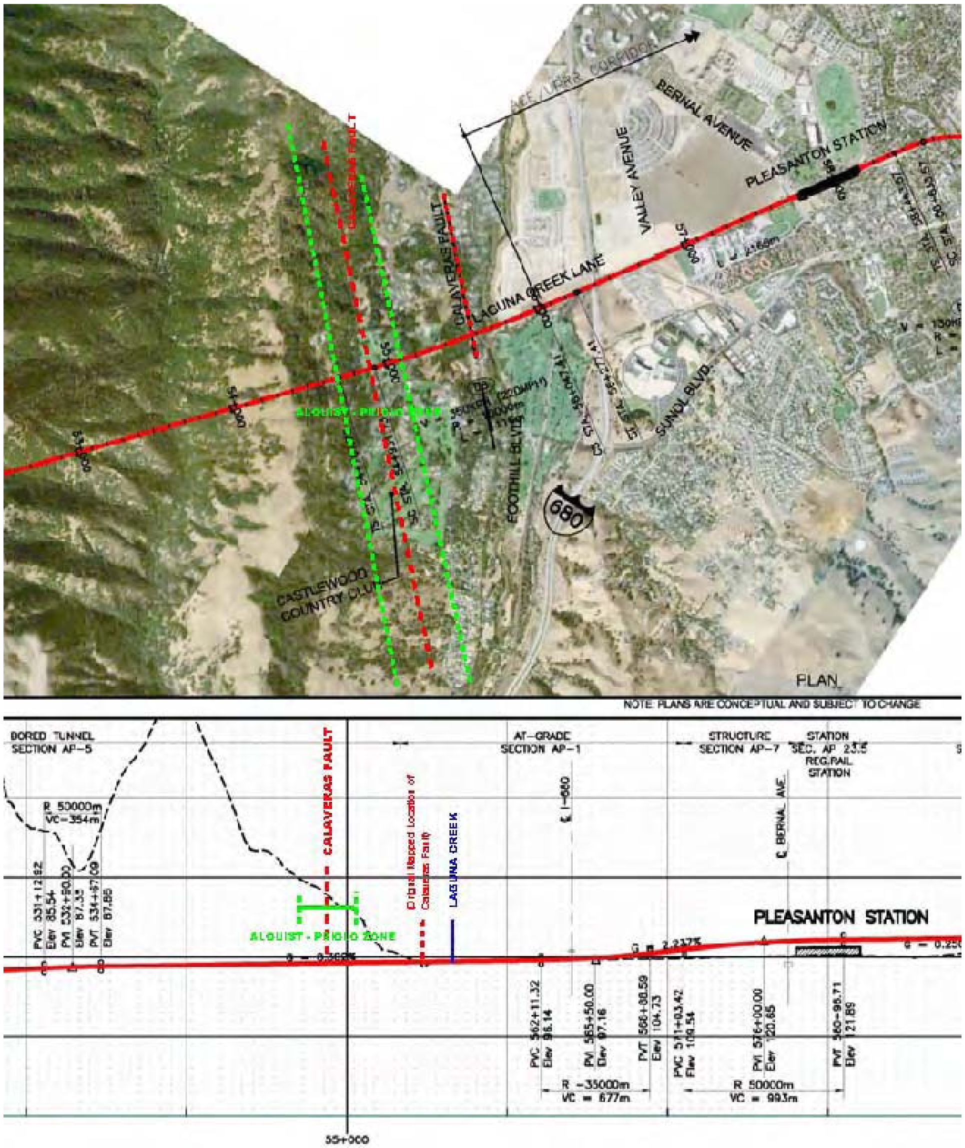


Figure 3.13-7
Revised Calaveras Fault Location

whenever possible. These objectives have been carried through the development of the HST Alignment Alternatives for the Bay Area to Central Valley Region.

FRA and the Authority discovered that the location of the Calaveras Fault was incorrectly shown in the Draft Program EIR/EIS. Thus, as proposed, the Altamont Alignment alternative would cross the actual fault line in tunnel. Addressing additional safety issues for crossing the fault in tunnel would require additional design work, or meeting the Authority's objective of crossing major fault zones at grade would require redesign and realignment of the Altamont Alignment alternatives and would result in increased environmental impacts, as well as increased travel times for the Altamont alignment alternatives.

Any impacts that remain at the conclusion of project-level environmental review would be mitigated through specific design and construction practices described in the following mitigation section.

3.13.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the CEQA thresholds of significance for geology and soils, all HST Alignment Alternatives would have less-than-significant geology and soils impacts related to: (1) access to mineral resources and other geologic features with potential scientific values and (2) the potential to create hazardous conditions from the release of gases into subsurface facilities.

The analysis indicates that significant impacts before mitigation are likely for some alignment alternatives related to (1) difficult excavation, (2) seismic hazards from ground motion and liquefaction, (3) active fault crossings, and (4) slope instability.

Without mitigation, significant impacts with respect to difficult excavation are anticipated for the Patterson Pass and UPRR alignment segments crossings of the Diablo Range, and the Niles to Sunol tunnel segment in the East Bay to Central Valley corridor, and for the Gilroy to San Luis Reservoir segment for the Pacheco Pass alternative. Significant slope instability impacts prior to mitigation are also anticipated for each of these segments, where they are not in tunnel.

Significant seismic hazards prior to mitigation are anticipated for the (1) San Francisco and San Jose corridor, (2) the Oakland to San Jose corridor, (3) the Pacheco Pass alternative between San Jose and the Central Valley floor, (4) the East Bay to Central Valley corridor, and (5) the San Francisco Bay Crossings. Each of these alternatives is potentially subject to strong ground shaking throughout the entire length of their alignments. The most significant hazard would be associated with the tunnel crossing of the Calaveras Fault for the East Bay to Central Valley corridor.

In addition, locally they are subject to liquefaction induced ground failure and active or potentially active fault crossings are present along the alternatives in each of these corridors.

This document contains a broad program analysis that generally identifies the locations of potential geologic impact areas of the proposed HST Alignment Alternatives. These are areas that would need further study in environmental documentation at the project level.

Mitigation of potential impacts related to geologic and soils conditions must be developed on a site-specific basis, based on the results of more detailed (design-level) geologic and geotechnical engineering studies. Consequently, geologic and geotechnical mitigation would be identified in subsequent, project-level analysis rather than at the program level. Following is an overview of general approaches to possible geologic and geotechnical mitigation.

A. SEISMIC HAZARDS

The potential for traffic safety issues related to ground shaking during a large earthquake cannot be mitigated completely; this holds true for most vehicle transportation systems throughout California. However, some strategies are available to reduce hazards, including the following:

- Design structures to withstand anticipated ground motion, using design options such as redundancy and ductility.
- Design and engineer all structures for earthquake activity using Caltrans Seismic Design Criteria.
- Prevent liquefaction and seismically induced settlement, and the resulting structural damage and traffic hazard impacts, using soil densification techniques such as preloading, stone columns, deep dynamic compaction or grouting.
- Design and install foundations resistant to soil liquefaction and settlement, e.g. deep foundations
- Utilize motion-sensing instruments to provide ground motion data and a control system to temporarily shut down HST operations during or after an earthquake to reduce risks.
- Apply Section 19 requirements from the most current Caltrans Standard Specifications to ensure geotechnically stable slopes are planned and created, using buttress berms, flattened slopes, drains, and/or tie-backs in areas of potential seismically induced slope instability.

B. FAULT CROSSINGS—SURFACE RUPTURE

The potential for ground rupture along active faults is one of the few geologic hazards that rarely can be fully mitigated. However, known active faults are typically monitored, and in some cases fault creep is mitigated with routine maintenance, which could include repaving or minor track re-alignment. Project design could provide for the installation of early warning systems triggered by strong ground motion associated with ground rupture. Linear monitoring systems such as time domain reflectometers (TDRs) could be installed along major highways and rail lines within the zone of potential ground rupture. These devices emit electronic information that is processed in a centralized location and could be used to temporarily control traffic and trains, thus reducing accidents. In addition, the HST project has been modified in mountain crossing areas where tunnels are proposed to avoid crossing known or mapped active faults within the tunnel. A tunnel crossing was proposed due to land use, environmental, and topographic conditions, but subsequently corrected information indicated that the tunnel as proposed would cross the Calaveras Fault.

The following mitigation strategies can be refined and applied at the project-specific level and will reduce this impact:

- Install early warning systems triggered by strong ground motion associated with ground rupture, such as linear monitoring systems (TDRs) along major highways and rail lines within the zone of potential rupture to provide early warnings and allow temporary control of rail and automobile traffic to avoid and reduce risks.
- Avoid active faults to the extent possible. Where avoidance is not possible, cross active faults at grade and perpendicular to the fault line, whenever possible. Where tunnel use is necessary across an active fault, assure safety through advanced tunnel design and fire/life/safety systems, or pursue further design and alignment variations to allow crossing at grade or on aerial structures.

C. SLOPE STABILITY/LANDSLIDES

- The potential for failure of natural and temporary construction slopes and retention structures can be mitigated through geotechnical investigation and review of proposed earthwork and foundation excavation plans and profiles. Based on investigation and review, recommendations would be provided for temporary and permanent slope reinforcement and protection, as needed. These recommendations would be incorporated into the construction plans. Additionally, during construction, geotechnical inspections will be performed to verify that no new, unanticipated conditions are encountered and to verify the proper incorporation of recommendations. Slope monitoring may also be incorporated into the final design where warranted.

The following mitigation strategies can be refined and applied at the project-specific level and will reduce this impact:

- Install temporary and permanent slope reinforcement and protection, based on geotechnical investigations and review of proposed earthwork and foundation excavation plans.
- Apply Section 19 requirements from the most current Caltrans Standard Specifications to ensure geotechnically stable slopes are planned and created, using buttress berms, flattened slopes, drains, and/or tie-backs in areas of potential slope instability.
- Conduct geotechnical inspections during construction to verify that no new, unanticipated conditions are encountered
- Incorporate slope monitoring into final design.

D. AREAS OF DIFFICULT EXCAVATION

The potential for difficult excavation in areas of hard rock and faults cannot be fully mitigated, but it can be anticipated so that safety is ensured, potential environmental impacts are addressed, and project schedule problems are avoided to the extent possible. This includes focusing future geotechnical engineering and geologic investigations in these areas and incorporating the findings into project construction documents, communicating with the contractors during the bid process, and monitoring actual conditions during and after construction.

The following mitigation strategies can be refined and applied at the project-specific level and will reduce this impact:

- Identify areas of potentially difficult excavation to ensure safe practices.
- Focus future geotechnical engineering and geologic investigations in areas of potentially difficult excavation.
- Monitor conditions during and after construction.
- Based on geologic and geotechnical investigations, incorporate appropriate tunnel excavation and lining techniques in the project design to ensure safety.

E. HAZARDS RELATED TO OIL AND GAS FIELDS

Hazards related to potential migration of hazardous gases attributable to the presence of oil fields, gas fields, or other subsurface sources can be mitigated by following strict federal and state Occupational Safety & Health Administration (OSHA/CalOSHA) regulatory requirements for excavations, and consulting with other agencies, such as the Department of Conservation (Division of Oil and Gas) and the Department of Toxic and Substances Control, as appropriate, regarding known areas of concern. Mitigation measures would include using safe and explosion-proof equipment during construction and testing for gases regularly. Active monitoring systems and alarms would be required in underground construction areas and facilities where subsurface gases are present. Gas barrier systems have also been used effectively for subways in the Los Angeles area. Installing gas detection systems can monitor the effectiveness of these systems.

The following mitigation strategies can be refined and applied at the project-specific level and will reduce this impact:

- Follow federal and state OSHA/CalOSHA regulatory requirements for excavations.
- Consult with other agencies, such as the Department of Conservation's Division of Oil and Gas and the Department of Toxic Substances Control, regarding known areas of concern.
- Use safe and explosion-proof equipment during construction.
- Test for gases regularly.
- Install monitoring systems and alarms in underground construction areas and facilities where subsurface gases are present.
- Install gas barrier systems or gas collection systems and passive or active gas venting systems in areas where subsurface gases are identified

F. MINERAL RESOURCES

In some cases, mineral resources sites may represent valuable sources of materials that either should be completely developed prior to use for another purpose or should be avoided by proposed facilities to the extent feasible. This practice could result in realignment and/or proposed relocation or modification of other proposed facilities. To mitigate the potential for significant project redesign, important mineral sites should be identified as early as possible.

The above mitigation strategies are expected to reduce the geologic and soils impacts of the HST Alignment Alternatives to a less-than-significant level. Additional environmental assessment will allow a more precise evaluation in the second-tier, project-level environmental analyses.

Subsequent Analysis

As described in Method of Evaluation of Impacts above, this analysis was performed generally on the basis of existing data available in GIS format. The data provided in this section are intended for planning purposes, are not meant to be definitive for specific sites, and have not been independently confirmed. More detailed geologic/geotechnical studies would be required at the project level and likely would include subsurface exploration, laboratory testing, and engineering analyses to support detailed alignment design and mitigation of potential impacts associated with geologic and soils conditions, including seismic hazards, slope stability, areas of difficult excavation, areas of potential oil and gas along proposed tunnel alignments, and mineral resources. In addition, the detailed geologic/geotechnical studies should address expansive and corrosive soils.

3.14 Hydrology and Water Resources

This section describes the environmental setting (regulatory setting and existing conditions) for hydrology and water quality relating to the proposed project, the impacts on hydrology and water quality that would result from implementation of the HST system, and mitigation measures that would reduce these impacts[1].

3.14.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Several federal and state laws regulate and protect hydrologic resources, floodplains, and water quality. Below is a list of these statutes.

Federal Laws and Regulations

Clean Water Act (33 U.S.C. § 1251 et seq.)
The purpose of the CWA is restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters through prevention and elimination of pollution. The CWA applies to discharges of pollutants into waters of the United States. The State Water Board is the state agency with primary responsibility for implementation of state and federally established regulations relating to hydrology and water quality issues. Typically, all regulatory requirements are implemented by the State Water Board through the nine different RWQCBs established throughout the state. The CWA operates on the principle that any discharge of pollutants into the nation's waters is prohibited unless specifically authorized by a permit; permit review is the CWA's primary regulatory tool. The following CWA sections are most relevant to this analysis.

Section 404 Permit for Fill Material in Waters and Wetlands
CWA Section 404 regulates the discharge of dredged and fill materials into *waters of the United States*, which include oceans, bays, rivers, streams, lakes, ponds, and wetlands. Refer to Section 3.15, "Biological Resources and Wetlands," for further discussion.

Section 402 NPDES Program
CWA Section 402 regulates discharges to surface waters through the NPDES program, administered by the EPA. In California, the State Water Board is authorized by the EPA to oversee the NPDES program through the RWQCBs (see related discussion under *Porter-Cologne Water Quality Control Act* below). The NPDES program provides for both general permits (those that cover a number of similar or related activities) and individual permits. Most construction projects that disturb 1 ac (0.4 ha) of land or more are required to obtain coverage under the NPDES General Permit for Construction Activities (General Construction Permit), which requires the property owner to file a NOI to discharge stormwater and to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP includes a site map and a description of proposed construction activities, along with demonstration of compliance with relevant local ordinances and regulations. The SWPPP must also describe the project-specific BMPs that will be implemented to prevent or reduce the discharge of construction-related pollutants, including sediments, into stormwater runoff and surface drainage. Permittees are required to conduct monitoring and reporting to ensure that BMPs are correctly implemented and effective in controlling the discharge of construction-related pollutants into stormwater runoff.

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

Section 401 Clean 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 must obtain certification from the state in which the discharge would originate, or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect the quality of the state's waters (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401. Section 401 certification or waiver is under the jurisdiction of the applicable RWQCBs.

Section 10 of the Rivers and Harbors Act (33 U.S.C. 401 *et seq.*)

Section 10 of the Rivers and Harbors Act, administered by the USACE, requires permits for all structures, such as riprap, and activities, such as dredging, in navigable waters of the United States. Refer to Section 3.15, "Biological Resources and Wetlands," for further discussion.

Executive Order 11988—Floodplain Management (U.S. DOT Order 5650.2; 23 C.F.R. 650, Subpart A)

Executive Order (EO) 11988 directs all federal agencies to avoid to the extent practicable and feasible all short-term and long-term adverse impacts associated with floodplain modification and to avoid direct and indirect support of development within 100-year floodplains whenever there is a reasonable alternative available.

Projects that encroach upon 100-year floodplains must be supported with additional specific information. The U.S. Department of Transportation Order 5650.2, *Floodplain Management and Protection*, prescribes "policies and procedures for ensuring that proper consideration is given to the avoidance and mitigation of adverse floodplain impacts in agency actions, planning programs and budget requests." The order does not apply to areas with Zone C (areas of minimal flooding as shown on Federal Emergency Management Agency [FEMA] Flood Insurance Rate Maps [FIRM]). Environmental review documents should indicate potential risks and impacts from proposed transportation facilities.

Flood Disaster Protection Act (42 U.S.C. 4001–4128; DOT Order 5650.2, 23 C.F.R. 650 Subpart A; and 23 C.F.R. 771)

The purpose of the Flood Disaster Protection Act is to identify flood-prone areas and provide insurance. The act requires purchase of insurance for buildings in special flood-hazard areas. The act is applicable to any federally assisted acquisition or construction project in an area identified as having special flood hazards. Projects should avoid construction in, or develop a design to be consistent with, FEMA-identified flood-hazard areas.

State Laws and Regulations

Porter-Cologne Water Quality Act (Water Code § 13000 et seq.)

The Porter-Cologne Water Quality Control Act, passed in 1969, articulates with the federal CWA (see the *Clean Water Act* section above). It established the State Water Board and divided the state into nine regions, each overseen by an RWQCB. The State Water Board is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies, but much of its daily implementation authority is delegated to the nine RWQCBs, which are responsible for implementing CWA, Sections 401, 402, and 303(d). In general, the State Water Board manages both water rights and statewide regulation of water quality, while the RWQCBs focus exclusively on water quality within their regions.

Three of the RWQCBs have jurisdiction over the water allocation and water quality in the area impacted by the HST (Central Coast RWQCB, Central Valley RWQCB, and the San Francisco RWQCB). See Appendix 3.14-B for a description of the RWQCBs.

There are a number of local regulatory and permitting agencies, such as flood control districts, irrigation districts, and water districts, that may have facilities that are affected by the project. These districts have different responsibilities to their customers but generally are required to provide drinking water, flood control, or irrigation water and administer local agreements regarding the quality and quantity of water delivered.

Dewatering Activities

On June 18, 2002, the Central Valley RWQCB (CVRWQCB) adopted Order No. 5-00-175, NPDES Permit No. CAG995001 (General Dewatering Permit). This general NPDES permit covers the discharge to waters of the United States of clean or relatively pollutant-free wastewater that poses little or no threat to water quality. The following categories are covered by this order: well development water, construction dewatering, pump/well testing, pipeline/tank pressure testing, pipeline/tank flushing or dewatering, condensate discharges, water supply system discharges, and miscellaneous dewatering/low threat discharges. This would apply to the HST system if there were use of a sheet pile cofferdam in any water body construction that would require dewatering. It could also apply to the proposed project for the use of simple wash water construction dewatering.

The districts in the project area include:

- Alameda County Flood Control and Water Conservation District.
- Central California Irrigation District.
- Del Puerto Water District.
- Grassland Water District.
- Merced Irrigation District.
- San Benito County Water District.
- San Joaquin River Group Authority.
- San Francisco Public Utilities Commission.
- San Luis and Delta-Mendota Water Authority.
- San Mateo County Department of Public Works.
- Santa Clara Water District.
- The Santa Clara Valley Urban Runoff Pollution Prevention Program.

See Appendix 3.14-B for a comprehensive description of each one of these local districts.

Basin Plans and Water Quality Objectives

The Porter-Cologne Act provides for the development and periodic review of basin plans that designate beneficial uses of California's major rivers and groundwater basins and establish narrative and numerical water quality objectives for those waters. Beneficial uses represent the services and qualities of a water body (i.e., the reasons why the water body is considered valuable), while water quality objectives represent the standards necessary to protect and support those beneficial uses. Basin plans are primarily implemented by using the NPDES permitting system to regulate waste discharges so that water quality objectives are met (see discussion of the NPDES system in the *Clean Water Act* section above). Basin plans are updated every 3 years and provide the technical basis for determining waste discharge requirements and taking enforcement actions. Basin plans are adopted and amended by the RWQCBs for all nine regions.

Cobey-Alquist Flood Plain Management Act (Water Code § 8400 *et seq.*):
The California Reclamation Board provides policy direction and coordination for the flood control efforts of state and local agencies along the Sacramento and San Joaquin Rivers and their tributaries in cooperation with USACE. The board cooperates with various federal, state, and local government agencies in establishing, planning, constructing, operating, and maintaining flood-control works. The California Reclamation Board also exercises regulatory authority to maintain the integrity of the existing flood-control system and designated floodways by issuing permits for encroachments.

California Department of Fish and Game Code (§ 1601–1603 [Streambed Alteration])
Under Sections 1601–1603 of the Fish and Game Code, agencies are required to notify the CDFG prior to implementing any project that would divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake.

B. METHOD OF EVALUATION OF IMPACTS

Impact Evaluation

Potential impacts on surface hydrologic resources, floodplains, and surface water quality were evaluated using a combination of both qualitative and quantitative assessment methods. The existing conditions described for the No Project Alternative provide the primary basis of comparison.

Potentially direct impacts are defined by the area within 50 ft total width of all alignment segments that have two tracks and 100 ft total width for segments that have four tracks (e.g., station location option areas and shared use corridors like Caltrain).

Indirect impacts may include such downstream effects as sedimentation, turbidity, impacts to water-dependent species, changes in flow-rate, erosion due to run-off, and ponding due to changes in flood flows. These impacts typically occur outside of the project footprint. Without project-level detail, it is difficult to identify specific locations for indirect impacts. Therefore, potential indirect impacts for hydrology and water quality are defined by the area within 200 ft total width of the entire alignment alternative regardless of if there are two tracks, four tracks, and/or station location options.

Potential tunnel impacts on hydrology and water resources were estimated from known information for groundwater and underground streams. These impacts, in addition to potential impacts from streams aboveground, were identified and discussed qualitatively.

Qualitative Assessment

A qualitative assessment was used to compare the alignment alternatives when discussing issues such as runoff rates, sedimentation, or other items that would ultimately require a more detailed analytic approach (i.e., at the project level) than appropriate for a program-level analysis. This also includes a description of the number and name (if available) of the water resources each alignment alternative would cross and therefore potentially impact. The number and names of water resources were determined using three different sources of information: northern and southern California atlases, aerial images, and GIS data files. Not all water resources identified have names, and therefore placeholders for unnamed canals or unnamed creeks were used.

Quantitative Assessment

For the quantitative assessment, readily available information on wetland areas, stream locations, existing water quality problem areas, flood zones, and general soil information was used to estimate the magnitude of the potential areas of direct and indirect impacts for the HST Alignment Alternatives. The following steps were followed to estimate the potential areas of impact for floodplains and water quality.

- Acreage of Special Flood Hazard Areas, as defined by FEMA on Flood Insurance Rate Maps, in the study area was identified and estimated to evaluate the area of floodplain potentially affected by project alternatives (Federal Emergency Management Agency 2007).
- Acreage of surface waters (lakes) and the linear feet of surface waters (rivers and streams) in the study area was estimated, using U.S. Geological Survey (USGS) 1:24,000 scale digital line graphs of blueline streams, including ephemeral streams as mapped. The linear feet of surface water was calculated based on the width of the HST crossing of rivers, streams, and canals in the study area. (U.S. Geological Survey 2006; U.S. Geological Survey with U.S. Environmental Protection Agency 2006; and U.S. Bureau of Reclamation 2005.)
- Waters with impaired water quality, i.e., waters included on the Section 303(d) CWA list distributed by the State Water Board, in the study area were identified along with the impairment (pollutant/stressor) and an indication of whether the impairment has the potential to be further affected by the proposed project. State GIS data from 2002 and 2006 TMDL description data were used to determine the location of the impaired segment and the type of pollutants causing the impairment. The 2006 description data was cross-checked with 2002 descriptions in the GIS files to ensure no duplicity or missing information (State Water Resources Control Board and Regional Water Quality Control Boards 2003).
- Acreage of areas of potential soil erosion in the study area was estimated to evaluate areas potentially affected by the project alternatives. The location of the potential erosive conditions was identified as those areas with a combination of erosive soils and high slopes, evaluated as the product of *kfact* and *slopeh* (listed in STATSGO data). Those conditions where kfact multiplied by slopeh is greater than 3.0 are potentially susceptible to soil erosion, and acreage of these areas within the study area was determined. This information was used to estimate potential erosion and sedimentation characteristics of the project area (U.S. Department of Agriculture, Natural Resource Conservation Service 2006).
- Acreage of groundwater was calculated using “Ground Water Basins” (Department of Water Resources, Division of Mines and Geology 2000).

Other sources used in calculating hydrology and water resources impacts include the following:

- California Department of Resources 2005.
- DeLorme 2003a and b.
- State Water Resources Control Board 2002a, b, c, d, e, and f.

C. CEQA SIGNIFICANCE CRITERIA

Under CEQA, a project may have a significant impact on hydrology and water quality if it would:

- Violate any water quality standards or waste discharge requirements.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge, resulting in a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on site or off site.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on site or off site.

- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Otherwise substantially degrade water quality.
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows.
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.

3.14.2 Affected Environment

A. STUDY AREA DEFINED

Direct Impacts

The potential direct impact study area is defined by the number of tracks of an HST Alignment Alternative and the presence of proposed new station facilities. This methodology allows for a larger area of analysis where the alignment alternative has a greater potential to affect the environment (i.e., is wider with more tracks). For alignment alternatives with two tracks, the area analyzed for direct impacts is 50 ft wide (25 ft on either side of the centerline of the alignment). For alignment alternatives with four tracks and/or proposed new station facilities, the area analyzed for direct impacts measures 100 ft in width (50 ft on either side of the centerline of the alignment alternative).

Indirect Impacts (Potentially Affected Area)

The potential indirect impact study area for hydrology and water quality is defined as the area within 200 ft (100 ft of either side of the centerline) of all alignment alternatives and station location options. This area is in addition to and does include the direct impact study area described above. Potential tunnel impacts on hydrology/water resources were also considered using known information for groundwater and underground streams.

Topography and Climate

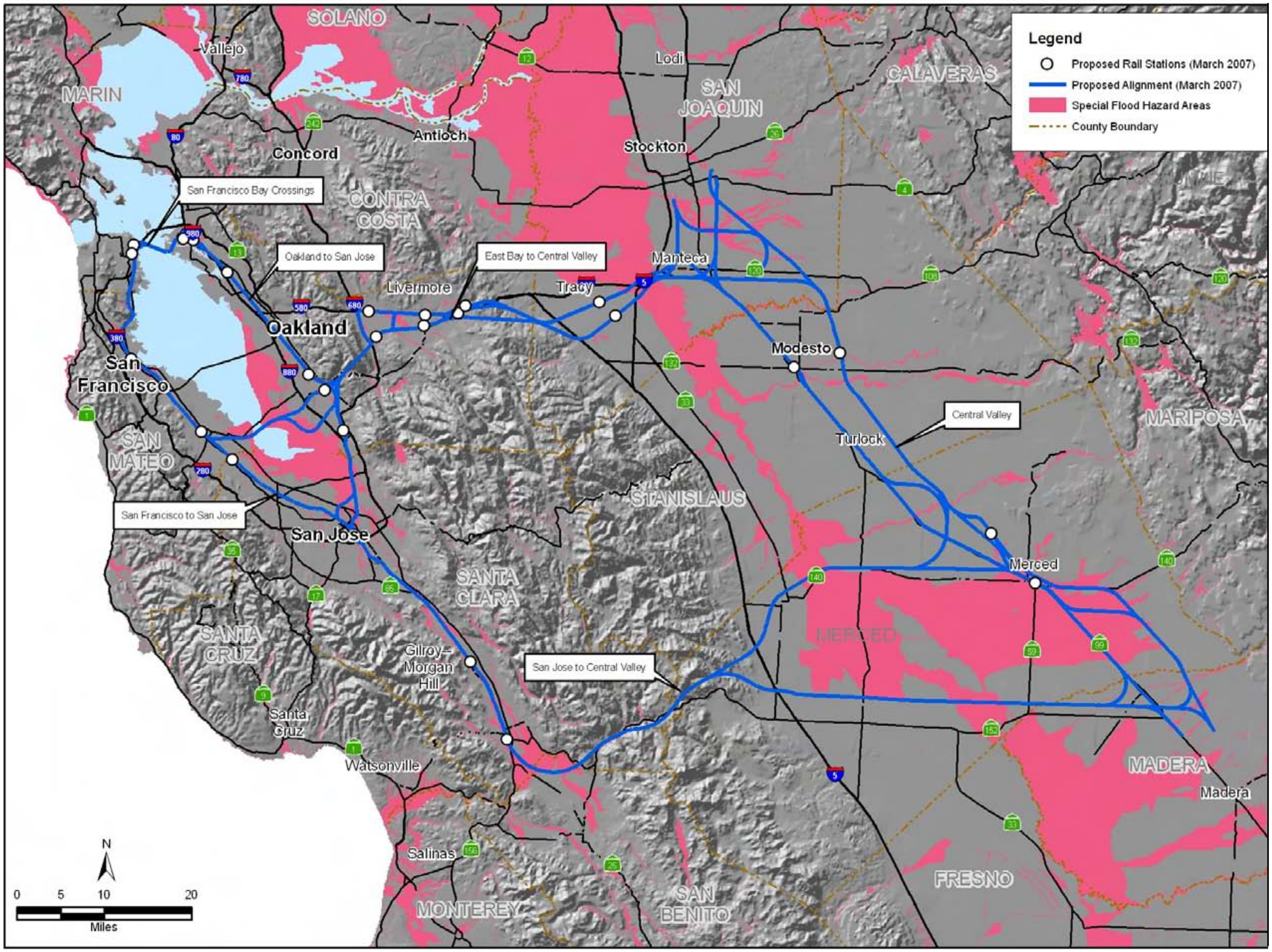
The topography of the hydrology study area ranges from flat coastal and valley areas to mountain ranges, as discussed in Section 3.13, “Geology and Soils.” On average, about 75% of California’s annual precipitation falls between November and March; 50% occurs between December and February. Northern California is much wetter than southern California, with more than 70% of California’s average annual precipitation and runoff occurring in the northern part of the state (California Department of Water Resources 2003).

B. GENERAL DISCUSSION OF HYDROLOGY AND WATER RESOURCES

Floodplains

Floodplains are lands next to a river that are inundated by water when the river overflows its banks. FEMA designates and maps floodplains. In support of the National Flood Insurance Program (NFIP), FEMA has undertaken flood hazard identification and mapping to produce Flood Hazard Boundary Maps, Flood Insurance Rate Maps (FRIMs), and Flood Boundary and Floodway Maps. The zone of interest for the analysis of hydrologic resources in this program-level evaluation is defined as a special flood hazard area (SFHA) or Zone A, which is the flood insurance rate zone that corresponds to the 100-year flood hazard area in the hydrologic resource study area. Figure 3.14-1 shows SFHAs in the general vicinity of the hydrologic resources study area.

Floodplains are important because they provide floodwater storage and attenuate the risk of downstream flooding, provide important habitat for native species (discussed in Section 3.15, “Biological Resources and Wetlands”), improve water quality by allowing filtration of sediments and other contaminants, and may provide locations for groundwater recharge.



SOURCE: ESRI Streetmap USA (2005), California High Speed Rail Authority (2007), FEMA (2004)

Figure 3.14-1
Bay Area to Central Valley Floodplains

Floodplains encompass floodways, which are the primary areas that convey flood flows. Floodways are typically channels of a stream, including any adjacent areas. NFIP has introduced the concept of floodways and floodplains to assist local communities in floodplain management. The floodway is the channel of a stream, including any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases to flood heights. The area between the floodway and the 100-year floodplain boundary is referred to as the floodway fringe. Any approved encroachment may take place within the floodway fringe. According to guidelines established by FEMA, increase in flood height in the floodway due to any encroachment in the floodway fringe areas may not exceed 12 in (30.48 cm), provided that hazardous velocities are not produced in the water body. Constructing levees, rail and road embankments, buildings, etc., that encroach on floodplains may reduce the flood-carrying capacity and increase flood elevations.

Surface Waters

For this analysis, surface waters include improved flood control or drainage channels, canals, intermittent river and stream channels, permanent river and stream channels, ponds, lakes, reservoirs, coastal estuaries and lagoons, and sloughs. In addition, other human-made water features include aqueducts and salt evaporating ponds.

The California State Water Project (SWP) is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping facilities. Its main purpose is to store water and distribute it to urban and agricultural water suppliers in northern California, the San Francisco Bay Area, the San Joaquin Valley, the central coast, and southern California. The SWP includes about 660 mi (1,062 km) of open canals and pipelines.

The federal Central Valley Project (CVP) is a long-term project for the storage and delivery of waters of the Sacramento River basin in the north for use in the San Francisco Bay area, the farmlands of the San Joaquin Valley, and other metropolitan areas in the south.

The CVP’s primary purposes include flood control; improvement of navigation on Central Valley rivers; development of hydroelectric power, irrigation, and municipal and industrial water supply; protection of the Sacramento-San Joaquin River Delta from salt water intrusion by allowing sufficient delivery of freshwater to the Delta; and protection and enhancement of fish and wildlife.

Streams and lakes are important because they support fish and wildlife, contribute to the water supply, convey floodwaters, and may contribute to or attenuate the risk of downstream flooding. They provide important habitat for native species and may support wetland and riparian habitats (discussed in Section 3.15, “Biological Resources and Wetlands”), direct pathways connecting to downstream ecological or human resources, and locations for groundwater recharge.

Lagoons and estuaries are sheltered, semi-enclosed, brackish bodies of water along shorelines where fresh water and saltwater interface through tidal flows and currents. Pollution from stormwater runoff, industrial discharges, and boats can damage these resources, especially if their tidal flow is limited. The amount, frequency, duration, and quality of freshwater flows affect the salinity levels, which in turn dictate the types of biological resources associated with a particular water body. Figure 3.14-2 shows surface waters in the general vicinity of the hydrologic resources study area. (See Section 3.15, “Biological Resources and Wetlands,” for a discussion of wetlands).

Groundwater

Groundwater is found in subsurface water-bearing formations. A groundwater basin is defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers. Groundwater basins, which do not necessarily coincide with surface drainage basins, are defined by surface features and/or geological features such as faults, impermeable layers, and natural or artificial divides in the water table surface. The elevation of groundwater varies with the amount of withdrawal and the amount of recharge to the groundwater basin. Groundwater basins may be recharged naturally as precipitation infiltrates and/or artificially with imported or reclaimed water. Shallow groundwater is subject to potential impacts from dewatering during construction.

Figure 3.14-3 shows groundwater basins within the general vicinity of the hydrologic resources study area.

C. GENERAL DISCUSSION OF WATER QUALITY

Surrounding land uses affect surface water and groundwater quality. Both point-source[2] and nonpoint-source[3] discharges contribute contaminants to surface waters. Pollutant sources in urban areas include parking lots and streets, rooftops, exposed earth at construction sites, and landscaped areas. Pollutant sources in rural/agricultural areas primarily include agricultural fields and operations.

The impacts of nonpoint-source pollutants on aquatic systems are many and varied. Polluted runoff waters can result in impacts on aquatic ecosystems, public use, and human health from ground and surface water contamination; damage to and destruction of wildlife habitat; decline in fisheries; and loss of recreational opportunities. Small soil particles washed into streams can smother spawning grounds and marsh habitat. Suspended small soil particulates can restrict light penetration into water and limit photosynthesis of aquatic biota. Metals and petroleum hydrocarbons washed off roadways and parking lots and fertilizers, pesticides, and herbicides from landscaped areas may cause toxic responses (acute or long-term) in aquatic life or may harm water supply sources such as reservoirs or aquifers.

Erosion

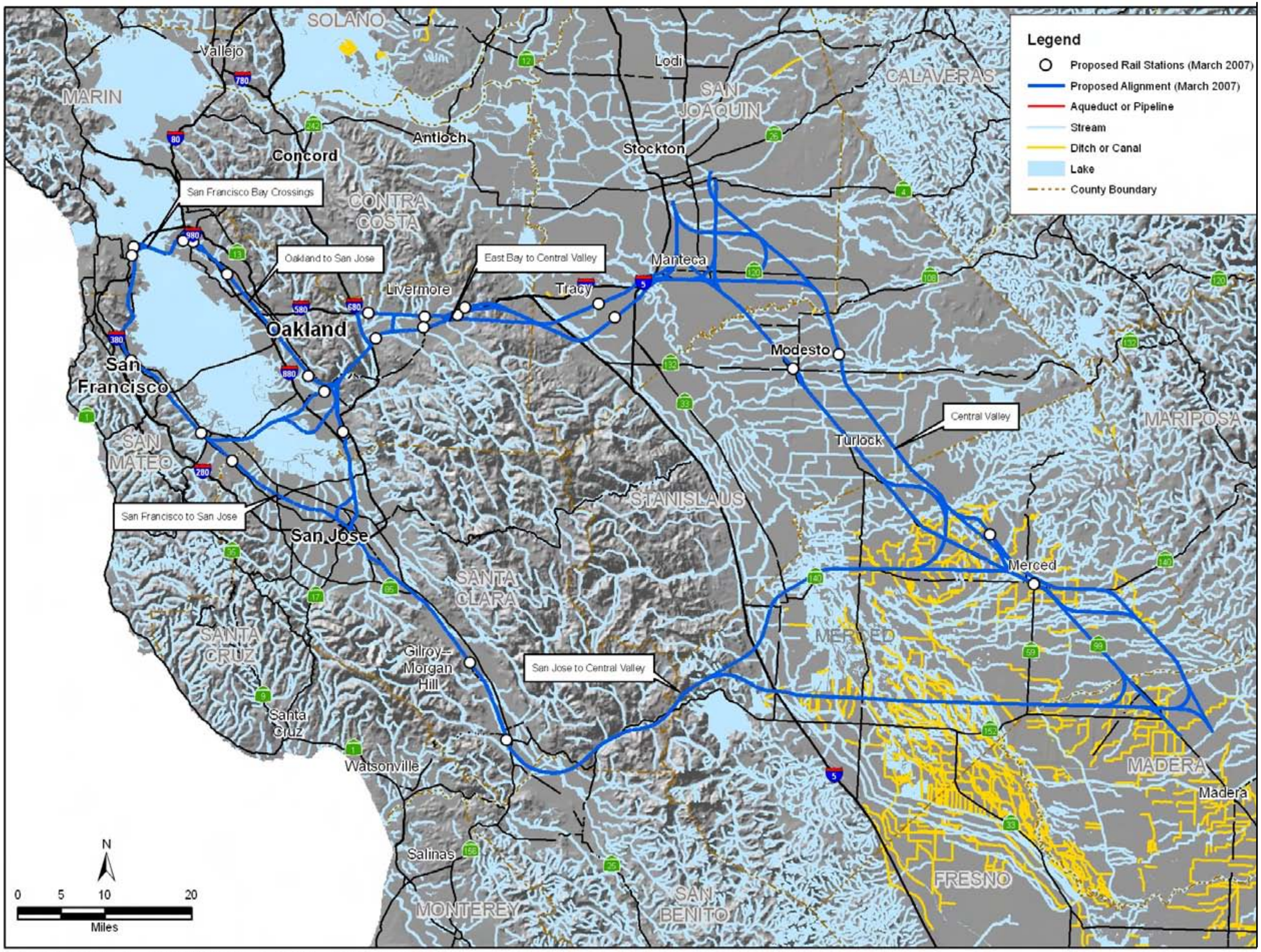
Potential impacts on water quality may result from construction activity (e.g., grading, which removes vegetation, exposing soil to wind and water erosion). A potential erosive condition occurs in areas with a combination of erosive soil types and steep slopes. Erosion can result in sedimentation that ultimately flows into surface waters. Contaminants in runoff waters may include sediment, hydrocarbons (e.g., fuels and solvents), metals, pesticides, bacteria, nutrients, and trash. Figure 3.14-4 shows areas with soils susceptible to erosion in the general vicinity of the hydrologic resources study area.

Impaired Waters

Some water bodies have been given special status under the CWA. The Section 303(d) list of CWA requires each state to identify waters that will not achieve water quality standards after application of effluent limits and to develop plans for water quality improvement. For each water body and pollutant for which water quality is considered impaired, the state must develop load-based (as opposed to concentration-based) limits called total maximum daily loads (TMDLs). TMDL is the maximum amount of pollution (both point and non-point sources) that a water body can assimilate without violating state water quality standards. Priorities for development of TMDLs are set by the state, based on the severity of the pollution and the beneficial uses of the waters. The EPA's TMDL program provides a process for determining pollution budgets for the nation's most impaired waters. Pollutant loading limits are set and implemented by the State Water Board under the Porter-Cologne Act. The program includes development of water quality standards, issuance of permits to control discharges, and enforcement action against violators.

[2] *Point source* is a stationary location or fixed facility, such as the end of a pipe, from which pollutants are discharged. (U.S. Environmental Protection Agency 2002.)

[3] *Nonpoint source* pollution is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water (U.S. Environmental Protection Agency 2002).

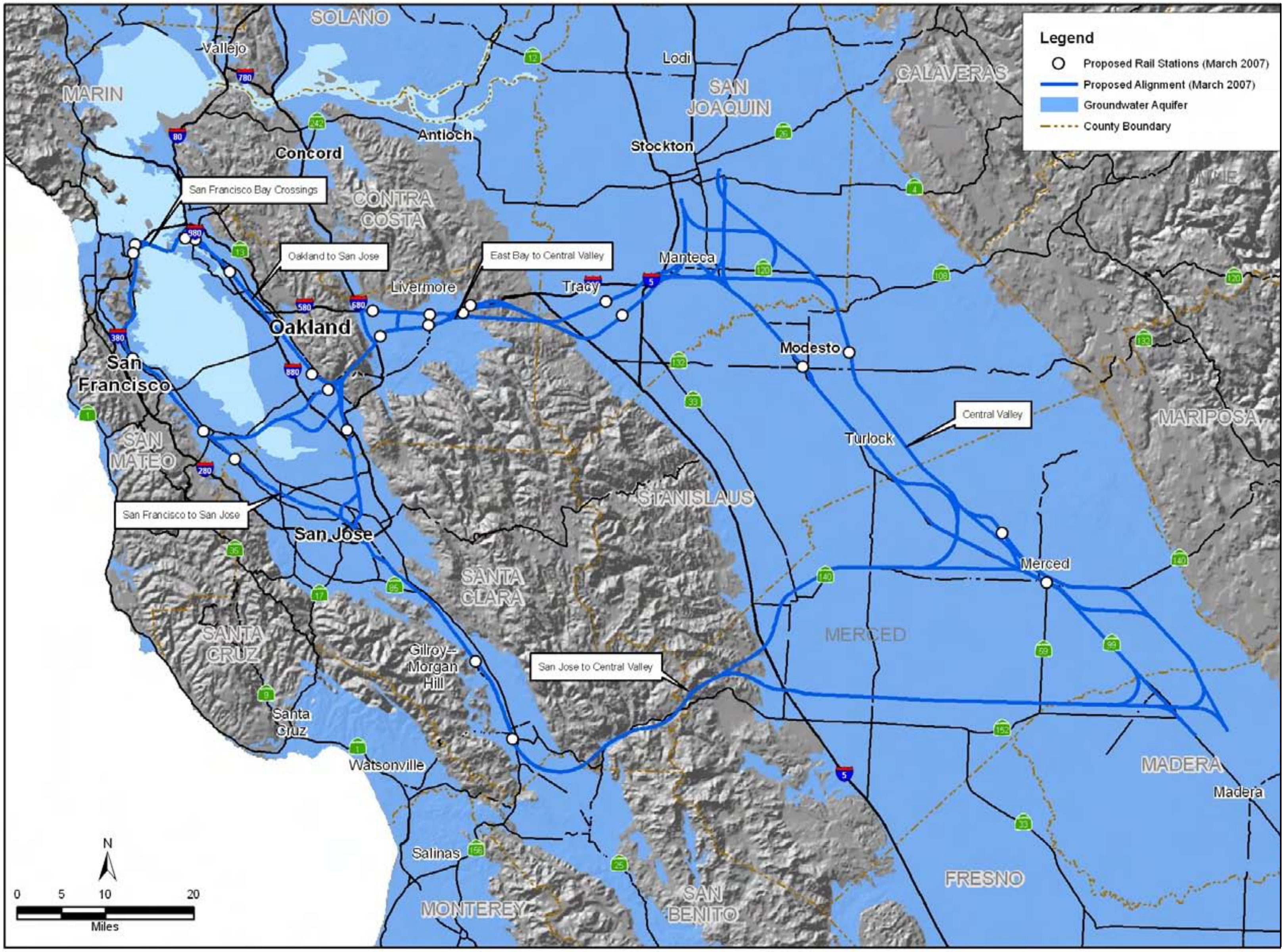


SOURCE: ESRI Streetmap USA (2005), California High Speed Rail Authority (2007), California Resources Agency (2003), US Bureau of Reclamation (2003)

FLY CALIFORNIA

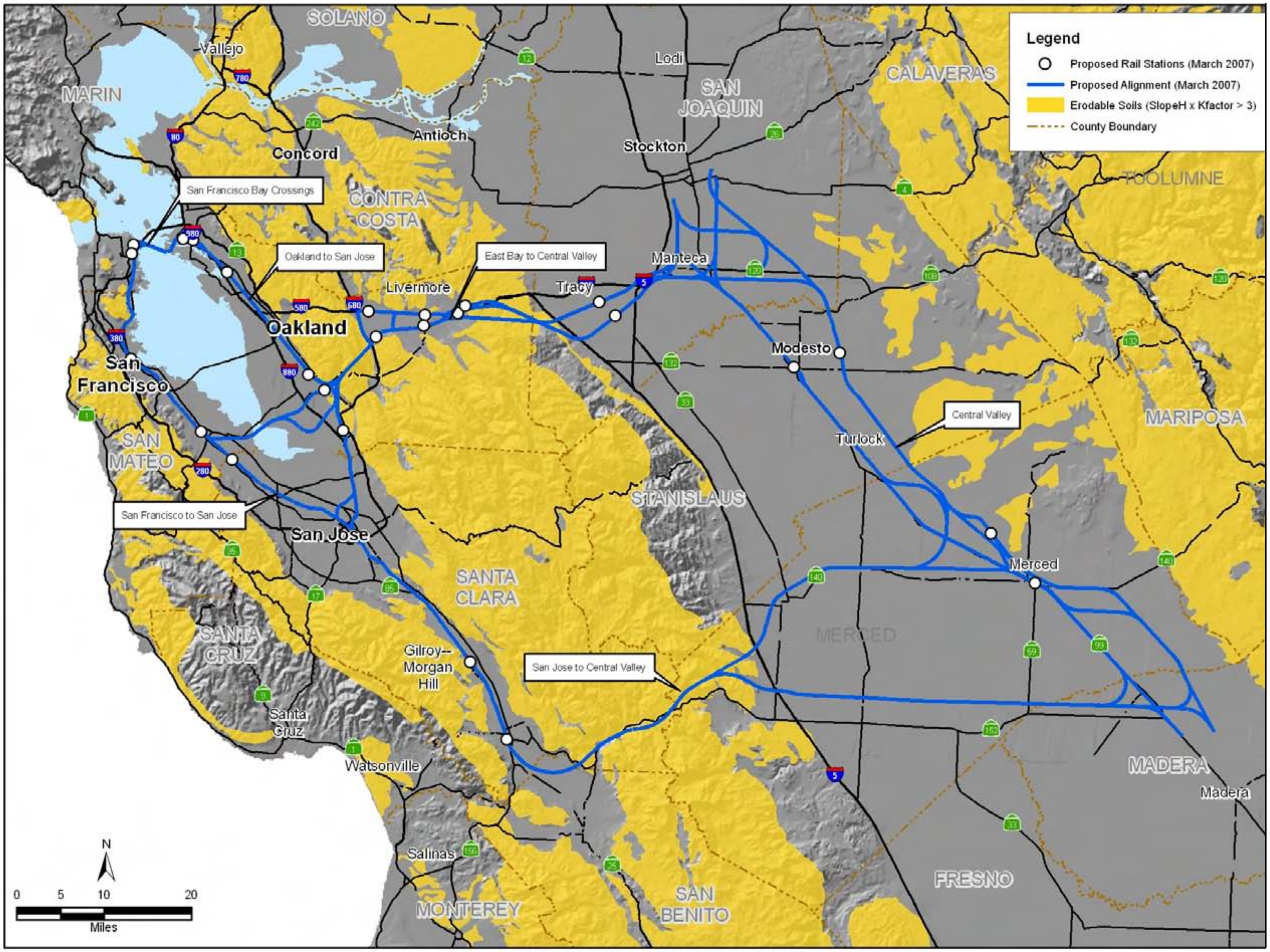
U.S. Department of Transportation Federal Railroad Administration

Figure 3.14-2
Bay Area to Central Valley Surface Waters



SOURCE: ESRI Streetmap USA (2005), California High Speed Rail Authority (2007), USGS (2000)

Figure 3.14-3
Bay Area to Central Valley Groundwater



SOURCE: ESRI Streetmap USA (2005), California High Speed Rail Authority (2007), USDA Natural Resources Conservation Service (2006)

Figure 3.14-4
Bay Area to Central Valley Erodable Soils

D. HYDROLOGY/WATER RESOURCES AND WATER QUALITY OF THE STUDY AREA

This region includes central California from the San Francisco Bay area (San Francisco and Oakland) south to the Santa Clara Valley and east across the Diablo Range to the Central Valley and east across the Altamont Pass to the Central Valley.

San Francisco to San Jose Corridor

The San Francisco to San Jose corridor includes the western portion of the San Francisco Bay area from San Francisco (San Francisco County), south through eastern San Mateo County to San Jose (Santa Clara County). The San Francisco Bay and the Santa Clara Valley geophysical features dominate the areas traversed by this corridor. The major watershed that corresponds to these geophysical features is the San Francisco Bay watershed, including the Guadalupe River and Coyote Creek. Elevation along the San Francisco to San Jose corridor ranges from sea level to around 200 ft (61 m).

Floodplains

As delineated by FEMA, 100-year floodplains have been mapped along the streams bordering San Francisco Bay, along Coyote and Suisun Creeks, and along the Guadalupe River.

Surface Waters

Major streams and surface waters in the study area include San Francisco Bay and the Guadalupe River. The study area also includes extensive tidal flats and salt evaporating ponds in the South Bay and the estuaries of Coyote Creek and Guadalupe River. In addition, the Hetch Hetchy Aqueduct is a major water resource in this area.

Groundwater

Relatively uniform, unconfined aquifers and associated water tables are expected in the San Francisco Bay/Santa Clara Valley Basins to the west. The Santa Clara Valley Basin is composed of the Santa Clara Subbasin and the San Mateo Subbasin along this corridor. Additionally, there is the San Francisco sand dune area and the Visitation Valley Basin that provide groundwater. Groundwater in this basin is routinely pumped for domestic purposes and is subject to long-term fluctuations in water levels due to overdraft and recharge conditions. Groundwater is generally considered shallow in recharge/discharge areas near San Francisco Bay.

Oakland to San Jose Corridor

The Oakland to San Jose corridor includes the eastern portion of the San Francisco Bay Area from Oakland in Alameda County south through Fremont and Milpitas to San Jose. The San Francisco Bay, the Santa Clara Valley, and the Diablo Range are the geophysical features that dominate the areas traversed by this corridor. The major watershed that corresponds to these geophysical features is the San Francisco Bay watershed, including the Guadalupe River and Coyote Creek. Elevation along the Oakland to San Jose corridor ranges from sea level to around 200 ft (61 m).

Floodplains

As delineated by FEMA, 100-year floodplains have been mapped along the streams bordering and leading into San Francisco Bay.

Surface Waters

Major streams and surface waters in the study area in this region include San Francisco Bay, Oakland Harbor, San Leandro Bay, and San Leandro and San Lorenzo Creeks. The Sacramento, San Joaquin, and Merced Rivers empty into the bay delta, which ultimately discharges into San Francisco Bay. The study area also includes Lake Merritt Tidal Channel, Quarry Lakes, extensive tidal flats and salt evaporating ponds in the South Bay, and the estuaries of Coyote Creek and Guadalupe River.

Groundwater

The Santa Clara Valley Basin is the primary source for groundwater along this corridor with three of its subbasins: the Alameda East Bay, the Niles Cone, and the Santa Clara. Groundwater in these basins is routinely pumped for domestic uses and is subject to long-term fluctuations in water levels due to overdraft and recharge conditions. Groundwater is generally considered shallow in recharge/discharge areas near San Francisco Bay. Occurrence of groundwater in the Diablo Range would likely be influenced by fracture patterns and rock type.

San Jose to Central Valley Corridor

The San Jose to Central Valley corridor includes the Santa Clara Valley from San Jose south through Morgan Hill and Gilroy, and then east through the Coast Range into the Central Valley. The major geophysical regions include the Santa Clara Valley, the southern reaches of the Diablo Range, and the Central Valley. The major watersheds include the San Francisco Bay watershed, including the Guadalupe River and Coyote Creek, the Pajaro River watershed, and the San Joaquin River watershed. Elevation along the San Jose to Central Valley Corridor ranges from 150 ft (46 m) to 1,200 ft (366 m).

In addition, The GEA is located in the area of this corridor. The GEA, located north, east, and south of the city of Los Banos in Merced County, encompasses approximately 180,000 ac (72,843.71 ha). It is the largest wetland complex in California and contains the largest block of contiguous wetlands remaining in the Central Valley.[4] This region is considered a critical component of the Central Valley wintering habitat for waterfowl and has been recognized as a resource of international significance. Included in the GEA are the San Luis National Wildlife Refuge and the Kesterson National Wildlife Refuge.

Floodplains

As delineated by FEMA, 100-year floodplains have been mapped along the Pajaro River and its tributaries.

Surface Waters

Major streams and surface waters in the study area in this region include the Guadalupe, Pajaro, San Joaquin, Chowchilla, and Merced Rivers. The Hetch Hetchy and California Aqueducts, Don Castro and San Luis Reservoirs, and O'Neill Forebay are also located in the study area in this region. In addition, there are a number of managed wetland areas including Mud Slough, Salt Slough, Los Banos Wildlife Area, Kesterson National Wildlife Refuge, and Kesterson Reservoir. Many of the streams and creeks in this region are considered impaired waters. Orestimba Creek and the surrounding watershed has been designated as an aquatic resource of national importance. In addition, there are a number of manmade canals and channels that crisscross the Central Valley alignments.

Groundwater

Relatively uniform, unconfined aquifers and associated water tables are expected in the two valleys at either end of the proposed alignment alternatives, the Central Valley to the east and the San Francisco Bay/Santa Clara Valley to the west. In the Central Valley, the largest groundwater basin is the San Joaquin, composed of the Delta Mendota Subbasin, the Merced Subbasin, the Chowchilla Subbasin, and the Madera Subbasin along the HST corridor. In the San Francisco Bay/Santa Clara Valley, the largest groundwater basins are the Santa Clara Valley, composed of the Santa Clara Subbasin, and the Gilroy-Hollister Valley Basin, composed of the Bolsa Area and the Llagas Area. Groundwater in these basins is routinely pumped for domestic and agricultural purposes and is subject to long-term fluctuations in water levels due to overdraft and recharge conditions. Groundwater is generally considered shallow in recharge/discharge areas near the San Joaquin River

[4] Grasslands Water District, Land Use and Economics Study: Grasslands Ecological Area (July 2001), P. 2 (hereafter "Grassland Water District").

and its tributaries in the Central Valley, near San Francisco Bay, and in the area of the Sacramento-San Joaquin River Delta. Occurrence of groundwater in the Diablo Range would likely be influenced by fracture patterns and rock type.

East Bay to Central Valley Corridor

The East Bay to Central Valley corridor includes the East San Francisco Bay near Union City (Alameda County) east to the Livermore Valley (Pleasanton and Livermore), across Patterson Pass into the Central Valley. The dominant geophysical features traversed by this corridor include the San Francisco Bay, the Diablo Range, and the Central Valley. Major watersheds include the San Francisco Bay watershed, the Las Positas watershed, and the San Joaquin River watershed. Elevation along the East Bay to Central Valley corridor ranges from 100 ft (30 m) to 1,300 ft (396 m).

Floodplains
As delineated by FEMA, 100-year floodplains have been mapped along the San Joaquin River and its tributaries.

Surface Waters
Major streams and surface waters in the study area in this region include the San Joaquin River, the Delta Mendota Canal, and the California Aqueduct. There are a number of additional manmade canals and channels that crisscross the East Bay to Central Valley alignments.

Groundwater
Relatively uniform, unconfined aquifers and associated water tables are expected in the San Francisco Bay/Santa Clara Valley groundwater basins to the west. This corridor is composed of a number of groundwater basins, as well as subbasins, including the Santa Clara Valley Basin and the Niles Subbasin; the San Joaquin Valley Basin and the Eastern San Joaquin and Tracy subbasins; Livermore Valley Basin; and Sunol Valley Basin. Groundwater in this basin is routinely pumped for domestic and agricultural purposes and is subject to long-term fluctuations in water levels due to overdraft and recharge conditions. Groundwater is generally considered shallow in recharge/discharge areas near the San Joaquin River and its tributaries in the Central Valley, near San Francisco Bay, and in the area of the Sacramento-San Joaquin River Delta. Occurrence of groundwater in the Diablo Range would likely be influenced by fracture patterns and rock type.

San Francisco Bay Crossings

The San Francisco Bay Crossings study area includes the San Francisco Bay area from San Francisco east to Oakland and the San Francisco Bay area from North Fair Oaks (San Mateo County) east to Union City. The major geophysical feature traversed is the San Francisco Bay, which is the major watershed. Elevation ranges from sea level to 50 ft (15 m).

The San Francisco Bay is an estuary divided in to the South, Central, and North Bay. It has a deep central channel, broad mudflats, and fringing marsh. The combined flows of the Sacramento and San Joaquin watersheds flow through the Sacramento Delta and into the San Francisco Bay (Department of Water Resources 2005, page 3-1).

The immediate region is generally highly urbanized and includes the major cities of San Francisco, Oakland, and the San Jose Metropolitan area. Water use in the Bay region is predominantly urban with more than 50% of the use as residential (Department of Water Resources 2005, page 3-1). Although local groundwater only accounts for about 5% of the region's average water supply, the more heavily used basins include the Santa Clara Valley, Livermore Valley, Westside, Niles Cone, Napa-Sonoma Valley, and Petaluma Valley groundwater basins(Department of Water Resources 2005, page 3-3).

Because the estuary's watershed is highly urbanized, contaminant loads come from both nonpoint and point sources, including stormwater runoff, construction site runoff, pesticide and erosion from agricultural land runoff, discharges from refineries, ships discharging ballast water, waste, and other industrial uses. (Department of Water Resources 2005, page 3-4 and 3-9). The Napa, Petaluma, and Guadalupe Rivers; the Sacramento-San Joaquin Delta; and the Central Valley all contribute different pollutants to the estuary. Sediment concentrations of legacy pollutants (polychlorinated biphenyls, mercury, silver, and selenium) are a continuing problem in the estuary, with sediment samples passing toxicity tests only about 60 percent of the time (Department of Water Resources 2005, page 3-9).

Floodplains

As delineated by FEMA, 100-year floodplains have been mapped along the streams bordering San Francisco Bay. They also have been mapped along many of the rivers that empty into the Bay, such as Coyote and Suisun Creeks, and along the Guadalupe, Sacramento, San Joaquin, and Merced Rivers and their tributaries.

Surface Waters

Major streams and surface waters in the study area in this region include San Francisco Bay. The Guadalupe, Pajaro, Sacramento, San Joaquin, and Merced Rivers and their tributaries all discharge into San Francisco Bay. The study area also includes Lake Merritt Tidal Channel, Quarry Lakes, extensive tidal flats and salt evaporating ponds in the South Bay, and the estuaries of Coyote Creek and Guadalupe River. Many of the streams and creeks in this region are considered impaired waters.

Groundwater

Relatively uniform, unconfined aquifers and associated water tables are expected in the Santa Clara Valley Basin (Niles Cone and Alameda East Bay Subbasins). Groundwater in this basin is routinely pumped for domestic purposes and is subject to long-term fluctuations in water levels due to overdraft and recharge conditions. Groundwater is generally considered shallow in recharge/discharge areas near San Francisco Bay.

Central Valley Corridor

The Central Valley corridor includes the Central Valley from Chowchilla (Madera County) and Merced (Merced County) north through Modesto (Stanislaus County) to Stockton (San Joaquin County). The major geophysical feature traversed by this corridor is the Central Valley. The major watershed in this corridor is the San Joaquin River watershed. Elevation range for the Central Valley corridor ranges from 30 ft (9 m) to 250 ft to (76 m).

As with the San Jose to Central Valley corridor, the Central Valley corridor falls within the San Joaquin River watershed. Six drainages make up the west side of the valley floor section of the San Joaquin River. From north to south, they are Del Puerto Creek, Orestimba Creek, Garzas Creek, Los Banos Creek, Mud Slough, and Salt Slough. Many of these tributaries are under the control of the Westside San Joaquin Valley Drainage Authority, and flows are dictated by the land use of the area, which is primarily agricultural. Summer water flows are entirely composed of agricultural return flows.

Floodplains

As delineated by FEMA, 100-year floodplains have been mapped along the Sacramento, San Joaquin, and Merced Rivers and their tributaries.

Surface Waters

Major streams and surface waters in the study area in this region include the San Joaquin, Tuolumne, Stanislaus, Chowchilla, and Merced Rivers. The Hetch Hetchy and California Aqueducts, Don Castro and San Luis Reservoirs, and O'Neill Forebay are also located in the study area in this corridor. Many of the streams and creeks in this corridor are considered impaired waters. In addition, there are a number of manmade canals and channels that crisscross the Central Valley.

Groundwater

Relatively uniform, unconfined aquifers and associated water tables are expected in the Central Valley groundwater basins to the east. The San Joaquin Valley groundwater basin encompasses this entire region, and the corridor impacts the following subbasins: Modesto, Eastern San Joaquin, Turlock, Merced, and Chowchilla. Groundwater in these basins is routinely pumped for domestic and agricultural purposes and is subject to long-term fluctuations in water levels due to overdraft and recharge conditions. Groundwater is generally considered shallow in recharge/discharge areas near the San Joaquin River and its tributaries in the Central Valley and in the area of the Sacramento-San Joaquin River Delta.

3.14.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

In addition to existing conditions, the No Project Alternative includes planned and programmed transportation improvements that would be constructed and operational by 2030. The potential impacts of the No Project Alternative on hydrologic resources and water quality are assumed to be limited because typical design and construction practices would need to meet permit conditions. However, some impacts on hydrologic resources would likely result from the implementation of the projects under the No Project Alternative, such as increased runoff from added lanes of paved surface and new columns for expanded bridges over rivers and streams. However, attempting to estimate these potential changes would be speculative. It is assumed that project-level environmental documents and permits would be prepared by project proponents for future projects that would affect hydrologic resources and water quality. These project-level documents would identify and analyze, and avoid, minimize, or mitigate potential impacts on hydrology and water quality to the extent feasible.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

Potential impacts on hydrology and water resources that may result from the proposed HST Alignment Alternatives and station options include potential encroachment on or location in a floodplain, potential impacts on water quality, potential increased/decreased runoff and stormwater discharge due to changes in the amount of paved surfaces, potentially increased or decreased contribution of nonpoint-source contamination from automobiles, and potential impacts on groundwater from dewatering or reduction of groundwater recharge.

The key findings of the hydrology and water quality analysis by corridor and alignment alternative are summarized below. For a summary of the hydrologic and water quality potential direct impacts, see Table 3.14-1. Potential indirect impacts are listed in Table 3.14-2. For complete data of all hydrological and water quality impacts by alignment segment, see Appendix 3.14-A.

Table 3.14-1. Summary of Direct Water Resource Impacts for Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters Affected
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	49.3	1,178	0.0	8.5	268.0	1
	1 of 1	Dumbarton to San Jose	46.5	1,435	0.0	0.0	238.8	6
Station Location Options								
Transbay Transit Center			0	0	0	0	9.1	0
4th and King (Caltrain)			0	0	0	0	40.6	0
Millbrae/SFO			0	0	0	0	11.0	0
Redwood City (Caltrain)			0	0	0	0	6.2	0
Palo Alto (Caltrain)			0	0	0	0	20.7	0
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	4.3	1,035	0.0	12.6	133.2	3
		12th Street/City Center to Niles Junction	4.3	1,035	0.0	12.6	132.1	3
	1 of 2	Niles Junction to San Jose via Trimble	36.4	1,013	0.7	22.5	143.2	3
		Niles Junction to San Jose via I-880	45.5	1,135	0.7	22.5	134.5	3
Station Location Options								
West Oakland/7th Street			0	0	0	0	5.1	
12th Street/City Center			0	0	0	0	4.8	0
Coliseum/Airport			1.61	1,683	0	0	15.1	0
Union City (BART)			1.12	273	0	0	56.0	0

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters Affected
Fremont (Warm Springs)			0	0	0	0	81.3	0
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	103.4	2,674	0.0	41.8	451.0	5
	1 of 3	Henry Miller (UPRR Connection)	126.4	6,697	2.3	22.2	355.4	3
		Henry Miller (BNSF Connection)	130.4	6,266	2.5	22.2	366.9	3
		GEA North	53.08	6,771	2.3	36.0	340.3	3
Station Location Options								
San Jose (Diridon)			0	0	0	0	18.8	0
Morgan Hill (Caltrain)			0	0	0	0	11.0	0
Gilroy (Caltrain)			0	0	0	0	40.1	0
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	3.7	2,583	0.0	62.5	105.6	3
		I-580/ UPRR	8.2	2,280	2.1	61.5	103.8	5
		Patterson Pass/UPRR	9.4	1,861	0.0	46.6	152.2	4
		UPRR	7.0	1,957	0.0	64.1	152.1	5
	1 of 4	Tracy Downtown (BNSF Connection)	41.4	6,228	2.3	15.8	329.3	2
		Tracy ACE Station (BNSF Connection)	48.9	7,390	3.0	17.2	331.9	2
		Tracy ACE Station (UPRR Connection)	29.3	5,433	2.1	17.2	205.2	1
		Tracy Downtown (UPRR Connection)	32.0	5,384	2.3	15.8	241.2	1
	2 of 2	East Bay Connections	0.6	322	0.0	30.3	18.9	

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters Affected
Station Location Options								
Pleasanton (I-680/Bernal Rd)			0	0	0	0	10.9	0
Pleasanton (BART)			2.4	438	0	0	16.2	0
Livermore (Downtown)			0	0	0	0	13.3	0
Livermore (I-580)			1.7	174	0	8.3	15.9	0
Livermore (Greenville Road/UPRR)			0	0	0	0	12.9	0
Livermore (Greenville Road/I-580)			0	0	0	8.2	13.8	0
Tracy (Downtown)			0	0	0	0	11.8	0
Tracy (ACE)			0	0	0	0	15.0	0
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	0.0	0	36.5	0.0	0	2
		Trans Bay Crossing – 4th & King	0.0	0	35.4	0.0	0	2
	1 of 6	Dumbarton (High Bridge)	47.4	1,028	37.3	10.0	133.7	1
		Dumbarton (Low Bridge)	47.4	1,028	37.3	10.0	133.7	1
		Dumbarton (Tube)	47.4	1,028	37.3	10.0	133.7	1
		Fremont Central Park (High Bridge)	71.7	2,041	46.3	0.0	127.7	1
		Fremont Central Park (Low Bridge)	71.7	2,041	46.3	0.0	127.7	1
		Fremont Central Park (Tube)	71.7	2,041	46.3	0.0	127.7	1

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters Affected
Station Location Options								
Union City (Shinn)			0	0	0	0	17.8	0
Central Valley	1 of 6	BNSF – UPRR	183.5	8,291	1.5	0	576.1	6
		BNSF	191.1	8,398	1.6	0	584.1	6
		UPRR N/S	123.4	7,547	0.0	0.0	606.5	3
		BNSF Castle	158.2	6.965	1.6	0	586.1	6
		UPRR – BNSF Castle	97.7	7,734	0.1	0.0	593.7	2
		UPRR – BNSF	123.1	9,060	0.0	0.0	582.9	3
Station Location Options								
Modesto (Downtown)			0	0	0	0	8.5	0
Briggsmore (Amtrak)			0	0	0	0	14.2	0
Merced (Downtown)			11.7	0	0	0	11.7	0
Castle AFB			0	416	0	0	18.0	0

Table 3.14-2. Summary of Indirect Water Resource Impacts for Alignment Alternatives and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	101.2	2,617	3.4	17.7	579.2	1
	1 of 1	Dumbarton to San Jose	74.2	2,649	0.0	0.0	517.9	6
Station Location Options								
Transbay Transit Center			0	0	0	0	12.7	0
4th and King (Caltrain)			0	0	0	0	48.8	0
Millbrae/SFO			0.1	0	0	0	15.2	0
Redwood City (Caltrain)			0	0	0	0	9.5	0
Palo Alto (Caltrain)			0	0	0	0	27.4	0
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	9.5	8,828	0.0	25.4	329.8	3
		12th Street/City Center to Niles Junction	9.5	8,828	0.0	25.4	326.1	3
	1 of 2	Niles Junction to San Jose via Trimble	129.8	2,220	1.3	45.2	484.7	3
		Niles Junction to San Jose via I-880	167.0	2,707	1.3	45.2	445.9	3

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters
Station Location Options								
West Oakland/7th Street			0	0	0	0	8.0	0
12th Street/City Center			0	0	0	0	7.9	0
Coliseum/Airport			2.8	1,734	0	0	20.1	0
Union City (BART)			1.4	831	0	0	63.8	0
Fremont (Warm Springs)			0	0	0	0	91.8	0
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	303.5	9,215	0.0	146.3	1,031.1	5
	1 of 3	Henry Miller (UPRR Connection)	469.5	44,458	10.0	88.9	1,412.5	3
		Henry Miller (BNSF Connection)	487.3	43,420	10.6	88.9	1,468.3	3
		GEA North	158.3	20,436	8.4	144.2	1,304.4	3
Station Location Options								
San Jose (Diridon)			0	0	0	0	24.6	0
Morgan Hill (Caltrain)			0	0	0	0	15.6	0
Gilroy (Caltrain)			0	0	0	0	46.7	0
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	18.8	13,310	0.0	210.1	424.1	3
		I-580/ UPRR	33.7	9,243	7.5	186.3	342.0	5
		Patterson Pass/UPRR	20.6	6,253	0.0	197.8	314.8	4
		UPRR	16.2	6,195	0.0	195.8	318.7	5

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters
	1 of 4	Tracy Downtown (BNSF Connection)	136.0	19,257	7.6	63.5	1,165.4	2
		Tracy ACE Station (BNSF Connection)	154.5	24,468	13.0	70.0	1,137.0	2
		Tracy ACE Station (UPRR Connection)	76.8	13,161	9.2	70.0	629.2	1
		Tracy Downtown (UPRR Connection)	99.6	15,605	7.6	63.5	812.6	1
	2 of 2	East Bay Connections	2.3	1,805	0.0	37.4	75.8	
Station Location Options								
Pleasanton (I-680/Bernal Rd)			0	0	0	0	15.6	0
Pleasanton (BART)			3.3	538	0	0	21.1	0
Livermore (Downtown)			0	276	0	0	17.2	0
Livermore (I-580)			2.7	0	0	11.7	23.1	0
Livermore (Greenville Road/UPRR)			0	0	0	0	21.91	0
Livermore (Greenville Road/I-580)			0	0	0	11.6	19.8	0
Tracy (Downtown)			0	0	0	0	16.3	0
Tracy (ACE)			0	0	0	0	20.3	0

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	0.0	0	235.5	0.0	0	2
		Trans Bay Crossing – 4th & King	0.0	0	228.0	0.0	0	2
	1 of 6	Dumbarton (High Bridge)	162.1	3,627	143.9	40.1	405.9	1
		Dumbarton (Low Bridge)	162.1	3,627	143.9	40.1	405.9	1
		Dumbarton (Tube)	162.1	3,627	143.9	40.1	405.9	1
		Fremont Central Park (High Bridge)	258.7	8,301	179.2	0.0	450.6	1
		Fremont Central Park (Low Bridge)	258.7	8,301	179.2	0.0	450.6	1
		Fremont Central Park (Tube)	258.7	8,301	179.2	0.0	450.6	1

Corridor	Possible Alignments	Alignment Alternative	Floodplains (acres)	Streams (linear feet)	Lakes/ Bay (acres)	Erosion (acres)	Groundwater (acres)	Section 303d Waters
Station Location Options								
Union City (Shinn)			0	0	0	0	22.9	0
Central Valley	1 of 6	BNSF–UPRR	669.5	31,632	6.3	0	2,108.1	6
		BNSF	759.2	32,594	6.7	0	2,218.9	6
		UPRR N/S	422.7	41,122	0.0	0	2,122.8	3
		BNSF Castle	628.8	30,371	6.7	0	2,220.6	6
		UPRR–BNSF Castle	388.0	43,276	0.4	0	2,243.4	2
		UPRR–BNSF	428.7	44,538	0.0	0	2,131.0	3
Station Location Options								
Modesto (Downtown)			0	0	0	0	12.6	0
Briggsmore (Amtrak)			0	0	0	0	18.9	0
Merced (Downtown)			15.3	0	0	0	15.3	0
Castle AFB			0	516	0	0	23.5	0

San Francisco to San Jose Corridor

Alignment Alternatives

San Francisco to Dumbarton Alignment Alternative

This alignment alternative could potentially affect at least 16 named and unnamed water resources, including (i.e., not limited to) Oyster Point Channel, San Bruno Channel, San Bruno Canal, Colma Creek, Mills Creek, San Mateo Creek, and Pulgas Creek.

This alignment alternative could directly impact 49.3 ac (19.95 ha) of areas identified as 100-year floodplains. In addition, 1,178 linear ft (359.1 m) of streams, rivers, and channels could be directly impacted. Surface water bodies are not present in the area of the alignment alternative and therefore would not be affected. Finally, the San Francisco to Dumbarton alignment alternative could directly impact 268 ac (108.46 ha) of groundwater and 8.5 ac (3.44 ha) of land that has potentially erosive conditions. (See Table 3.14-1.)

This alignment alternative could indirectly impact 101.2 ac (40.96 ha) of areas identified as 100-year floodplains. In addition, 2,617 linear ft (797.7 m) of streams, rivers, and channels could be impacted. Finally, this alignment alternative could indirectly impact 579.2 ac (234.4 ha) of groundwater and 17.7 ac (7.16 ha) of land that has potentially erosive conditions (Table 3.14-2).

The San Francisco to Dumbarton alignment alternative would traverse San Mateo Creek, which is identified by the State of California as a TMDL impaired water for the following pollutants: chlordane, DDT, dieldrin, dioxin compounds (including 2,3,7,8-TCDD), exotic species, furan compounds, mercury, PCBs, PCBs (Dioxin Like), selenium, and diazinon. The construction and operation of the HST is not a likely source of any of these contaminants; therefore, this alignment alternative is not expected to increase identified contaminants of this impaired water (Table 3.14-A-5 in Appendix 3.14-A).

Dumbarton to San Jose Alignment Alternative

This alignment alternative would continue south, from Redwood City to San Jose. The alignment alternative could potentially affect at least nine named and unnamed water resources, including (i.e., not limited to) San Francisquito Creek, Matadero Creek, Barron Creek, Permenente Creek, Stevens Creek, Calabasas Creek, and Saratoga Creek.

The Dumbarton to San Jose alignment alternative could directly impact 46.5 ac (18.82 ha) of floodplains. In addition, 1,435 linear ft (437.4 m) of streams, rivers, and channels could be directly impacted. Surface water bodies are not in the study area and therefore would not be impacted by this alignment alternative. Finally, the alignment alternative could directly impact 238.8 ac (96.64 ha) of groundwater. None of the land has potentially erosive conditions; therefore, erosion impacts would not occur (Table 3.14-1).

The Dumbarton to San Jose alignment alternative could indirectly impact 74.2 ac (30.03 ha) of floodplain. In addition, 2,649 linear ft (807.4 m) of streams, rivers, and channels could be impacted. Surface water bodies are not in the study area and therefore would not be impacted. Finally, 517.91 ac (209.59 ha) of groundwater could be indirectly impacted. None of the land has potentially erosive soil conditions; therefore, erosion impacts would not occur. (See Table 3.14-2)

This alignment alternative would traverse TMDL impaired segments of the following six water resources: San Francisquito Creek, Matadero Creek, Stevens Creek, Permanente Creek, Calabasas Creek, and Saratoga Creek. Diazinon is identified as the impairment for these water resources. The construction and operation of the HST is not a likely source of these contaminants; therefore, the alignment alternative is not expected to increase the identified contaminants of waters in the study area. San Francisquito Creek is also impaired for sediment and siltation. The construction of the HST may affect sediment and siltation in San Francisquito Creek.

Station Location Options

There are no floodplains, streams, surface water bodies, or potentially erosive soils within the vicinity of the stations in this corridor. The only differences relate to groundwater. Refer to Tables 3.14-1 and 3.14-2.

Transbay Transit Center

The station location option could directly impact 9.1 ac (3.68 ha) of groundwater and indirectly impact 12.7 ac (5.14 ha).

4th and King (Caltrain) Station

The station location option could directly impact 40.6 ac (16.43 ha) of groundwater and indirectly impact 48.8 ac (19.75 ha).

Millbrae-SFO Station

The station location option could directly impact 11 ac (4.45 ha) of groundwater and indirectly impact 15.2 ac (6.15 ha).

Redwood City (Caltrain) Station

The station location option could directly impact 6.2 ac (2.51 ha) of groundwater and indirectly impact 9.5 ac (3.84 ha).

Palo Alto (Caltrain) Station

The station location option could directly impact 20.7 ac (8.38 ha) of groundwater and indirectly impact 27.4 ac (11.09 ha).

Summary of Impacts

As shown in Tables 3.14-1 and 3.14-2, the San Francisco to San Jose corridor does not include optional alignment alternatives. This corridor generally follows and is adjacent to the Caltrain corridor and minimizes impacts on water resources. At least 25 named and unnamed water resources in the area could be affected within this corridor.

Direct Impacts

The HST has the potential to directly impact 95.8 ac (38.77 ha) of 100-year floodplains, primarily along the segments south of SFO, in Palo Alto, and in Sunnyvale. Within this corridor, the 100-year floodplain is often confined by the embankments of the existing Caltrain or roadway facility. Although there are no surface water bodies in the direct path of the alignment alternatives, there is the potential to impact 2,613 linear ft (796.5 m) of streams, creeks, and channels. In addition, 506.8 ac (205.1 ha) of groundwater basins could be affected. Given the developed and urban area in which the HST is proposed within this corridor, the change in impervious surfaces would be minimal and impacts on groundwater recharge would be low. This corridor would extend through approximately 8.5 ac (3.44 ha) of potentially erosive soil conditions between San Francisco and Millbrae near the Bay. (See Table 3.14-1.)

Indirect Impacts

During site grading and construction activities, areas of bare soil would likely be exposed to erosive forces. Bare soils are much more likely to erode than vegetated areas due to the lack of dispersion, infiltration, and retention created by covering vegetation. Construction activities involving soil disturbance, excavation, cutting/filling, stockpiling, and grading activities could result in increased erosion and sedimentation to surface waters. If precautions are not taken to contain contaminants, construction could produce contaminated stormwater runoff, a major contributor to the degradation of water quality. Hazardous materials associated with construction equipment could also adversely affect water quality if spilled or stored improperly. In addition, construction in areas of high groundwater could require dewatering, with subsequent discharge to surface waters. This process could result in the release of sediment or other contaminants to surface waters.

Construction near the bay or river, stream, and canal crossings has the potential to degrade water quality due to the direct exposure of surface waters to construction-related contaminants. Water quality impacts from construction activities could violate water quality standards, exceed contaminant loadings in impaired waters, provide additional sources of polluted runoff, or otherwise degrade water quality. Construction activities such as excavation, trenching, or tunneling that occur in areas of high groundwater could impact groundwater supplies. While construction activities would also likely occur within a 100-year floodplain, the potential to expose workers to a risk of loss, injury, or death if flooding were to occur during construction would be minimal.

The San Francisco to San Jose corridor has the potential to indirectly impact 175.77 ac (71.13 ha) of floodplains. Although there are no surface water bodies immediately adjacent to the alignment alternatives, there is the potential to impact 5,266 linear ft (1,605.1 m) of streams, creeks, and channels. Finally, 1,097.1 ac (444 ha) of groundwater and 17.7 ac (7.18 ha) of land with potentially erosive soil conditions could be indirectly impacted. (See Table 3.14-2.)

TMDL

The corridor traverses seven TMDL-impaired segments of water resources in the area. The construction and operation of the HST is an unlikely source of most of the contaminants that impair the water resources. The contaminants are generally chlorinated hydrocarbons, heavy metals, and organophosphate pesticides. However, San Francisquito Creek is impaired for sediment and siltation, and the construction of the Dumbarton to San Jose alignment alternative may affect the sediment/silt load in this drainage.

<u>Oakland to San Jose Corridor</u>

Alignment Alternatives

West Oakland to Niles Junction Alignment Alternative

This alignment alternative could potentially affect at least 13 named and unnamed water resources, including (i.e., not limited to) Arroyo Viejo, Lion Creek, San Leandro Creek, San Lorenzo Creek, and Alameda Creek.

The West Oakland to Niles Junction alignment alternative could directly impact 4.3 ac (1.74 ha) of floodplains. In addition, it could directly impact 1,035 linear ft (315.5 m) of streams, rivers, and channels. Surface water bodies are not in the study area and therefore would not be directly affected. Finally, the alignment alternative could directly impact 133.2 ac (53.91 ha) of groundwater and 12.6 ac (5.1 ha) of land that has potentially erosive soil conditions. (See Table 3.14-1)

This alignment alternative could indirectly impact 9.5 ac (3.84 ha) of floodplains. In addition, 8,828 linear ft (2,690.8 m) of streams, rivers, and channels could be indirectly impacted. There are no surface water bodies in the study area, and therefore no impact would occur. Finally, the West Oakland to Niles Junction alignment alternative could indirectly impact 329.8 ac (133.47 ha) of groundwater and 25.4 ac (10.28 ha) of land that has potentially erosive conditions. (See Table 3.14-2.)

The alignment alternative would traverse TMDL impaired segments of the following three water resources: San Leandro Creek, San Lorenzo Creek, and Alameda Creek. These waters are impaired with diazinon. The construction and operation of the HST is not a likely source of these pollutants; therefore, the HST is not expected to increase the identified contaminants of these waters.

12th Street/City Center to Niles Junction Alignment Alternative

This alignment alternative could potentially affect the same 13 named and unnamed water resources as the West Oakland to Niles Junction alignment alternative. This alignment alternative would also have the same direct impacts on floodplains, streams and waters, and land with potentially erosive soil conditions. The direct impact of this alignment alternative on groundwater would be 132.1 ac (53.46 ha). (See Table 3.14-1.)

This alignment alternative would also have the same indirect impacts on floodplains, streams and waters, and land with potentially erosive soil conditions as the West Oakland to Niles Junction alignment alternative. The indirect impact of this alignment alternative on groundwater would be 326.1 ac (131.97 ha) of groundwater. (See Table 3.14-2.)

The alignment alternative would traverse the same TMDL impaired segments of surface waters as the West Oakland to Niles Junction alignment alternative (San Leandro Creek, San Lorenzo Creek, and Alameda Creek). The construction and operation of the HST is not a likely source of diazinon; therefore, the HST is not expected to increase the identified contaminants of these waters.

Niles Junction to San Jose via Trimble Alignment Alternative
This alignment alternative could potentially affect eight named and unnamed water resources, including (i.e., not limited to) Mission Creek, Alameda Creek, the Lagoon/Elizabeth Lake, Penitencia Creek, and Mud Slough/Coyote Creek.

This alignment alternative could directly impact 36.4 ac (14.73 ha) of floodplains. In addition, 1,013 linear ft (308.8 m) of streams, rivers, and channels and 0.7 ac (0.28 ha) of surface water bodies could be impacted. The Niles Junction to San Jose via Trimble alignment alternative could also directly impact 143.2 ac (57.95 ha) of groundwater and 22.5 ac (9.11 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

The Niles Junction to San Jose via Trimble alignment alternative could indirectly impact 129.8 ac (52.53 ha) of floodplains. In addition, 2,220 linear ft (676.7 m) of streams, rivers, and channels and 1.3 ac (0.53 ha) of surface water bodies could be impacted. This alignment alternative could also indirectly impact 484.7 ac (196.16 ha) of groundwater and 45.20 ac (18.29 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The Niles Junction to San Jose via Trimble alignment alternative would traverse TMDL-impaired segments of three of the following surface water resources: Mission Creek, Mud Slough/Coyote Creek, and Guadalupe River/Creek. These waters are impaired for the following pollutants: diazinon and mercury. The construction and operation of the HST is not a likely source of these contaminants; therefore, the HST is not expected to increase the identified contaminants of these waters. Mission Creek is also impaired for ammonia, chlordane (sediment), dieldrin (sediment), hydrogen sulfide, lead (sediment), mercury (sediment), PAHs, PCBs, silver (sediment), and zinc (sediment). Construction and operation of the HST along this alignment alternative is not a likely source of these contaminants; however, sediment transport from construction may affect lead, mercury, silver, and zinc concentrations in Mission Creek.

Niles Junction to San Jose via I-880 Alignment Alternative
This alignment alternative could potentially affect the same eight named and unnamed water resources as the Niles Junction to San Jose via Trimble alignment alternative; however, this alignment alternative would also cross independent segments of Coyote Creek and Guadalupe River for a total of at least 10 water resources potentially affected.

This alignment alternative could directly impact 45.5 ac (18.41 ha) of floodplains. In addition, 1,135 linear ft (345.9 m) of streams, rivers, and channels and 0.7 ac (0.28 ha) of surface water bodies could be impacted. Finally, the Niles Junction to San Jose via I-880 alignment alternative could directly impact 134.5 ac (54.43 ha) of groundwater and 22.5 ac (9.11 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

This alignment alternative could indirectly impact 167 ac (67.58 ha) of floodplains. In addition, 2,707 linear ft (825.1 m) of streams, rivers, and channels and 1.3 ac (0.53 ha) of surface waters bodies could be affected. The Niles Junction to San Jose via I-880 alignment alternative could also indirectly impact 445.9 ac (180.46 ha) of groundwater and 45.20 ac (18.29 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The alignment alternative would traverse TMDL-impaired segments of the same three water resources as the Trimble alignment alternative (Mission Creek, Coyote Creek, and Guadalupe Creek/River). Construction and operation of the HST is not a likely source of the impaired contaminants for these waters; however, sediment transport from construction along this alignment alternative may affect lead, mercury, silver, and zinc concentrations in Mission Creek.

Station Location Options

There are no floodplains, streams, surface water bodies, or potentially erosive soils within the vicinity of the West Oakland/7th Street, 12th Street/City Center, and Freemont (Warm Springs) station location options.

West Oakland/7th Street Station

The station location option could directly impact 5.1 ac (2.06 ha) of groundwater and indirectly impact 8 ac (3.24 ha).

12th Street/City Center Station

The station location option could directly impact 4.8 ac (1.94 ha) of groundwater and indirectly impact 7.9 ac (3.2 ha).

Coliseum/Airport Station

There are 1.6 ac (0.65 ha) of floodplains and 1,683 linear ft (513 m) of streams, rivers, and channels that could be directly impacted by this station location option. Also, 15.1 ac (6.11 ha) of groundwater could be directly impacted. Indirect impacts could occur to 2.8 ac (1.13 ha) of floodplains and 1,734 linear ft (528.5 m) of streams, rivers, and channels. In addition, 20.1 ac (8.13 ha) of groundwater could also be indirectly impacted. There are no surface water bodies or land with potentially erosive soil conditions near this station location option.

Union City (BART) Station

There are 1.1 ac (0.45 ha) of floodplains and 273 linear ft (83.2 m) of streams, rivers, and channels that could be directly impacted by this station. Also, 56 ac (22.66 ha) of groundwater could be directly impacted. Indirect impacts could occur to 1.4 ac (0.57 ha) of floodplains and 831 linear ft (253.3 m) of streams, rivers, and channels. In addition, 63.8 ac (25.82 ha) of groundwater could also be indirectly impacted. There are no surface water bodies or land with potentially erosive soil conditions near this station location option.

Freemont (Warm Springs) Station

The station could directly impact 81.3 ac (32.90 ha) of groundwater and indirectly impact 91.8 ac (37.15 ha).

Summary of Impacts

As shown in Tables 3.14-1 and 3.14-2, a combination of alignment alternatives would be required within this corridor to complete the connection from Oakland to San Jose. The discussion below compares the potential direct and indirect impacts of the West Oakland to Niles Junction alignment alternative to the 12th Street/City Center to Niles Junction alignment alternative and the Niles Junction to San Jose via Trimble alignment alternative to the Niles Junction to San Jose via I-880 alignment alternative.

The West Oakland to Niles Junction and or Niles Junction to San Jose via I-880 alignment alternatives could potentially affect 21 and 23 named and unnamed water resources, respectively. The 12th Street/City Center to Niles Junction and the Niles Junction to San Jose via Trimble alignment alternatives could affect the same water resources, respectively. The Niles Junction to San Jose via I-880 alignment alternative could also affect different segments of Coyote Creek and Guadalupe River not affected by the Niles Junction to San Jose via Trimble alignment alternative.

Direct Impacts

As shown in Table 3.14-1, the West Oakland to Niles Junction alignment alternative would have slightly more impact on groundwater as compared to the 12th Street/City Center to Niles Junction alignment alternative. Both of these alignment alternatives include tunnels that would avoid impacts on the floodplain, and aerial structures that would minimize impact on the floodplain and streams, creeks, and channels. The tunnels in downtown Oakland, either on the West Oakland or 12th Street/City Center to Niles Junction alignment alternatives, would have the potential to encounter groundwater and would require dewatering as part of construction and possibly during operation. The West Oakland to Niles Junction alignment alternative extends under the tributary that extends from Lake Merritt to the Bay. Other areas along these alignment alternatives are highly developed and the change in impervious surfaces would be minimal, and the impacts on groundwater recharge would be low. Both of these alignment alternatives would extend through approximately 12.6 ac (5.1 ha) of potentially erosive soil conditions near Niles Boulevard. Overall, the direct impacts of these two alignment alternatives on water resources are essentially the same.

The Niles Junction to San Jose via Trimble alignment alternative would have the potential to affect approximately 9 ac (3.64 ha) more groundwater than the Niles Junction to San Jose via I-880 alignment alternative, primarily due to the longer length of the Trimble Road option to San Jose. The Niles Junction to San Jose via Trimble alignment alternative would likely encounter groundwater in the South Bay area even though almost 3 miles (4.8 km) of this alignment alternative would be in tunnel along Trimble Road. Dewatering would likely be required during construction and potentially during operation of the HST where the tunnel would encounter groundwater. The tunnel for this alignment alternative would also extend under the Guadalupe River and Coyote Creek, whereas the Niles Junction to San Jose via I-880 alignment alternative would extend over these on aerial structure. Both alignment alternatives may also encounter groundwater where column support footings would be required for aerial structures. Because most of the Niles Junction to San Jose via Trimble alignment alternative would be on aerial structure or in tunnel (along Trimble Road), impacts on 100-year floodplains and streams in the South Bay area would be minimized. Impacts on the floodplain from aerial structures would be limited to column footings. The Niles Junction to San Jose via I-880 alignment alternative extends through additional floodplain areas near the San Jose International Airport, but the potential for impacts would be minimized by using aerial structures for the HST. The amount of erosive soil effects would also be the same for these two alignment alternatives. Overall, the Niles Junction to San Jose via Trimble alignment alternative would have the least potential for direct impacts to floodplains and streams, but it has a higher potential to encounter groundwater due to tunneling along Trimble Road.

Indirect Impacts

Potential indirect impacts from construction within this corridor would be similar to those discussed for the San Francisco to San Jose corridor.

Comparison of the indirect impacts for the West Oakland to Niles Junction and 12th Street/City Center to Niles Junction alignment alternatives is also consistent with what was described above for the direct impacts except for the potential amount of impact that could occur. Overall, the indirect impacts of these two alignment alternatives on water resources are essentially the same (see Table 3.14-2).

Comparison of the indirect impacts for the Niles Junction to San Jose via Trimble and Niles Junction to San Jose via I-880 alignment alternatives is also consistent with what was described above for the direct impacts except for the potential amount of impact that could occur. Overall, the Niles Junction to San Jose via Trimble alignment alternative would have the least potential for indirect impacts to floodplains and streams, but it has a higher potential to encounter groundwater due to tunneling along Trimble Road. (Table 3.14-2)

TMDL
All the alignment alternatives would traverse the same TMDL-impaired sections of water resources. The impaired sections are impaired for the organophosphate pesticide, diazinon. The construction and operation of the HST is not expected to be a likely source of diazinon; therefore, impacts would not occur to the impaired sections. However, the Niles Junction to San Jose via Trimble and Niles Junction to San Jose via I-880 alignment alternatives would both traverse one impaired section of Mission Creek with sediment contamination. Construction of either of these two alignment alternatives could cause sediment transport that could affect the concentrations of sediment contamination.

<u>San Jose to Central Valley Corridor</u>

Alignment Alternatives
Pacheco Alignment Alternative
This alignment alternative could potentially affect at least 13 unnamed and named water resources, including (i.e., not limited to) Los Gatos Creek, Guadalupe River, Little Llagas Creek, Llagas Creek, Miller Slough, Pajaro River, Pacheco Creek, and Tequisquita Slough.

The Pacheco alignment alternative could directly impact 103.4 ac (41.84 ha) of floodplains. In addition, 2,674 linear ft (815 m) of streams, rivers, and channels could be affected. There are no surface water bodies that would be affected. Finally, this alignment alternative could impact 451 ac (182.52 ha) of groundwater and 41.8 ac (16.92 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

This alignment alternative could indirectly impact 303.5 ac (122.83 ha) of floodplains. In addition, 9,215 linear ft of (2,808.7 m) streams, rivers, and channels could be affected. There are no surface water bodies that would be affected. The Pacheco alignment alternative could indirectly impact 1,031.1 ac (417.29 ha) of groundwater and 146.3 ac (59.21 ha) of land that may have erosive soil conditions. (See Table 3.14-2.)

The alignment alternative would traverse TMDL-impaired segments of four surface water resources: Los Gatos Creek, Guadalupe Creek/River, Llagas Creek, and Pajaro River. These waters are impaired with the following pollutants: diazinon, mercury, boron, fecal coliform, chloride, low dissolved oxygen, nitrate, and pH. The construction and operation of the HST is not a likely source of these contaminants; therefore, the alignment alternative is not expected to increase the identified contaminants of these waters. Llagas Creek is also impaired for total dissolved solids (TDS), and any sediment increase associated with construction and operation of the alignment alternative could increase the levels of TDS in the creek. The alignment alternative would be downstream of Tequisquita Slough, a tributary to Pajaro River, which is impaired for fecal coliform. The construction and operation of the HST along this alignment alternative is not a likely source of this contaminant; therefore, the HST is not expected to affect fecal coliform levels in the Pajaro River.

Henry Miller (UPRR Connection) Alignment Alternative
This alignment alternative could potentially affect at least 44 unnamed and named water resources, including (i.e., not limited to) Tule Lake, California Aqueduct, San Luis Creek, Mendota Canal, Main Canal, Los Banos Creek, Los Banos Wildlife Area, San Luis Wasteway, Mud Slough, Delta Canal, Santa

Rita Slough/Salt Slough, San Joaquin River, Mariposa Slough, Chowchilla River, Ash Slough, and Berenda Slough.

This alignment alternative could directly impact 126.4 ac (51.15 ha) of floodplains. In addition, 6,697 linear ft (2,041.2 m) of streams, rivers, and channels and 2.3 ac (0.93 ha) of surface water bodies could be affected. The Henry Miller (UPRR Connection) alignment alternative could also directly impact 355.4 ac (143.83 ha) of groundwater and 22.2 ac (8.98 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

This alignment alternative could indirectly impact 469.5 ac (190.01 ha) of floodplains. In addition, 44,458 linear ft (13,550.8 m) of streams, rivers, and channels and 10.0 ac (4.05 ha) of surface water bodies could be indirectly impacted. Finally, this alignment alternative could indirectly impact 1,412.5 ac (571.64 ha) of groundwater and 88.9 ac (35.98 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The alignment alternative would traverse TMDL-impaired segments of three surface water resources: Mud Slough, San Joaquin River (portion from the Mendota Pool to Bear Creek), and Santa Rita Slough/Salt Slough (portion upstream from the confluence with the San Joaquin River). These waters are impaired with the following pollutants: boron, electrical conductivity, DDT, unknown toxicity, Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor expoxide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), diazinon, and chlorpyrifos. Construction and operation of the HST is not a likely source of these contaminants; however, the Central Valley has a long history of heavy pesticide use and depending on the binding properties of the pesticides to soil and water, sediment runoff from the construction could potentially mobilize and release additional pesticides into these water resources.

Henry Miller (BNSF Connection) Alignment Alternative

This alignment alternative could potentially affect the same 44 named and unnamed streams listed above in the Henry Miller (UPRR Connection) alignment alternative.

This alignment alternative could directly impact 130.4 ac (52.77 ha) of floodplains. In addition, 6,266 linear ft (1,909.9 m) of streams, rivers, and channels and 2.5 ac (1.01 ha) of surface water bodies could be affected. The Henry Miller (BNSF Connection) alignment alternative could also directly impact 366.9 ac (148.48 ha) of groundwater and 22.2 ac (8.96 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

This alignment alternative could indirectly impact 487.3 ac (197.21 ha) of floodplains. In addition, 43,420 linear ft (13,234.4 m) of streams, rivers, and channels and 10.6 ac (4.29 ha) of surface water bodies could be indirectly affected. This alignment alternative could also indirectly impact 1,468.3 ac (594.22 ha) of groundwater and 88.9 ac (35.98 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The Henry Miller (BNSF Connection) alignment alternative would traverse the same TMDL-impaired segments of the three surface water resources identified by the Henry Miller (UPRR Connection) alignment alternative (Mud Slough, San Joaquin River, and Santa Rita Slough/Salt Slough). Construction and operation of the HST is not a likely source of the contaminants affecting these waters; however, the Central Valley has a long history of heavy pesticide us and depending on the binding properties of the pesticides to soil and water, sediment runoff from the construction could potentially mobilize and release additional pesticides into these water resources.

GEA North Alignment Alternative

The GEA North alignment alternative could potentially affect at least 44 unnamed and named water resources, including (i.e., not limited to) California Aqueduct, Mendota Canal, Garzas Creek, Sullivan

Extension, Duck Ponds, Mud Slough, San Joaquin River, Cottonwood Creek, Los Banos Creek, Livingston Canal, and the Merced River.

This alignment alternative could directly impact 53.1 ac (21.48 ha) of floodplains. In addition, 6,771 linear ft (2,063.8 m) of streams, rivers, and channels and 2.3 ac (0.93 ha) of surface water bodies could be affected. Finally, the GEA North alignment alternative could directly impact 340.3 ac (137.72 ha) of groundwater and 36 ac (14.57 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

This alignment alternative could indirectly impact 158.3 ac (64.04 ha) of floodplains. In addition, 20,436 linear ft (6,228.9 m) of streams, rivers, and channels and 8.4 ac (3.4 ha) of surface water bodies could be indirectly affected. This alignment alternative could also indirectly impact 1,304.4 ac (527.89 ha) of groundwater and 144.2 ac (58.36 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The GEA North alignment alternative would cross the San Joaquin River (portion from Bear Creek to Mud Slough), which is impaired for the following pollutants: boron, electrical conductivity, DDT, unknown toxicity, Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor expoxide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), diazinon, and chlorpyrifos. This alignment alternative would also cross the Merced River (portion from McSwain Reservoir to San Joaquin River), which is impaired for the following pollutants: chlorphrifos, diazinon, Group A pesticides (including: aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor expoxide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), and mercury. Construction and operation of the HST is not a likely source of these contaminants; however, the Central Valley has a long history of heavy pesticide use and depending on the binding properties of the pesticides to soil and water, sediment runoff from the construction could potentially mobilize and release additional pesticides into these water resources.

Station Location Options

There are no floodplains, streams, surface water bodies, or potentially erosive soils within the vicinity of the station location options within this corridor.

San Jose (Diridon) Station
The station location option could directly impact 18.8 ac (7.61 ha) of groundwater and indirectly impact 24.6 ac (9.96 ha).

Morgan Hill (Caltrain) Station
The station location option could directly impact 11 ac (4.45 ha) of groundwater and indirectly impact 15.6 ac (6.31 ha).

Gilroy (Caltrain) Station
The station location option could directly impact 40.1 ac (16.23 ha) of groundwater and indirectly impact 46.7 ac (18.9 ha).

Summary of Impacts
As shown in Tables 3.14-1 and 3.14-2, any combination of alignment alternatives within this corridor would have to include the Pacheco alignment alternative to complete the connection from San Jose to the Central Valley.

The Pacheco alignment alternative could affect approximately 13 water resources. The Henry Miller alignment alternatives could affect 44 named and unnamed water resources, and the GEA North alignment alternative could also affect approximately 44 water resources. Many of the water resources identified along both of the Henry Miller alignment alternatives and GEA North alignment alternative are manmade canals and ditches used to transport agricultural waters. It should be noted that the USACE or the CDFG do not consider all canals in the Central Valley to be jurisdictional waters. Certain canals that intercept natural drainages/streams and divert the water to another water body such as a reservoir or river can be considered jurisdictional. The USACE makes those determinations on a case-by-case basis. This would occur as part of subsequent project level analysis and in close coordination with the USACE and CDFG.

Direct Impacts

The Pacheco alignment alternative generally follows and is adjacent to the Caltrain corridor from San Jose to Gilroy. From San Jose to Gilroy, this alignment alternative would be constructed at-grade and on aerial structures. From Gilroy across the Diablo Range, the alignment alternative would include a combination of at-grade, aerial structure, and tunnel. The alignment alternative crosses several major watercourses for a total of approximately 2,674 linear ft (815 m) including the Guadalupe River, Pajaro River, and several branches of Pacheco Creek. The alignment alternative extends at-grade or on aerial structure through approximately 103.4 ac (41.85 ha) of 100-year floodplains, with the largest area of floodplain being crossed at-grade between Gilroy and the Diablo Range. The HST would be constructed with culverts under the tracks to convey anticipated storm flows and to minimize ponding. Across the Diablo Range, the amount of 100-year floodplain is minimal and confined to canyons. Impacts on the floodplain from aerial structures would be limited to column footings. The potential to encounter groundwater from San Jose to Gilroy would be limited to where column support footings would be required for aerial structures. The change in impervious surfaces within this same portion would be minimal because the alignment alternative would be adjacent to the existing Caltrain and roadway corridors, which are already developed. South of Gilroy, the alignment alternative extends through agricultural areas before crossing the Diablo Range on a new track and result in a slight increase in impervious surfaces; however, the HST would consist of permeable track-fill rather than impervious pavement resulting in a low runoff potential. The potential to encounter groundwater along this portion would be limited to the area between Gilroy and the Diablo Range and the impacts on groundwater recharge would be low. The potential for erosion due to runoff would primarily be limited to locations of erosive soil conditions within the Diablo Range to the San Luis Reservoir where tunnels and earthwork would be required.

The Henry Miller and GEA North alignment alternatives would connect to the Pacheco alignment alternative north of the San Luis Reservoir. The two Henry Miller alignment alternatives would share most of the same alignment with the exception of the connections to the UPRR and BNSF. The Henry Miller (BNSF Connection) alignment alternative would have slightly more impact on the 100-year floodplain, water bodies, and groundwater as compared to the Henry Miller (UPRR Connection) alignment alternative. The alignment alternative is primarily at-grade and adjacent to Henry Miller Road, which also extends across the floodplain. The HST would be constructed to minimize additional impacts on the floodplain by constructing culverts under the track to convey anticipated storm flows and to minimize ponding. The GEA North alignment alternative would affect up to 77 ac (31.16 ha) less floodplain than either of the Henry Miller alignment alternatives. The GEA North alignment alternative would cross the 100-year floodplain in the area of Mud Slough and the San Joaquin River as well as at the two Merced River crossings where the alignment alternative connects with the BNSF and UPRR. Most of the track for the GEA North would be constructed on embankment and would be designed to convey anticipated storm flows and to minimize ponding. Overall, the GEA North alignment alternative would have the least impact on the 100-year floodplain.

While the Henry Miller and GEA North alignment alternatives would each have similar impacts on streams and canals, the Henry Miller (BNSF Connection) alternative alignment would impact between 24 and 500 linear ft less than the other two alignment alternatives. Because the Henry Miller (UPRR Connection) alignment alternative would re-cross the Chowchilla River and Ash Slough with the north connection to UPRR, the overall amount of impact on streams would be 430 linear ft (131.1 m) more than the Henry Miller (BNSF Connection). Subsequent project level analysis and coordination with the USACE and CDFG would be required to determine which canals would be considered jurisdictional. At this program level of analysis, the Henry Miller (BNSF Connection) alignment alternative would have the least impact on streams and canals.

Both of the Henry Miller alignment alternatives would have 13 ac (5.26 ha) less erosive soil effects than the GEA North alignment alternative, where additional erosive soils exist in the area between I-5 and San Luis Reservoir. The potential to encounter groundwater along each of these three options would be limited to the area east of I-5 and the impacts on groundwater recharge would be low because of the overall footprint of the HST. The potential for erosion due to runoff would primarily be limited to locations of erosive soil conditions at the edge of the Diablo Range where tunnels and earthwork would be required.

Indirect Impacts

Potential indirect impacts from construction would be similar to those discussed for the San Francisco to San Jose corridor. As shown in Table 3.14-2, the indirect impacts associated with the Pacheco alignment alternative generally follow what was described above for the direct impacts except for the potential amount of impacts that could occur.

Comparison of the indirect impacts for the Henry Miller and GEA North alignment alternatives is also consistent with what was described above except for the potential amount of impact. One exception is that the GEA North alignment alternative would indirectly impact substantially fewer streams or canals than either of the Henry Miller alignment alternatives. The GEA North alignment alternative would indirectly impact up to 24,000 less linear ft (7,315.2 m) of streams, rivers, and canals. As shown on Figure 3.14-3, there are fewer streams and canals north and south of the GEA North alignment alternative compared to the Henry Miller alignment alternatives.

TMDL

While the Pacheco alignment alternative would traverse a number of TMDL impaired water resources, the construction and operation of the HST may only impact one of these impaired resources, Llagas Creek, for TDS. Both Henry Miller alignment alternatives would traverse the same three impaired water resources: Mud Slough, San Joaquin River (portion from the Mendota Pool to Bear Creek) and Santa Rita Slough/Salt Slough (portion upstream from the confluence with the San Joaquin River). Although the construction and operation of the HST along these two alignment alternatives is not a likely source of the many contaminants identified as impairing the water resources, depending on the binding properties of the pesticides to soil and water, sediment runoff from construction could potentially mobilize and release additional pesticides into these water resources. Finally, the GEA North alignment alternative would be likely to impact the fewest impaired water resources: the San Joaquin River (segment from Bear Creek to Mud Slough) and Merced River, Lower (segment from McSwain Reservoir to San Joaquin River). However, as with the Henry Miller alignment alternatives, the sediment runoff from the construction of the HST along the GEA North alignment alternative could potentially mobilize and release additional pesticides into the San Joaquin and Merced Rivers.

East Bay to Central Valley Corridor

Alignment Alternatives

Altamont Pass Options (Niles Junction to Altamont)

I-680/580/UPRR Alignment Alternative

This alignment alternative could potentially affect at least 17 unnamed and named water resources, including (i.e., not limited to) Alameda Creek, Laurel Creek, Gold Creek, Arroyo Valle, Arroyo De La Laguna, Tassajara Creek, Cottonwood Creek, Arroyo Las Positas, Arroyo Seco, and South Bay Aqueduct.

This alignment alternative could directly impact 3.7 ac (1.5 ha) of floodplains. In addition, 2,583 linear ft (787.3 m) of streams, rivers, and channels could be impacted. Surface water bodies are not in the study area, and therefore impacts would not occur. Finally, this alignment alternative could directly impact 105.6 ac (42.74 ha) of groundwater and 62.5 ac (25.29 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

The I-680/580/UPRR alignment alternative could indirectly impact 18.8 ac (7.61 ha) of floodplains. In addition, 13,310 linear ft (4,056.9 m) of streams, rivers, and channels could be indirectly affected. Surface water bodies are not in the study area of the alignment alternative, and therefore impacts would not occur. Finally, it could indirectly impact 424.1 ac (171.63 ha) of groundwater and 210.1 ac (85.03 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The I-680/580/UPRR alignment alternative would traverse TMDL-impaired segments of three surface water resources: Alameda Creek, Arroyo De La Laguna, and Arroyo Las Positas. These waters are impaired with diazinon. The construction and operation of the HST is not a likely source of this contaminant; therefore, this alignment alternative is not expected to increase the diazinon levels in these waters.

I-580/UPRR Alignment Alternative

This alignment alternative could potentially affect 15 unnamed and named water resources, including (i.e., not limited to) Arroyo Valle, Arroyo De La Laguna, Cottonwood Creek, Arroyo Las Positas, Arroyo Seco, Arroyo Gravel Pits/Arroyo Mocho, South Bay Aqueduct, and Patterson Run (canal).

This alignment alternative could directly impact 8.2 ac (3.32 ha) of floodplains. In addition, 2,280 linear ft (694.9 m) of streams, rivers, and channels and 2.1 ac (0.85 ha) of surface water bodies could be affected. The I-580/UPRR alignment alternative could also directly impact 103.8 ac (42.01 ha) of groundwater and 61.5 ac (24.89 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

The I-580/UPRR alignment alternative could indirectly impact 33.7 ac (13.64 ha) of floodplains. In addition, 9,243 linear ft (2,817.3 m) of streams, rivers, and channels and 7.5 ac (3.04 ha) of surface water bodies could be indirectly impacted. Finally, this alignment alternative could indirectly impact 342 ac (138.41 ha) of groundwater and 186.3 ac (75.4 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The I-580/UPRR alignment alternative would traverse TMDL-impaired segments of five surface water resources including Alameda Creek, Arroyo De La Laguna, Arroyo Del Valle, Arroyo Positas, and Arroyo Mocho. These waters are impaired with diazinon. The construction and operation of the HST is not a likely source of this contaminant; therefore, the HST along this alignment alternative is not expected to increase diazinon levels in these waters.

Patterson Pass/UPRR Alignment Alternative

This alignment alternative could potentially affect nine unnamed and named water resources, including (i.e., not limited to) Arroyo Valle, Arroyo De La Laguna, Arroyo Las Positas, Arroyo Seco, Arroyo Gravel Pits/Arroyo Mocho, and South Bay Aqueduct and Patterson Run (canal).

This alignment alternative could directly impact 9.4 ac (3.8 ha) of floodplains. In addition, 1,861 linear ft (567.2 m) of streams, rivers, and channels could be impacted. Surface water bodies would not be affected. The Patterson Pass/UPRR alignment alternative could directly impact 152.2 ac (61.6 ha) of groundwater and 46.6 ac (18.86 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

This alignment alternative could indirectly impact 20.6 ac (8.34 ha) of floodplain. In addition, 6,253 linear ft (1,905.9 m) of streams, rivers, and channels and 0.03 ac (0.01 ha) of surface water bodies could be indirectly affected. The Patterson Pass/UPRR alignment alternative could indirectly impact

314.8 ac (127.4 ha) of groundwater and 197.8 ac (80.05 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The Patterson Pass/UPRR alignment alternative would traverse TMDL-impaired segments of four of the five surface water resources that the I-580/UPRR alignment alternative may traverse, with the exception of Arroyo Positas. These waters are impaired with diazinon. The construction and operation of the HST is not a likely source of this contaminant; therefore, the HST along this alignment is not expected to increase diazinon levels in these waters.

UPRR Alignment Alternative

This alignment alternative could potentially affect 12 unnamed and named water resources, including (i.e., not limited to) Alameda Creek, Arroyo Valle, Arroyo De La Laguna, Arroyo Las Positas, Arroyo Seco, Arroyo Gravel Pits/Arroyo Mocho, South Bay Aqueduct, and Patterson Run (canal).

The UPRR alignment alternative could directly impact 7 ac (2.83 ha) of floodplains. In addition, 1,957 linear ft (596.5 m) of streams, rivers, and channels could be affected. Surface water bodies are not in the area; therefore, impacts would not occur. This alignment alternative could also directly impact 152.1 ac (61.55 ha) of groundwater and 64.1 ac (25.94 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

This alignment alternative could indirectly impact 16.2 ac (6.56 ha) of floodplain. In addition, 6,195 linear ft (1,888.2 m) of streams, rivers, and channels and 0.03 ac (0.01 ha) of surface water bodies could be indirectly affected. The UPRR alignment alternative could indirectly impact 318.7 ac (128.98 ha) of groundwater and 195.8 ac (79.24 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The UPRR alignment alternative would traverse TMDL-impaired segments of five surface water resources: Alameda Creek, Arroyo De La Laguna, Arroyo Del Valle, Arroyo Positas, and Arroyo Mocho. These waters are impaired with diazinon. The construction and operation of the HST is not a likely source of this contaminant; therefore, the HST along this alignment is not expected to increase diazinon levels in these waters.

Altamont Pass Options

Tracy Downtown (BNSF Connection) Alignment Alternative

The Tracy Downtown (BNSF Connection) alignment alternative could potentially affect at least 14 unnamed and named water resources, including (i.e., not limited to) California Aqueduct, Delta Mendota Canal, Upper Main Canal, San Joaquin River, Paradise Cut, Tom Paine Slough, Lone Tree Creek, and Avena Drain.

This alignment alternative could directly impact 41.4 ac (16.75 ha) of floodplains. In addition, 6,228 linear ft (1,898.3 m) of streams, rivers, and channels and 2.3 ac (0.93 ha) of surface water bodies could be impacted. Finally, it could directly impact 329.3 ac (133.27 ha) of groundwater and 15.8 ac (6.39 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

The Tracy Downtown (BNSF Connection) alignment alternative could indirectly impact 136.00 ac (55.04 ha) of floodplains. In addition, 19,257 linear ft (5,869.5 m) of streams, rivers, and channels and 7.6 ac (3.08 ha) of surface water bodies could be indirectly affected. This alignment alternative could indirectly impact 1,165.4 ac (471.64 ha) of groundwater and 63.5 ac (25.7 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The Tracy Downtown (BNSF Connection) alignment alternative would be downstream of the San Joaquin River (segment from Stanislaus River to Delta Boundary), identified as TMDL impaired for the following pollutants: boron, electrical conductivity, DDT, unknown toxicity, and Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor expoxide, hexachlorocyclohexane—

including lindane—endosulfan, and toxaphene), diazinon, and chlorpyrifos. Construction and operation of the HST is not a likely source of these contaminants and would not impact this impaired portion of the San Joaquin River, which is upstream of the alignment alternative and any potential contaminants from the construction or operation of the HST would travel downstream and not affect the impaired river segment. The alignment alternative would also traverse Lone Tree Creek, identified as TMDL-impaired for the following pollutants: ammonia, BOD, and electrical conductivity. Construction and operation of the HST is not a likely source of these contaminants; therefore, the alignment alternative is not expected to increase the identified contaminants in Lone Tree Creek.

Tracy ACE Station (BNSF Connection) Alignment Alternative

The Tracy ACE Station (BNSF Connection) alignment alternative could potentially affect at least 14 unnamed and named water resources, including (i.e., not limited to) California Aqueduct, Delta Mendota Canal, Upper Main Canal, San Joaquin River, Paradise Cut, Tom Paine Slough, Lone Tree Creek, and Avena Drain.

This alignment alternative could directly impact 48.9 ac (19.79 ha) of floodplains. In addition, 7,390 linear ft (2,252.5 m) of streams, rivers, and channels and 3.0 ac (1.21 ha) of surface water bodies could be impacted. The Tracy ACE Station (BNSF Connection) alignment alternative could directly impact 331.9 ac (134.32 ha) of groundwater and 17.2 ac (6.96 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

The Tracy ACE Station (BNSF Connection) alignment alternative could indirectly impact 154.5 ac (62.53 ha) of floodplains. In addition, 23,468 linear ft (7,457.8 m) of streams, rivers, and channels and 13 ac (5.26 ha) of surface water bodies could be indirectly affected. This alignment alternative could indirectly impact 1,137 ac (460.14 ha) of groundwater and 70.0 ac (28.33 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The Tracy ACE Station (BNSF Connection) alignment alternative would be downstream of the San Joaquin River (portion from Stanislaus River to Delta Boundary), identified as TMDL impaired for the following pollutants: boron, electrical conductivity, DDT, unknown toxicity, and Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor expoxide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), diazinon, and chlorpyrifos. Construction and operation of the HST is not a likely source of these contaminants and would not impact this impaired segment of the San Joaquin River because the segment is upstream of the alignment alternative. Any potential contaminants from the construction or operation of the HST would travel downstream, not upstream, and therefore would not affect the impaired river segment. The alignment alternative would also traverse Lone Tree Creek, identified as TMDL impaired for the following pollutants: ammonia, BOD, and electrical conductivity. Construction and operation of the HST is not a likely source of these contaminants; therefore, the HST along this alignment alternative is not expected to increase the identified contaminants in Lone Tree Creek.

Tracy ACE Station (UPRR Connection) Alignment Alternative

The Tracy ACE Station (UPRR Connection) alignment alternative could potentially affect at least 9 of the water resources identified in the Tracy ACE Station BNSF alignment alternative, excluding Lone Tree Creek, Avena Drain, and the Main Drain Canal.

This alignment alternative could directly impact 29.3 ac (11.86 ha) of floodplains. In addition, 5,433 linear ft (1,656 m) of streams, rivers, and channels and 2.1 ac (0.85 ha) of surface water bodies could be affected. The Tracy ACE Station (UPRR Connection) alignment alternative could also directly impact 205.2 ac (83.04 ha) of groundwater and 17.2 ac (6.96 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

The Tracy ACE Station (UPRR Connection) alignment alternative could indirectly impact 76.8 ac (31.08 ha) of floodplains. In addition, 13,161 linear ft (4,011.5 m) of streams, rivers, and channels and 9.2 ac (3.72 ha) of surface water bodies could be indirectly impacted. This alignment alternative could indirectly impact 629.2 ac (254.64 ha) of groundwater and 70 ac (28.33 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The Tracy ACE Station (UPRR Connection) alignment alternative would be downstream of the San Joaquin River (portion from Stanislaus River to Delta Boundary), identified as TMDL impaired for the following pollutants: boron, electrical conductivity, DDT, unknown toxicity, and Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor expoxide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), diazinon, and chlorpyrifos. Construction and operation of the HST is not a likely source of these contaminants, and would not impact this impaired segment of the San Joaquin River because the segment is upstream of the alignment alternative. Any potential contaminants from the construction or operation of the HST would travel downstream, not upstream, and therefore would not affect the impaired river segment.

Tracy Downtown (UPRR Connection) Alignment Alternative

The Tracy Downtown (UPRR Connection) alignment alternative could potentially affect at least 9 of the water resources identified in the Tracy Downtown (BNSF Connection) alignment alternative, excluding Lone Tree Creek, Avena Drain, and the Main Drain Canal.

This alignment alternative could directly impact 32 ac (12.95 ha) of floodplains. In addition, 5,484 linear ft (1,641 m) of streams, rivers, and channels and 2.3 ac (0.93 ha) of surface water bodies could be impacted. The Tracy Downtown (UPRR Connection) alignment alternative could also directly impact 241.2 ac (97.61 ha) of groundwater and 15.8 ac (6.39 ha) of land with potentially erosive soil conditions. (See Table 3.14-1.)

The Tracy Downtown (UPRR Connection) alignment alternative could indirectly impact 99.6 ac (40.31 ha) of floodplains. In addition, 15,605 linear ft (4,756.4 m) of streams, rivers, and channels and 7.6 ac (3.08 ha) of surface water bodies could be indirectly impacted. This alignment alternative could indirectly impact 812.6 ac (328.86 ha) of groundwater and 63.5 ac (25.7 ha) of land with potentially erosive soil conditions. (See Table 3.14-2.)

The Tracy Downtown (UPRR Connection) alignment alternative would be downstream of the San Joaquin River (portion from Stanislaus River to Delta Boundary), identified as TMDL impaired for the following pollutants: boron, electrical conductivity, DDT, unknown toxicity, and Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor expoxide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), diazinon, and chlorpyrifos. Construction and operation of the HST is not a likely source of these contaminants, and would not impact this impaired segment of the San Joaquin River because the affected portion is upstream of the alignment alternative. Any potential contaminants from the construction or operation of the HST would travel downstream and not affect the impaired river.

East Bay Connections

The East Bay Connections alignment alternative would directly impact approximately 0.6 ac (0.24 ha) of floodplains and 322 linear ft (98.1 m) of streams, 30.3 ac (12.26 ha) of land with potentially erosive soil conditions, and 18.9 ac (7.65 ha) of groundwater. Indirect impacts include up to 2.3 ac (0.93 ha) of floodplains, 1,805 linear ft (550.2 m) of streams, 37.4 ac (15.14 ha) of land with potentially erosive soil conditions, and 75.8 ac (30.68 ha) of groundwater.

Station Location Options

There are no floodplains, streams, surface water bodies, or potentially erosive soils within the vicinity of the Pleasanton (I-680/Bernal) Station, Livermore (Downtown), Tracy (Downtown), and Tracy (ACE) station location options.

Pleasanton (I-680/Bernal) Station
This station location option could directly impact 10.9 ac (4.41 ha) and indirectly impact 15.6 ac (6.31 ha) of groundwater.

Pleasanton (BART) Station
There are 2.4 ac (0.97 ha) of floodplains and 438 linear ft (133.5 m) of streams, rivers, and canals that could be directly impacted by this station location option. The station location option also has the potential to impact 16.2 ac (6.56 ha) of groundwater. Indirect impacts could occur to 3.3 ac (1.34 ha) of floodplains and 538 linear ft (164 m) of streams, rivers, and channels. In addition, 21.1 ac (8.54 ha) of groundwater could also be indirectly impacted. There are no surface water bodies or land with potentially erosive soil conditions near this station location option.

Livermore (Downtown) Station
This station location option could directly impact 13.3 ac (5.38 ha) of groundwater. It could also indirectly impact 276 linear ft (84.1 m) of streams, rivers, and channels and 17.2 ac (6.96 ha) of groundwater.

Livermore (I-580) Station
This station location option would not affect surface water bodies. The station location option could directly impact 1.7 ac (0.69 ha) of floodplains. In addition, 174 linear ft (53 m) of streams, rivers, and channels could be affected. Finally, 15.9 ac (6.43 ha) of groundwater and 8.3 ac (3.36 ha) of land with potentially erosive soil conditions could be directly impacted. The station location option could indirectly impact 2.7 ac (1.09 ha) of floodplains. In addition, 23.1 ac (9.35 ha) of groundwater as well as 11.7 ac (4.73 ha) of land with potentially erosive soil conditions could be indirectly affected.

Livermore (Greenville Road/UPRR) Station
This station location option could directly impact 12.9 ac (5.22 ha) and indirectly impact 21.9 ac (8.87 ha) of groundwater.

Livermore (Greenville Road/I-580)
There are no floodplains, streams, and surface water bodies near this station location option. The station could directly impact 13.8 ac (5.59 ha) of groundwater as well as 8.2 ac (3.33 ha) of land with potentially erosive conditions. In addition, the station could indirectly impact 19.8 ac (8.01 ha) of groundwater and 11.6 ac (4.69 ha) of land with potentially erosive conditions.

Tracy (Downtown) Station
This station location option could directly impact 11.8 ac (4.78 ha) and indirectly impact 16.3 ac (6.6 ha) of groundwater.

Tracy (ACE) Station
This station location option could directly impact 15.0 ac (6.07 ha) and indirectly impact 20.3 ac (8.22 ha) of groundwater.

Summary of Impacts
As shown in Tables 3.14-1 and 3.14-2, a combination of alignment alternatives would be required within this corridor. Any combination of alignment alternatives within this corridor would have to include the East Bay Connections alignment alternative to complete the connection from the East Bay to the Central Valley. The discussion below compares the potential direct and indirect impacts of two sets of options. The Altamont Pass Options (Niles Junction to County Line) include four alignment alternatives that extend from Niles Junction to the Alameda County line. The Altamont Pass Options (County Line to Central Valley) also include four alignment alternatives that extend through Tracy to the Central Valley Corridor.

Altamont Pass Options (Niles Canyon to County Line)

The I-680/I-580/UPRR alignment alternative could potentially affect the most water resources (17) when compared with the other alignment alternatives. Nine of these water resources are also potentially affected by the I-580/UPRR, Patterson Pass/UPRR, and UPRR alignment alternatives.

Direct Impacts

As shown in Table 3.14-1, the Patterson Pass/UPRR alignment alternative would potentially impact the most area within the 100-year floodplain but the least amount of streams. This alignment alternative would have up to 5.6 more ac (2.27 ha) of floodplain impacts, primarily in the area of Arroyo Moche between Pleasanton and Livermore. This alignment alternative would be on aerial structure through most of the areas within the 100-year floodplain and would and not impede storm flows. The I-680/580/UPRR alignment alternative would have the least amount of impact on floodplains and also be on aerial structure, but would cross several watercourses for a total of approximately 2,583 linear ft (787.3m), including South San Ramon Creek, Laurel Creek, Arroyo de la Laguna, Arroyo Las Positas, and Patterson Run Canal. This alignment alternative would cross all but nine of the watercourses on aerial structure and would span the watercourse channels and embankments. While there are less floodplains and streams in the path of the I-580/UPRR and UPRR alignment alternatives compared to the Patterson Pass/UPRR and I-680/580/UPRR alignment alternatives, respectively, the I-580/UPRR alignment alternative would have the potential to impact more area of floodplain because it would be constructed at-grade through the Arroyo Gravel Pits southeast of the Livermore Municipal Airport. The I-580/UPRR alignment alternative would also potentially impact approximately 2.1 ac (0.85 ha) of the water-filled gravel pits. The UPRR alignment alternative would pass adjacent to the gravel pits but on an aerial structure with limited impact. The UPRR alignment alternative would also cross fewer watercourses than either the I-680/580/UPRR or I-580/UPRR alignment alternatives but have a greater potential impact because 13 of the watercourses would be crossed at-grade rather than spanned by aerial structure. Overall, the I-680/580/UPRR alignment alternative would have the least potential impact on floodplains, and the Patterson Pass/UPRR alignment alternative would have the least potential impact on streams. Where there is the potential to impact floodplains, alignment alternatives that are either at-grade or on embankments would be constructed with culverts sized appropriately to convey anticipated storm flows and to minimize ponding.

The Patterson Pass/UPRR alignment alternative would have up to 18 ac (7.28 ha) less of erosive soil effects than the other alignment alternatives where additional erosive soils exist in the Altamont Pass area. There would be a small increase in the amount of impervious surfaces in areas where the alignment alternatives would not be along existing transportation facilities or in developed areas, such as through the Altamont Pass or Patterson Pass; however, the HST would consist of permeable track-fill rather than impervious pavement resulting in a low runoff potential. The Patterson Pass/UPRR and UPRR alignment alternatives have the potential to encounter more groundwater east of Livermore than the other two alignment alternatives, but in these areas, much of the alignment alternative would be at-grade and the potential to encounter groundwater would be limited. For all of the alignment alternatives, there is the potential to encounter groundwater where column support footings for aerial structures would be required. Each of the alignment alternatives would have the potential to encounter groundwater as a result of tunneling under Alameda Creek, near the City of Freemont city limits and would require dewatering as part of construction and possibly during operation. Impacts on groundwater recharge would be low for all of the alignment alternatives due to the use of aerial structure for much of the length of the alignment alternatives and also due to the overall footprint of the HST. The potential for erosion due to runoff would primarily be limited to locations of erosive soil conditions through the Altamont Pass and Patterson Pass where tunnels and earthwork would be required. Overall, the Patterson Pass/UPRR alignment alternative would have the least potential to be affected by erosive soils, and the I-680/580/UPRR and I-580/UPRR alignment alternatives would have the least potential impact on groundwater.

Indirect Impacts
Potential indirect impacts from construction within this corridor would be similar to those discussed above for the San Francisco to San Jose Corridor. As shown in Table 3.14-2, the I-580/UPRR alignment alternative would potentially indirectly impact up to 17 more ac (6.88 ha) of floodplains and 7.45 more ac (3.01 ha) of surface waters than the other alignment alternatives between Niles Junction and the county line. The I-680/580/UPRR alignment alternative could indirectly impact up to 7,500 more ft (2,286 m) of streams and canals and have the highest potential to encounter erosive soil conditions and groundwater basins. The UPRR alignment alternative would have the least potential to indirectly impact 100-year floodplains and watercourses. Because of location through the Altamont Pass, the I-580/UPRR alignment alternative would have slightly less potential to encounter erosive soils compared to the other alignment alternatives. The Patterson Pass/UPRR and UPRR alignment alternatives would have the least potential indirect impact on groundwater.

TMDLs
The alignment alternatives between Niles Junction and the Altamont county line would all traverse many of the same impaired water resources; however, the I-580/UPRR and the UPRR alignment alternatives would traverse five impaired water resources. The I-580/UPRR and UPRR alignment alternatives would traverse the following TMDL impaired surface water resources: Alameda Creek, Arroyo De La Laguna, Arroyo Del Valle, Arroyo Positas, and Arroyo Mocho. These waters are impaired with diazinon. The construction and operation of the HST is not a likely source of these contaminants; therefore, the HST along these alignment alternatives is not expected to increase diazinon levels in these waters.

Altamont Pass Options (County Line to Central Valley)
The Tracy Downtown (BNSF Connection) and Tracy ACE Station (BNSF Connection) alignment alternatives could each affect 14 water resources, many the same. The Tracy Downtown (UPRR Connection) and Tracy ACE Station (UPRR Connection) alignment alternatives could affect the same 9 water resources, fewer than either the Tracy Downtown (BNSF Connection) or Tracy ACE Station (BNSF Connection) alignment alternatives. All of the alignment alternatives within this set of options cross the California Aqueduct, Delta-Mendota Aqueduct, and the San Joaquin River.

Direct Impacts
As shown in Table 3.14-1, the Tracy ACE Station (BNSF Connection) alignment alternative would potentially impact the most area within the 100-year floodplain, the most number of streams and canals, and the most area of surface waters. This alignment alternative is also the longest of the four alignment alternatives. This alignment alternative would have up to 7.5 more ac (3.04 ha) of floodplain impacts primarily in the area east of Manteca. All of the alignment alternatives would have substantial floodplain impacts around the San Joaquin River, but these alignments would also be adjacent to existing railroad corridors. The alignment alternatives would be at-grade or on embankment through most of the areas within the 100-year floodplain. The Tracy ACE Station (UPRR Connection) alignment alternative would have the least amount of impact on floodplains. Where there is the potential to impact floodplains, alignment alternatives that are either at-grade or on embankments would be constructed with culverts sized appropriately to convey anticipated storm flows and to minimize ponding. The Tracy Downtown (UPRR Connection) alignment alternative would have the least potential impact on watercourses.

Each of the alignment alternatives within this set of options would be affected by potentially erosive soils where the alignment alternatives extend east of the Altamont Pass and Patterson Pass. The Tracy ACE Station (BNSF Connection) and Tracy ACE Station (UPRR Connection) alignment alternatives would encounter up to 1.4 ac (0.57 ha) more of erosive soils than the other two alignment alternatives. There would be an increase in the amount of impervious surfaces in areas where the alignment alternatives would not be along existing transportation facilities or in developed areas, such as through the Altamont Pass or Patterson Pass. Both the Tracy Downtown (BNSF Connection) and Tracy ACE Station (BNSF Connection) alignment alternatives would have the potential to encounter more groundwater than the other two alignment alternatives, primarily due to the longer length of the alignments to the BNSF. The additional alignment length of the Tracy Downtown (UPRR Connection) and Tracy ACE Station (UPRR Connection) alignment alternatives would primarily be at-grade and the potential to encounter groundwater would be limited. For all of the alignment alternatives, there is the potential to encounter groundwater where column support footings for aerial structures would be required, such as through portions of Tracy, Lathrop, and Manteca. Impacts on groundwater recharge would be low to moderate for all of the alignment alternatives due to the overall footprint of the HST alignments. The potential for erosion due to run-off would primarily be limited to locations of erosive soil conditions around the Altamont Pass and Patterson Pass where some earthwork would be required. Overall, the Tracy Downtown (BNSF Connection) and Tracy Downtown (UPRR Connection) alignment alternatives would have the least potential to be affected by erosive soils, and the Tracy ACE Station (UPRR Connection) alignment alternative would have the least potential impact on groundwater.

Indirect Impacts

Potential indirect impacts from construction within this corridor would be similar to those discussed above for the San Francisco to San Jose Corridor. As shown in Table 3.14-2, the Tracy ACE Station (BNSF Connection) alignment alternative would potentially have substantially higher indirect impacts than the other alignment alternatives between the county line and the Central Valley. This alignment alternative would affect up to 55 more acres (22.6 ha) of 100-year floodplains, 4,800 more linear ft (1,463 m) of watercourses, 5 more acres (2.02 ha) of water bodies such as lakes, and encounter 6.5 ac (2.63 ha) more of erosive soils compared to the other alignment alternatives. The Tracy ACE Station (UPRR Connection) alignment alternative would have substantially less potential to have indirect impacts on floodplains and watercourses, and encounter the least amount of groundwater.

TMDLs

All of the alignment alternatives would all cross the San Joaquin River downstream of a TMDL impaired portion; therefore, any potential contaminants from the construction or operation of the HST would travel downstream and would not affect the impaired river segment. The Tracy ACE Station (BNSF Connection) and the Tracy Downtown (BNSF Connection) alignment alternatives would also traverse an impaired portion of Lone Tree Creek. Construction and operation of the HST is not expected to increase the contaminants identified within Lone Tree Creek.

East Bay Connections

Two segments make up the East Bay Connections alignment alternative: the north segment (Niles to Union City – Niles Wye [E] to Niles Wye [N]) and south segment (Niles to Fremont – Niles Wye [E] to Niles Wye [S]). The south segment would be the longer of the two segments and would therefore have the potential to have greater impacts. The north segment of the East Bay Connections alignment alternative would potentially impact 0.17 ac (0.07 ha) of the Alameda Creek floodplain and the southern segment would impact 0.4 ac (0.16 ha) of the floodplain of several intermittent streams. Both the north and south connection segments would encounter potentially erosive soil conditions in the area where they would connect with the alignment alternatives between Niles Junction and the Altamont county line). Both segments would be constructed on cut and fill or at-grade and would have minimal impacts on groundwater or groundwater recharge. The East Bay Connections alignment alternative would not impact any streams identified as TMDL impaired.

San Francisco Bay Crossings Corridor

Alignment Alternatives

Trans Bay Crossing – Transbay Transit Center and Trans Bay Crossing – 4th & King

The alignment alternatives in this corridor would extend from the Oakland Inner Harbor to the city of San Francisco, crossing San Francisco Bay.

There are no floodplains, streams, rivers or channels, groundwater, or soils with potentially erosive soil conditions within the vicinity of the transbay tube crossings; therefore, direct impacts would not occur. The transbay crossing at the Transbay Transit Center could directly impact 36.5 ac (14.77 ha) of the San Francisco Bay and indirectly impact 235.5 ac (95.31 ha). The transbay crossing at 4th and King could directly impact 35.4 ac (14.33 ha) of the San Francisco Bay and indirectly impact 228 ac (92.27 ha).

The only TMDL impaired water resources that the Trans Bay Crossing alignment alternatives could traverse are central San Francisco Bay and the Oakland Inner Harbor. Central San Francisco Bay is identified as being impaired for the following pollutants: chlordane, DDT, didieldrin, dioxin compounds (including 2,3,7,8-TCDD), exotic species, furan compounds, mercury, PCBs, PCBs (dioxin-like), and selenium. The Oakland Inner Harbor is impaired for the following pollutants: chlordane, chlordane (sediment), copper (sediment), DDT, dieldrin, dieldrin (sediment), dioxin compounds, exotic species, furan compounds, lead (sediment), mercury, mercury (sediment) PAHs (sediment), PCBs, PCBs (dioxin-like), PCBs (sediment), and selenium. Construction of these alignment alternatives is likely to disrupt Bay sediment and may disrupt any contaminants trapped in the sediment.

Dumbarton (High Bridge, Low Bridge, or Tube) Alignment Alternative
The high bridge, low bridge, or tube alignment alternatives could all potentially affect the same unnamed and named water resources, including (i.e., not limited to) tidal flats, South San Francisco Bay, Hetch Hetchy Aqueduct, Newark Slough and Salt Evaporating Ponds, and the Alameda Creek Quarries.

The high bridge, low bridge, or tube alternatives would all directly impact the same water resources. Direct impacts could include 47.4 ac (19.17 ha) of floodplains and 37.3 ac (15.10 ha) of surface water bodies. The alignment alternatives would cross 1,028 linear ft (313.3 m) of streams and canals including Hetch Hetchy Aqueduct and Newark Slough. In addition, there could be 133.7 ac (54.12 ha) of groundwater and 10 ac (4.03 ha) of potentially erosive soils directly affected. (See Table 3.14-1.)

The high bridge, low bridge, or tube alternatives could all indirectly impact the same water resources. Indirect impacts could include 162.1 ac (65.58 ha) of floodplains, as well as 143.9 ac (58.24 ha) of surface waters and 3,627 linear ft (1,105.5 m) of streams, rivers, or channels. There could be 405.9 ac (164.27 ha) of groundwater potentially indirectly impacted by the high bridge, low bridge, or tube alignment alternatives. Finally, 40.1 ac (16.24 ha) of land with potentially erosive soils could be indirectly impacted (Table 3.14-2).

The two bridge alignment alternatives and the tube alignment alternative would traverse south San Francisco Bay. The Bay is identified as being TMDL impaired for the following pollutants: chlordane, DDT, dieldrin, dioxin compounds, exotic species, furan compounds, mercury, PCBS, dioxin-like PCBs, and selenium. The construction of the bridge and tube alignment alternatives might disrupt any pollutants trapped in the sediment of south San Francisco Bay. The operation of the bridge would not be a likely source of any of the pollutants.

Fremont Central Park (High Bridge, Low Bridge, or Tube) Alignment Alternative
The high bridge, low bridge, or tube alignment alternatives would all cross the same unnamed and named water resources, including (i.e., not limited to) tidal flats, south San Francisco Bay, Hetch Hetchy, Newark Slough, Salt Evaporation Ponds, the Lagoon/Lake Elizabeth, and Mowry Slough/Mud Slough/Salt Evaporating Ponds.

The high bridge, low bridge, or tube options could all directly affect the same water resources. Direct impacts could include 71.7 ac (29.02 ha) of floodplains as well as 46.3 ac (18.74 ha) of surface water bodies and 2,041 linear ft (622.1 m) of streams, rivers, or channels. In addition, 127.7 ac (51.66 ha) of groundwater would be directly impacted. Finally, there are no potentially erosive soils in the area of these alignment alternatives. (Table 3.14-1.)

The high bridge, low bridge, or tube alternatives could all indirectly impact the same water resources. Indirect impacts could include 258.7 ac (104.69 ha) of floodplains, as well as 179.2 ac (72.52 ha) of surface water bodies and 8,301 linear ft (2,530.1 m) of streams, rivers, or channels. In addition, 450.6 ac (182.34 ha) of groundwater could be indirectly impacted. Finally, there are no potentially erosive soils in the area of these alignment alternatives. (Table 3.14-2.)

The two bridge alignment alternatives and the tube alignment alternative would traverse south San Francisco Bay. The Bay is identified as being TMDL impaired for the following pollutants: chlordane, DDT, dieldrin, dioxin compounds, exotic species, furan compounds, mercury, PCBS, dioxin-like PCBs, and selenium. The construction of these alignment alternatives might disrupt any pollutants trapped in the sediment of south San Francisco Bay. The operation of the bridge or tunnel alignment alternatives would not be a likely source of any of the pollutants.

Station Location Options

Union City (Shinn) Station

The station could directly impact 17.79 ac (7.20 ha) of groundwater and indirectly impact 22.92 ac (9.28 ha).

Summary of Impacts

There are no floodplains, streams, groundwater, or land with potentially erosive conditions related to any of the Trans Bay Crossing alignment alternatives; therefore, direct and indirect impacts would not occur. The Trans Bay Crossing — 4th and King alignment alternative would have slightly less impacts to water resources than the Transbay Transit Center alignment alternative due primarily to the length of the alignment alternative.

Potential indirect impacts from construction within this corridor would be similar to those discussed above for the San Francisco to San Jose corridor. Construction of the transbay tube for both of these alignment alternatives would potentially have significant impacts on the Bay. In addition to the USACE Section 404, RWQCB Section 401, and CDFG 1600 permits that may be required, coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission to ensure project compliance with the California Coastal Act.

Generally, the various Dumbarton alignment alternatives could directly and indirectly impact fewer water resources than the Freemont Central Park alignment alternatives due primarily to the length of the alignment alternatives. The Dumbarton alignment alternatives impact less floodplains and fewer surface water bodies than the Freemont Central Park alignment alternatives; however, they would directly and indirectly impact slightly more acres of groundwater and land with potentially erosive soil conditions. Erosive soil conditions are found east of Mission Boulevard in Fremont. The Freemont Central Park alignment alternative would include a tunnel portion east of Freemont Boulevard and under Freemont Central Park Lake and several streams and would likely require dewatering as part of construction and possibly during operation. There is the potential to encounter groundwater where column support footings for aerial structures would be required such as through portions of Newark and Fremont. In addition to the USACE Section 404, RWQCB Section 401, and CDFG 1600 permits that may be required, coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission to ensure project compliance with the California Coastal Act. Overall, the Dumbarton alignment alternatives would have lesser impacts on water resources as compared to the Freemont Central Park alignment alternatives. Construction of the tube for both of these alignment alternatives would potentially have significant impacts on the bay.

The Trans Bay Crossing alignment alternatives would cross central San Francisco Bay and the Inner Oakland Harbor, potentially impacting any contaminated sediment during construction. The Dumbarton and Freemont Park Central alignment alternatives would cross south San Francisco Bay, which also has contaminated sediment. Construction of any bridge or tube alternative across south San Francisco Bay has the potential to disrupt contaminated sediment.

<u>Central Valley Corridor</u>

Alignment Alternatives

BNSF–UPRR Alignment Alternative

This alignment alternative could potentially affect least 33 unnamed and named water resources, including (i.e., not limited to) Mormon Slough/Stockton Diverting Canal; Duck Creek; Littlejohns Creek; Avena Drain; Lone Tree Creek; Main District Canal; Stanislaus River; Hetch Hetchy Aqueduct; Lateral Numbers 6, 3, 2, and 1; Tuolumne River; Upper Lateral Numbers 2 ½ and 3; Merced River; North and South Bloom Laterals; Main Ash Lateral; Black Rascal Creek/Hesse Lateral/Medowbrook Lateral; Farmdale Lateral; Miles Creek; Owens Creek; North Slough/Mariposa Creek; El Nido; Deadman Creek; Dutchman Creek; Chowchilla River; Ash Slough and Bypass; and the Berenda Slough.

The BNSF–UPRR alignment alternative could directly impact 183.5 ac (74.26 ha) of floodplains. In addition, 8,291 linear ft (2,527.1 m) of streams, rivers, and channels and 1.5 ac (0.61 ha) of surface water bodies could be impacted. This alignment alternative could impact 576.1 ac (233.15 ha) of groundwater. (See Table 3.14-1.)

The BNSF–UPRR alignment alternative could indirectly impact 669.5 ac (270.95 ha) of floodplains. In addition, 31,632 linear ft (9,641.4 m) of streams, rivers, and channels and 6.3 ac (2.55 ha) of surface water bodies could be indirectly affected. It could also impact 2,108.1 ac (853.15 ha) of groundwater. (See Table 3.14-2.)

This alignment alternative would traverse TMDL-impaired portions of the following five surface water resources: Avena Drain, Lone Tree Creek, Stanislaus River, Tuolumne River (Don Pedro Reservoir to San Joaquin Reservoir), and the Lower Merced River (McSwain Reservoir to San Joaquin River). These surface waters are impaired for a variety of pollutants, including (i.e., not limited to) ammonia, pathogens, BOD, electrical conductivity, diazinon, Group A pesticides (aldrin, deldrin, chlordane, endrin, heptachlor, heptachlor exposide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), mercury, and unknown toxicity. Although the construction and operation of the HST would not be a likely source of these contaminants, the Central Valley has a long history of heavy pesticide use, and depending on the binding properties of the pesticides to soil and water, sediment runoff from the construction could potentially mobilize and release additional pesticides into these water resources. The BNSF–UPRR alignment alternative would be upstream of Mormon Slough (section from Commerce Street to Stockton Diverting Channel and section from Stockton Diverting Canal to Commerce Street), which is identified as an impaired water resource for organic enrichment, low dissolved oxygen, and pathogens. The construction and operation of the HST would not be a likely source of these contaminants.

BNSF Alignment Alternative

This alignment alternative could potentially affect at least 45 number of unnamed and named water resources, including (i.e., not limited to) Mormon Slough/Stockton Diverting Canal; Duck Creek; Littlejohns Creek; Avena Drain; Lone Tree Creek; Main District Canal; Stanislaus River; Hetch Hetchy Aqueduct; Lateral Numbers 6, 3, 2, and 1; Tuolumne River; Upper Lateral Numbers 2 ½ and 3; Merced River; north and south Bloom Laterals; Main Ash Lateral; Black Rascal Creek/Hesse Lateral/Medowbrook Lateral; Farmdale Lateral; Miles Creek; Owens Creek; Hadley Lateral/Givens Lateral; Le Grand Canal; North Slough/Mariposa Creek; El Nido; the northern and southern section of

Deadman Creek; Dutchman Creek; Chowchilla River; Ash Slough and Bypass; Berenda Slough; and Berenda Creek.

This alignment alternative could directly impact 191.1 ac (77.34 ha) of floodplains. In addition, 8,398 linear ft (2,559.7 m) of streams, rivers, and channels and 1.6 ac (0.65 ha) of surface water bodies could be affected. This alignment alternative could impact 584.1 ac (236.39 ha) of groundwater. (See Table 3.14-1.)

The BNSF alignment alternative could indirectly impact 759.2 ac (307.25 ha) of floodplains. In addition, 32,594 linear ft (9,934.7 m) of streams, rivers, and channels and 6.7 ac (2.71 ha) of surface water bodies could be indirectly impacted. Finally, it could impact 2,218.9 ac (897.99 ha) of groundwater. (See Table 3.14-2.)

This alignment alternative would traverse TMDL-impaired portions of the same five surface water resources as the BNSF-UPRR alignment alternative.

UPRR N/S Alignment Alternative

This alignment alternative could affect at least 35 unnamed and named streams, rivers, creeks, channels, and canals, including (i.e., not limited to) French Camp Slough/Littlejohns Creek; Stanislaus River; Lateral Numbers 8, 6, 7, 3, 4, and 1; Hetch Hetchy Aqueduct; Tuolumne River; Upper/Lower Lateral 3; Merced River; Bear Creek/Black Rascal/Hesse Lateral; Farmdale Lateral Miles Creek; Owens Creek; North Slough/Mariposa Creek; El Nido; South Slough; Deadman Creek; Dutchman Creek; Chowchilla River; Ash Slough/Ash Slough Bypass; and Berenda Slough.

The UPRR N/S alignment alternative could directly impact 123.4 ac (49.94 ha) of floodplains. In addition, 7,547 linear ft (2,300.3 m) of streams, rivers, and channels could be impacted. Surface water bodies are not in the area, and therefore impacts would not occur. This alignment alternative could impact 606.5 ac (245.45 ha) of groundwater. There is no land with potentially erosive soils that would be directly impacted by this alignment alternative. (See Table 3.14-1.)

This alignment alternative could indirectly impact 422.7 ac (171.07 ha) of floodplains. In addition, 41,122 linear ft (12,534 m) of streams, rivers, and channels could be indirectly impacted. Surface water bodies are not in the area and therefore would not be impacted. The UPRR N/S alignment alternative could impact 2,122.8 ac (859.1 ha) of groundwater. (See Table 3.14-2.)

This alignment alternative would traverse TMDL-impaired portions of the following three surface waters: Stanislaus River, Lower; Tuolumne River (Don Pedro Reservoir to San Joaquin Reservoir); and the Merced River, Lower (McSwain Reservoir to San Joaquin River). These surface waters are impaired for a variety of pollutants, including (i.e., not limited to) ammonia, pathogens, BOD, electrical conductivity, diazinon, Group A pesticides (aldrin, deldrin, chlordane, endrin, heptachlor, heptachlor exposide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), mercury, and unknown toxicity. Although, the construction and operation of the HST would not be a likely source of these contaminants, the Central Valley has a long history of heavy pesticide use, and depending on the binding properties of the pesticides to soil and water, sediment runoff from the construction could potentially mobilize and release additional pesticides into these water resources.

BNSF Castle Alignment Alternative

This alignment alternative could potentially affect at least 43 unnamed and named streams, rivers, creeks, channels, and canals, including (i.e., not limited to) Mormon Slough/Stockton Diverting Canal; Duck Creek; Littlejohns Creek; Avena Drain; Lone Tree Creek; Stanislaus River; Lateral Numbers 6, 3, 2, and 1; Hetch Hetchy Aqueduct; Tuolumne River; Upper Lateral Numbers 2½ and 3; Merced River; North Bloom Lateral; Gertrude Lateral; Fahrens Creek; Bear Creek/Black Rascal Creek; Doane Canal; Fairfield Canal; Miles Creek; Planada Canal; Owens Creek; Le Grand Canal; Mariposa Creek/Duck

Slough; north and south sections of Deadman Creek; Dutchman Creek; Chowchilla River; Ash Slough and Ash Bypass Canal; Berenda Slough; and Berenda Creek.

The BNSF Castle alignment alternative could directly impact 158.2 ac (64.02 ha) of floodplains. In addition, 6,965 linear ft (2,122.9 m) of streams, rivers, and channels and 1.6 ac (0.65 ha) of surface water bodies could be affected. This alternative could impact 586.1 ac (237.19 ha) of groundwater. (See Table 3.14-1.)

The BNSF Castle alignment alternative could indirectly impact 628.8 ac (254.48 ha) of floodplains. In addition, 30,371 linear ft (9,257.1 m) of streams, rivers, and channels and 6.7 ac (2.71 ha) of surface water bodies could be indirectly affected. This alignment alternative could also impact 2,220.6 ac (898.68 ha) of groundwater. (See Table 3.14-2.)

This alignment alternative would traverse TMDL-impaired portions of same six surface waters as the BNSF and BNSF-UPRR alignment alternatives.

UPRR-BNSF Castle Alignment Alternative

This alignment alternative could potentially affect at least 34 unnamed and named streams, rivers, creeks, channels, and canals, including (i.e., not limited to) French Camp Slough/Littlejohns Creek; Stanislaus River; Lateral Numbers 8, 6, 7, 3, 4, and 1; Hetch Hetchy Aqueduct; Tuolumne River; Lower Lateral Number 2; Upper/Lower Lateral Number 3; North Bloom Lateral; Gertrude Lateral; Casad Canal; Canal Creek/Livingston Canal; Fahrens Creek; Bear Creek/Black Rascal Creek; Doane Canal; Fairfield Canal; Miles Creek; Planada Canal; Owens Creek; Le Grand Canal; Mariposa Creek/Duck Slough; north and south sections of Deadmans Creek; Dutchman Creek; Chowchilla River; Ash Slough and Ash Bypass Canal; Berenda Slough; and Berenda Creek.

The UPRR-BNSF Castle alignment alternative could directly impact 97.7 ac (39.54 ha) of floodplains. In addition, 7,734 linear ft (2,357.3 m) of streams, rivers, and channels and 0.1 ac (0.04 ha) of surface water bodies could be affected. This alignment alternative could impact 593.7 ac (240.27 ha) of groundwater as well. There are no potentially erosive soils that would be directly impacted in this area. (See Table 3.14-1.)

The UPRR-BNSF Castle alignment alternative could indirectly impact 388 ac (157.02 ha) of floodplains. In addition, 43,276 linear ft (13,190.5 m) of streams, rivers, and channels and 0.4 ac (0.16 ha) of surface water bodies could be indirectly affected. This alignment alternative could indirectly impact 2,243.4 ac (907.9 ha) of groundwater as well. There are no potentially erosive soils that could be indirectly impacted in this area. (See Table 3.14-2.)

This alignment alternative would traverse TMDL-impaired portions of the following two surface water resources: Lower Stanislaus River and Tuolumne River (Don Pedro Reservoir to San Joaquin Reservoir). These surface waters are impaired for a variety of pollutants, including diazinon, Group A pesticides (aldrin, deldrin, chlordane, endrin, heptachlor, heptachlor exposide, hexachlorocyclohexane—including lindane—endosulfan, and toxaphene), mercury, and unknown toxicity. Although the construction and operation of the HST would not be a likely source of these contaminants, the Central Valley has a long history of heavy pesticide use. Depending on the binding properties of the pesticides to soil and water, sediment runoff from the construction could potentially mobilize and release additional pesticides into these water resources.

UPRR-BNSF Alignment Alternative

This alignment alternative could potentially affect least 42 unnamed and named streams, rivers, creeks, channels, and canals, including (i.e., not limited to) French Camp Slough/Littlejohns Creek; Stanislaus River; Lateral Numbers 8, 6, 7, 3, 4, and 1; Hetch Hetchy Aqueduct; Tuolumne River; Lower Lateral Number 2; Upper/Lower Lateral Number 3; upper, middle, and lower sections of Cross

Ditch Number 2; Merced River; north and south Bloom Lateral; Black Rascal Creek/Hesse Lateral/Medowbrook Lateral; Merced Lateral/Bear Creek/Black Rascal Creek; Farmdale Lateral; Miles Creek; Owens Creek; North Slough/Mariposa Creek; El Nido; South Slough; Deadman Creek; Dutchman Creek; Chowchilla River; Ash Slough and Ash Slough Bypass; and Berenda Slough.

This alignment alternative could directly impact 123.1 ac (49.82 ha) of floodplains and 9,060 linear ft (2,761.5 m) of streams, rivers, and channels. This alignment alternative could also impact 582.9 ac (235.9 ha) of groundwater as well. There are no potentially erosive soils that would be directly affected in the area. (See Table 3.14-1.)

The UPRR-BNSF alignment alternative could indirectly impact 428.7 ac (173.49 ha) of floodplains and 44,538 linear ft (13,575.2 m) of streams, rivers, and channels. This alignment alternative could also indirectly impact 2,131 ac (862.42 ha) of groundwater as well. There are no potentially erosive soils that could be indirectly affected in this area. (See Table 3.14-2.)

This alignment alternative would traverse TMDL-impaired segments of the same three surface water resources as the UPRR N/S Alignment Alternative.

Station Location Options

Modesto (Downtown) Station

There are no floodplains, streams, surface water bodies, or potentially erosive soils near this station. The station could directly impact 8.5 ac (3.44 ha) and indirectly impact 12.6 ac (5.10 ha) of groundwater.

Briggsmore (Amtrak) Station

There are no floodplains, streams, surface water bodies, or potentially erosive soils within the vicinity of this station. The station could directly impact 14.2 ac (5.75 ha) and indirectly impact 18.9 ac (7.65 ha) of groundwater.

Merced (Downtown) Station

There are no streams, surface water bodies, or potentially erosive soils near this station. The station could directly impact 11.7 ac (4.73 ha) of floodplains, as well as 11.7 ac (4.73 ha) of groundwater. In addition, the station could indirectly impact 15.3 ac (6.19 ha) of floodplains and 15.3 ac (6.19 ha) of groundwater.

Castle AFB Station

There are no floodplains, surface water bodies, or potentially erosive soils near this station. The station could directly impact 416 linear ft (126.8 m) of streams, rivers, and channels, as well as 18 ac (7.28 ha) of groundwater. In addition, the station could indirectly impact 516 linear ft (157.3 m) of streams, rivers, and channels and 23.5 ac (9.51 ha) of groundwater.

Summary of Impacts

The alignment alternatives in this corridor would either connect with the alignment alternatives from the East Bay to Central Valley corridor or the San Jose to Central Valley corridor. This corridor would also connect with the statewide system extending north to Sacramento and south to Los Angeles. The corridor is composed of variations of BNSF alignment alternatives and UPRR alignment alternatives.

The alignment alternatives within the Central Valley corridor have the potential to affect between 33 and 45 named and unnamed water resources. Many of the alignment alternatives could impact many of the same water resources. For example, the BNSF-UPRR, BNSF, and BNSF-Castle alignment alternatives all cross the same water resources with a few exceptions. Likewise, the UPRR N/S, UPRR-BNSF-Castle, and UPRR-BNSF alignment alternatives also all cross the same water resources with a few exceptions.

Direct Impacts

As shown in Table 3.14-1 and Figure 3.14-1, the BNSF-UPRR, BNSF, and BNSF Castle alignment alternatives could directly impact more area within the 100-year floodplain than the UPRR N/S, UPRR-BNSF-Castle, and UPRR-BNSF alignment alternatives. The primary difference in potential floodplain impacts between the BNSF alignment alternatives as compared to the UPRR alignment alternatives is in the area southeast of Stockton to Escalon. Within this area, BNSF alignment alternatives could potentially impact 67 ac (27.11 ha) and would be constructed primarily at-grade or on cut and fill. The UPRR alignment alternatives would also potentially impact about 7 ac (2.83 ha) of floodplain in the area around Stockton, and the alignment would be constructed on aerial structure and at-grade. The other large area of potential floodplain impacts is around Merced where the BNSF alignment alternatives could potentially affect up to 32 ac (12.95 ha) more floodplain than the UPRR alignment alternatives. Both the BNSF and UPRR alignment alternatives would be constructed primarily either at-grade or on cut and fill. Overall, the UPRR-BNSF Castle alignment alternative would have the least amount of impact on floodplains. Where there is the potential to impact floodplains, alignments that are either at-grade or on cut and fill would be constructed with culverts sized appropriately to convey anticipated storm flows and to minimize ponding.

Each of the alignment alternatives would cross the Hetch Hetchy Aqueduct, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River, as well as many of the same streams and canals. The UPRR-BNSF alignment alternative would have the potential to impact up to 2,095 linear ft (638.6 m) more rivers, streams, and canals as compared to the other alignment alternatives. This is primarily due to the impacts associated with the numerous water crossings south of Turlock through Merced County where the majority of water crossings are within this corridor as shown on Figure 3.14-3. The UPRR N/S and UPRR-BNSF Castle alignment alternatives would have similar amounts of impact on watercourses, as would the BNSF-UPRR and BNSF alignment alternatives. Overall, the BNSF-Castle alignment alternative would have the least amount of potential impact on watercourses, affecting approximately 6,965 linear ft (2,122.9 m) with most of the difference between alignment alternatives being south of Turlock. The BNSF-UPRR, BNSF, and BNSF-Castle alignment alternatives would impact up to 1.6 ac (0.65 ha) of water bodies, primarily associated with agriculture.

With each of the alignment alternatives, there would be a small increase in the amount of impervious surfaces in areas where the alignment alternatives would not be along existing transportation facilities or in developed areas; however, the HST would consist of permeable track-fill rather than impervious pavement resulting in a low runoff potential. Each of the alignment alternatives would have the potential to encounter groundwater because the whole Central Valley is underlain by groundwater. The UPRR N/S alignment alternative would have the potential to encounter the most groundwater due to its longer length, and the BNSF-UPRR alignment alternative the least because it is the shortest in length of the alignment alternatives. All of the alignment alternatives within this corridor would primarily be constructed at-grade, on cut and fill, or on embankment with some aerial structures and the potential to encounter groundwater would be limited. Where are aerial structures are proposed, there is the potential to encounter groundwater where column support footings would be required. Impacts on groundwater recharge would be low to moderate for all of the alignment alternatives due to the overall footprint of the HST Alignment Alternatives. The potential for erosion due to runoff would primarily be limited to locations where earthwork would be required, such as near the river crossings. Overall, the BNSF-UPRR alignment alternative would have the least potential impact on groundwater.

Indirect Impacts

The findings for indirect impacts are similar to what was discussed above regarding direct impacts. As shown in Table 3.14-2, the BNSF alignment alternative would have the potential to indirectly impact up to 370 more acres (149.74 ha) of floodplains than the UPRR-BNSF Castle alignment alternative. The UPRR-BNSF alignment alternative would affect up to 14,000 more linear ft (4,267.2

m) of watercourses compared to the BNSF Castle alignment alternative. Like direct impacts, the BNSF alignment alternatives would have the potential to indirectly affect water bodies. Each of the alignment alternatives would have the potential to indirectly impact groundwater, but as noted above, the alignment alternatives would primarily be constructed at-grade, on cut and fill, or on embankment with some aerial structures, and the potential to encounter groundwater would be limited.

TMDLs

The BNSF-UPRR, BNSF, and BNSF Castle alignment alternatives would each traverse the same six TMDL-impaired water resources and they would all be upstream of the Mormon Slough, also an impaired water resource. The UPRR N/S and UPRR-BNSF alignment alternatives could traverse the same three surface water resources. Although none of the alignment alternatives are expected to contribute to the impairments of these waters, the waters are impaired for Group A pesticides, and based on the binding properties of the pesticides to soil and water, any sediment runoff from the construction of the HST could potentially mobilize and release additional pesticides into the water resources.

3.14.4 Role of Design Practices in Avoiding and Minimizing Effects

The Authority is committed to utilizing existing transportation corridors (existing railroad or highway right-of-way) in the proposed HST system in order to minimize potential impacts to biological resources bisecting sensitive areas and creating new crossings or encroachments on water resources. Use of existing transportation corridors helps minimize potential impacts because they have already imposed a footprint/crossing that the HST alignment alternatives would expand. Moreover, portions of the system would be in tunnel or on aerial structure, which would avoid and/or minimize impacts to surface water resources.

The Authority has striven to avoid water resources throughout the extensive alignment studies leading to and including this program-level study. In addition, the Authority is committed to continuing avoidance and minimization of potential impacts during subsequent project-level analysis; however, it is unavoidable that many streams and water resources would be crossed with the proposed Bay Area to Central Valley HST Alignment Alternatives. Therefore, during project-level studies, the Authority would work closely with the regulatory agencies to develop acceptable specific design and construction standards for stream crossings, including (i.e., not limited to) maintaining open surface (bridged versus closed culvert) crossings, infrastructure setbacks, erosion control measures, sediment controlling excavation/fill practices, and other BMPs.

There is also potential for impacts to groundwater in areas of the system where tunneling or substantial excavation would be necessary. For the portions of the HST alignment alternatives in tunnel, geologic exploration, including groundwater sampling, would be completed prior to constructing the proposed tunnels. The geologic/soils/groundwater conditions would be evaluated prior to and monitored during construction to aid in the development of construction techniques and measures to minimize effects to ground- and surface water resources. Based on available geologic information and previous tunneling projects in proximity to proposed tunnels, the Authority plans to fully line tunnels with impermeable material to prevent infiltration of ground- or surface waters. Infiltration of ground and surface waters into tunnels is undesirable for operations and maintenance reasons and increases the potential for adverse impacts to ground and surface waters. All reasonable measures would be taken to avoid water infiltration. In addition, it is assumed that tunnel boring machines would be appropriately equipped with shielding to minimize the infiltration of higher pressure groundwater during the boring process.

3.14.5 Mitigation Strategies and CEQA Significance Conclusions

Based on the analysis above, and considering the sophisticated design, engineering, and construction practices that would be used (and required in order to obtain permits), each of the proposed HST

Alignment Alternatives would have a potentially significant impact on hydrology and water quality in the study area. Placing the HST alignment alternatives within or along existing transportation corridors reduces the potential for adverse effects to these water resources, and engineering and design practices further reduce potential adverse impacts to these water resources (e.g., avoiding encroachments on water resources, use of tunnels lined with impermeable surfaces, infrastructure setbacks from surface waters, and using permeable surfaces and structures to reduce flow and drainage obstructions). Additional avoidance and mitigation strategies, as well as the design practices, would be applied to reduce these impacts in the second-tier, project-level analyses and in obtaining permits for facilities included in the HST system.

Proposed general mitigation strategies would be fairly similar for all HST Alignment Alternatives. These strategies are described as general policies that could be adopted and developed in detail at the project-specific level of environmental analysis. First, measures designed to avoid or limit impacts would be considered. If avoidance measures are not feasible, then mitigation measures directed at reconstruction, restoration, or replacement of the resource, in close coordination with state and federal resource agencies, would be considered as part of subsequent project planning, environmental review, and design. Potential mitigation strategies are listed below.

A. FLOODPLAINS

Mitigation for potential impacts on floodplains would include consideration of the following strategies.

- Avoid or minimize construction of facilities within floodplains where feasible.
- Minimize the footprint of facilities within floodplains through design changes or use of aerial structures.
- Restore the floodplain to be equivalent to its prior function in instances where the floodplain is affected by construction.

B. SURFACE WATERS, RUNOFF, AND EROSION

Mitigation strategies for potential impacts on surface waters would include consideration of the following.

- As part of the future project-level analysis, conduct studies and evaluate potential alteration in coastal hydrology/hydraulics in tidal lagoons, bays, and marshes from specific construction methods or facility designs. Construction methods or facility designs to minimize potential impacts would be considered and used to the extent feasible.
- Permit requirements as part of project-level review would include SWPPPs and NPDES permits. The SWPPP would include BMPs to minimize potential short-term increases in sediment transport caused by construction, including erosion control requirements, stormwater management, and channel dewatering for all stream and lake crossings. Regional NPDES permit requirements would be followed and BMPs, as required for new developments, would be implemented. These may include measures to provide permeable surfaces where feasible and to retain and treat stormwater on site using catch basins and treatment (filtering) wet basins. Other measures to manage the overall amount and quality of stormwater runoff to regional systems would be detailed as part of SWPPP.
- Apply for and obtain appropriate permits under Sections 404 and 401 of the Clean Water Act and comply with mitigation measures required in the permits. Other mitigation measures may include habitat restoration, reconstruction on site, or habitat replacement off site to compensate for loss of native habitats and wetlands. The ultimate goal of the mitigation would be to ensure minimal impact on surface water quality.

- Under the requirements of the NPDES Caltrans Statewide Storm Water Permit and the Construction General Permit, a SWPPP would be developed during construction and implemented to reduce pollutants in stormwater discharges and the potential for erosion and sedimentation.
- Implement BMPs which would include:
  - Practices to minimize the contact of construction materials, equipment, and maintenance supplies with stormwater.
  - Practices to reduce erosion of exposed soil, including soil stabilization, watering for dust control, perimeter silt fences, placement of rice straw bales, and sediment basins.
  - Practices to maintain water quality, including infiltration systems, detention systems, retention systems, constructed wetland systems, filtration systems, biofiltration/bioretention systems, grass buffer strips, ponding areas, organic mulch layers, planting soil beds, sand beds, and vegetated systems (biofilters) such as vegetated swales and grass filter strips that are designed to convey and treat either shallow flow (swales) or sheetflow (filter strips) runoff.
- Work around various surface water bodies would be required to follow CWA Sections 401 and 404 and applicable permit requirements.
- Follow requirements of Section 10 of the Rivers and Harbors Act if work is required around a water body, such as the crossing of the San Francisco Bay, designated as navigable and applicable permit requirements.
- Work along the banks of various surface water bodies would require an application for a CDFG Section 1600 Lake or Streambed Alteration Agreement.
- Implement a spill prevention and emergency response plan to handle potential fuel or other spills.
- Incorporate biofiltration swales to intercept surface runoff.
- Where feasible, avoid significant development of facilities in areas that may have substantial erosion risk, including areas with erosive soils and steep slopes.

C. GROUNDWATER

Mitigation to reduce potential impacts from construction and operation of project components on groundwater discharge or recharge would include consideration of the following strategies.

- As part of the future project-level analysis, minimize development of facilities in areas that may have substantial groundwater discharge or affect recharge.
- Apply for and obtain waste discharge requirements, where needed (e.g., for dewatering), as part of project-level review.
- As part of the future project-level analysis, develop facility designs that are elevated, or at a minimum are permeable, and would not affect recharge potential where construction is required in areas of potentially substantial groundwater discharge or recharge.
- Apply for and obtain a SWPPP under NPDES permit requirements for grading, and describe BMPs that would control release of contaminants near areas of surface water or groundwater recharge (include constraining fueling and other sensitive activities to alternative locations, providing drip pans under some equipment, and providing daily checks of vehicle condition).
- Include consideration of use and retention of native materials with high infiltration potential at the ground surface in areas that are critical to infiltration for groundwater recharge.

The above mitigation strategies, which include further study leading to refinement of site-specific mitigation measures and BMPs, are expected to substantially lessen or avoid impacts to hydrology and water quality. At the second-tier, project-level review, applications of these mitigation strategies are expected to reduce impacts to hydrology and water quality to a less-than-significant level. Additional environmental assessment would allow more precise evaluation in the second-tier, project-level environmental analyses.

3.15 Biological Resources and Wetlands

This section describes the biological resources and wetlands that could occur in the study region and identifies the potential for impacts on biological resources and wetlands as a result of the construction and operation of the various HST Alignment Alternatives[1]. The evaluation in this section includes potential adverse biological impacts on sensitive habitat and plant and wildlife species that have been listed or proposed as threatened or endangered under the federal Endangered Species Act (ESA) or California Endangered Species Act (CESA). The evaluation also includes potential adverse affects to wetlands under the jurisdiction of Section 404 of the CWA. This section also evaluates potential interference with the movement of native or migratory species, potential conflicts with policies protecting biological resources, and/or potential conflicts with an adopted Habitat Conservation Plan (HCP) or other approved habitat management plan.

3.15.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

This section briefly identifies the key federal and state laws and regulations related to biological resources.

Federal Laws and Regulations

Federal Endangered Species Act

The ESA protects fish and wildlife species that have been identified as threatened or endangered by the USFWS or National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). The ESA also protects their habitats. *Endangered* refers to species, subspecies, or distinct populations that are in danger of extinction through all or a significant portion of their range; *threatened* refers to species, subspecies, or distinct populations that are likely to become endangered in the near future.

The USFWS and NOAA Fisheries administer the ESA. In general, NOAA Fisheries is responsible for protection of ESA-listed marine species and anadromous fishes, whereas listed, proposed, and candidate wildlife and plant species and inland fish species are under USFWS jurisdiction. Section 9 of the ESA prohibits the unlawful take of federally threatened or endangered species. Take of listed species can be authorized through the Section 7 consultation process for actions either undertaken or funded by federal agencies, or take can be authorized through the Section 10 permit process for actions undertaken by nonfederal agencies. Federal agency actions include activities that are on federal land, conducted by a federal agency, funded by a federal agency, or authorized by a federal agency (including issuance of federal permits and licenses).

Under Section 7, the federal agency conducting, funding, or permitting an action (i.e., the federal lead agency) must consult with the USFWS or NOAA Fisheries, as appropriate, to ensure that the proposed action will not jeopardize endangered or threatened species or destroy or adversely modify designated critical habitat. If a proposed project "may affect" a listed species or designated critical habitat, the lead agency is required to prepare a biological assessment (BA) evaluating the nature and severity of the expected effect. In response, the USFWS issues a biological opinion (BO) with a determination that the proposed action either:

- May jeopardize the continued existence of one or more listed species (jeopardy finding) or result in the destruction or adverse modification of critical habitat (adverse modification finding) or

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

- Will not jeopardize the continued existence of any listed species (no jeopardy finding) or result in adverse modification of critical habitat (no adverse modification finding).

The BO issued by the USFWS may stipulate discretionary "reasonable and prudent" conservation measures. If the project does not jeopardize a listed species, the USFWS issues an incidental take statement to authorize the proposed activity.

In cases where a nonfederal entity is undertaking an action that does not require federal authorization, the take of listed species must be permitted by the USFWS through the Section 10 process. If the proposed project would result in the incidental take of a listed species, the applicant must first obtain a Section 10(a)(1)(B) incidental take permit (ITP). Incidental take under Section 10 is defined as take of federally listed fish and wildlife species "that is incidental to, but not the purposes of, otherwise lawful activities." To receive an ITP, the nonfederal entity is required to prepare an HCP, which must include conservation measures that avoid, minimize, and mitigate the project's impact on listed species and their habitat.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires all federal agencies to consult with NOAA Fisheries on all actions or proposed actions (permitted, funded, or undertaken by the agency) that may adversely affect fish habitats. Under the provisions of the act, Congress mandated the identification of habitats essential to managed species (e.g., commercial species) and measures to conserve and enhance this habitat. The act requires cooperation among NOAA Fisheries, the councils, fishing participants, and federal and state agencies to protect, conserve, and enhance Essential Fish Habitat (EFH). EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, and growth to maturity.

Clean Water Act

The 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 now serves as the primary federal law protecting the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands.

The CWA empowers the EPA to set national water quality standards and effluent limitations and includes programs addressing both point-source and non-point-source pollution. Point-source pollution originates or enters surface waters at a single, discrete location, such as an outfall structure or excavation on a construction site. Non-point-source pollution originates over a broader area and includes urban contaminants in stormwater runoff and sediment loading from upstream areas. The CWA operates on the principle that all discharges into the nation's waters are unlawful unless specifically authorized by a permit; permit review is the CWA's primary regulatory tool.

Additional details on specific sections of the CWA are provided below.

Section 401

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 must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with Section 401.

Section 402

CWA Section 402 regulates construction-related stormwater discharges to surface waters through the NPDES program, administered by the EPA. In California, the State Water Board is authorized by the EPA to oversee the NPDES program through the RWQCBs (see Porter-Cologne Water Quality Control Act below). Most of the study region is under the jurisdiction of the San Francisco Bay RWQCB and the Central Valley RWQCB; southern Santa Clara Valley and northern San Benito County are under the jurisdiction of the Central Coast RWQCB.

NPDES permits are required for projects that disturb more than 1 ac (0.4 ha) of land and for discharge of groundwater into waterways. The NPDES permitting process requires the applicant to file a public NOI to discharge stormwater and to prepare and implement a SWPPP. The SWPPP includes a site map and a description of proposed construction activities. In addition, it describes the BMPs that will be implemented to prevent soil erosion and discharge of other construction-related pollutants (e.g., petroleum products, solvents, paints, cement) and potential groundwater pollutants that could contaminate nearby water resources. Permittees are required to conduct annual monitoring and reporting to ensure that BMPs are correctly implemented and effective in controlling the discharge of stormwater-related pollutants.

Section 404

CWA Section 404 regulates the discharge of dredged and fill materials into waters of the United States. *Waters of the United States* refers to oceans, bays, rivers, streams, lakes, ponds, and wetlands, including nonperennial drainages with a defined bed and bank and any drainage channel that conveys natural runoff, even if it has been realigned, and seasonal and perennial wetlands, including coastal wetlands.

Applicants must obtain a permit from the U.S. Army Corps of Engineers (USACE) for all discharges of dredged or fill material into waters of the United States, including wetlands, before proceeding with a proposed activity. As part of the wetland delineation and verification process, the USACE will determine whether the wetlands in the study area are regulated under Section 404.

The USACE may issue either an individual permit evaluated on a case-by-case basis or a general permit evaluated at a program level for a series of related activities. General permits are preauthorized and are issued to cover multiple instances of similar activities expected to cause only minimal adverse environmental effects. Nationwide permits (NWPs) are a type of general permit issued to cover particular fill activities. Each NWP specifies particular conditions that must be met for the NWP to apply to a particular project. Waters of the United States in the study area are under the jurisdiction of the USACE Sacramento District.

Compliance with Section 404 requires compliance with several other environmental laws and regulations. The USACE cannot issue an individual permit or verify the use of a general permit until the requirements of the NEPA, ESA, and National Historic Preservation Act have been met. In addition, the USACE cannot issue or verify any permit until a water quality certification or waiver of certification has been issued pursuant to Section 401.

Certain activities are exempt from the Section 404 permitting process, including:

- Farming, ranching, and forestry activities that are considered normal and ongoing (as of 1985 conditions), such as plowing, harvesting, and minor drainage of upland areas to waters of the United States.
- Construction and maintenance of stock ponds and irrigation ditches.
- Maintenance of drainage ditches.
- Construction of temporary sedimentation basins in upland areas.

- Construction and maintenance of farm, forest, and mining roads in accordance with BMPs.
- Other activities regulated by an approved program of BMPs authorized by CWA Section 208(b)(4).

Section 404 permits may be issued only for the project's LEDPA. That is, authorization of a proposed discharge is prohibited if there is a practicable alternative that would have less adverse impacts and lacks other significant adverse consequences.

Section 10 of the Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the USACE for the construction of any structure in or over any navigable waters of the United States. Tidal waterways within the Sacramento/San Joaquin drainage basin are considered navigable waters. The law applies to any dredging, excavation, filling, or other modification of a navigable water of the United States, as well as to all structures, including bank protection (e.g., riprap) and mooring structures, such as those in a marina. Structures or work outside the limits defined for navigable waters of the United States requires a Section 10 permit if the structure or work affects the course, location, or condition of the water body.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act requires consultation with the USFWS when the waters of any stream or other body of water are proposed, authorized, permitted, or licensed to be impounded, diverted, or otherwise controlled or modified under a federal permit or license (16 USC 661-667[e]). Most USFWS comments on applications for permits under CWA Section 404 or River and Harbors Act Section 10 are conveyed to the USACE through the consultation process required by this act.

The USFWS provides advisory comments and recommends mitigation measures to avoid impacts on wetlands or modify activities that may directly affect wetlands. Mitigation recommended by the USFWS may include restoring or creating habitat to avoid a net loss of wetland functions and values. Although consultation with the USFWS is required, the USACE is not required to implement USFWS recommendations.

Migratory Bird Treaty Act

The Federal Migratory Bird Treaty Act (16 USC 703, Supp. I, 1989) prohibits killing, possessing, or trading in migratory birds except in accordance with regulations prescribed by the U.S. Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs.

Executive Order 13186, signed January 10, 2001, directs each federal agency taking actions that will have or will likely have a negative impact on migratory bird populations to work with the USFWS to develop an MOU to promote the conservation of migratory bird populations. Protocols developed under the MOU will include the following agency responsibilities:

- Avoid and minimize, to the extent possible, adverse impacts on migratory bird resources when coordinating agency actions.
- Restore and enhance habitat of migratory birds, as practicable.
- Prevent or abate the detrimental alteration of environment for the benefit of migratory birds, as practicable.

Bald and Golden Eagle Protection Act of 1947, as amended

The federal Bald and Golden Eagle Protection Act (16 USC 668 *et seq.*) makes it unlawful to import, export, take, sell, purchase, or barter any bald eagle or golden eagle, or their parts, products, nests, or eggs. The term *take* includes pursuing, shooting, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing. Exceptions may be granted by the USFWS for scientific or exhibition use, or for traditional and cultural use by Native Americans. However, no permits may be issued for import, export, or commercial activities involving eagles.

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972 (administered by NOAA Fisheries) provides for the management of the nations coastal resources, including the Great Lakes, and balances economic development with environmental conservation.

The CZMA is a voluntary federal-state partnership that is designed to encourage state-tailored coastal management programs. It outlines two national programs, the National Coastal Zone Management Program and the National Estuarine Research Reserve System, and aims to balance competing land and water issues in the coastal zone, while estuarine reserves serve as field laboratories to provide a greater understanding of estuaries and how humans impact them. The overall program objectives of CZMA remain balanced to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone."

Executive Order 11990, Protection of Wetlands

Executive Order 11990 (issued in 1977) is an overall wetland policy for all federal agencies managing federal lands, sponsoring federal projects, or providing federal funds to state and local projects. It requires federal agencies to follow procedures for avoidance, mitigation, and preservation, with public input, before proposing new construction in wetlands. Compliance with CWA Section 404 permit requirements may constitute compliance with the requirements of Executive Order 11990. The DOT's policies for complying with Executive Order 11990 are set forth in DOT Order 5660 1.A, and its regulations for implementing Executive Order 11990 are provided in 23 CFR 777.

Executive Order 13112, Invasive Species

Executive Order 13112 (February 3, 1999) directs all federal agencies to prevent and control introductions of invasive species in a cost-effective and environmentally sound manner. It established a National Invasive Species Council (NISC) made up of federal agencies and departments and a supporting Invasive Species Advisory Committee (ISAC) composed of state, local, and private entities. The NISC and ISAC have prepared a national invasive species management plan (2001) that recommends objectives and measures to implement the order and prevent the introduction and spread of invasive species.

State Laws and Regulations

California Endangered Species Act

CESA protects plant and wildlife species that have been designated by CDFG as threatened or endangered. CESA prohibits the take of endangered and threatened species. Under CESA, *take* is defined as an activity that would directly or indirectly kill an individual of a species. The definition of *take* does not include harm or harassment of state-listed species or the destruction of their habitat. In accordance with the CESA, CDFG has jurisdiction over state-listed species (California Fish and Game Code 2070). Additionally, CDFG maintains lists of species of special concern that are defined as species that appear to be vulnerable to extinction because of declining populations, limited ranges, or continuing threats.

California Fish and Game Code

Fully Protected Species

The California Fish and Game Code provides protection from take for a variety of species, referred to as *fully protected species*. Fully protected fish species are protected under Section 5515; fully protected amphibian and reptile species are protected under Section 5050; fully protected bird species are protected under Section 3511; and fully protected mammal species are protected under Section 4700. The California Fish and Game Code defines *take* as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." Except for take related to scientific research, all take of fully protected species is prohibited.

Sections 3503 and 3503.5

Section 3503 of the California Fish and Game Code prohibits the killing of birds or the destruction of bird nests. Section 3503.5 prohibits the killing of raptor species and the destruction of raptor nests. Many bird species could potentially nest in the study area or vicinity. These nests would be protected under these sections of the California Fish and Game Code.

California Native Plant Protection Act

Regarding rare plant species, CESA defers to the California Native Plant Protection Act of 1977. This act prohibits importing rare and endangered plants into California, taking rare and endangered plants, and selling rare and endangered plants. State-listed plants are protected mainly in cases where state agencies are involved in projects under CEQA. In these cases, plants listed as rare under the Native Plant Protection Act are not protected under CESA but can be protected under the act through the CEQA process.

Streambed Alterations

Under Sections 1600–1607 of the California Fish and Game Code, the CDFG has jurisdictional authority over rivers, streams, and lakes from which fish and wildlife derive benefit. Under Section 1602, CDFG regulates projects that will 1) divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake designated by the department in which there is at any time an existing fish or wildlife resource or from which these resources derive benefit; 2) use material from the streambeds designated by the department; or 3) result in the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into any river, stream, or lake designated by the department. A proponent of a project that has the potential to affect a stream- or lakebed is required to notify the CDFG of the proposed activity.

The ephemeral drainages within the study area are likely to meet the California Fish and Game Code's definition of a stream and would be subject to CDFG regulation, and the CDFG would need to be notified before undertaking activities in the ephemeral drainages. It is likely that CDFG would require a lake- or streambed alteration agreement for construction across these drainages.

Porter-Cologne Water Quality Control Act

Section 13260(a) of the Porter-Cologne Water Quality Control Act (contained in the California Water Code) requires any person discharging waste or proposing to discharge waste, other than to a community sewer system, within any region that could affect the quality of the waters of the State to file a report of waste discharge (ROWD). The discharge of dredged or fill material may constitute a discharge of waste that could affect the quality of waters of the State.

Historically, California relied on its authority under Section 401 of the CWA to regulate discharges of dredged or fill material to California waters. That section requires an applicant to obtain "water quality certification" from the State Water Board through its RWQCBs to ensure compliance with state water quality standards before certain federal licenses or permits may be issued. The permits subject to Section 401 include permits for the discharge of dredged or fill materials (CWA Section 404 permits) issued by the USACE. Waste discharge requirements under the Porter-Cologne Water Quality Control Act were typically waived for projects that required certification.

In 2004, the State Water Board issued Water Quality Order No. 2004-004-DWQ. This order addresses general waste discharge requirements (general WDRs) for discharges of dredged or fill material to waters deemed by the USACE to be outside its jurisdiction and therefore not subject to Section 404 of the CWA. In general, these are waters found to be "isolated." These general WDRs are restricted to discharges of less than 0.2 ac (0.08 ha). If a discharge does not qualify for general WDRs, an ROWD must be filed using a 401 Certification Application. Because the impacts on the ephemeral drainages within the study area would be temporary and less than 0.2 ac (0.08 ha) of land, a ROWD would not need to be filed.

California Coastal Act

The California Coastal Act requires preparation of a local coastal program (LCP) by local municipalities located in whole or in part in the coastal zone. The LCP consists of a land use plan and its implementing measures (e.g., zoning ordinances). The act requires the incorporation of its policies into local LCPs. Policies relevant to biological resources are listed below.

- Coastal Act Section 30121 defines wetlands as “lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, and mudflats.”
- Coastal Act Section 30233 (a) states that the diking, filling, or dredging of wetlands can only be permitted for certain specified activities where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse effects.
- Coastal Act Section 30107.5 defines an environmentally sensitive area as “any area in which plants or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could easily be disturbed or degraded by human activities.”
- Coastal Act Section 30240 states that “environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources hall be allowed within those area.” This section also states that “development in areas adjacent to environmentally sensitive habitat areas and parks and recreational areas shall be sited and designed to prevent impacts which would significantly degrade those areas and shall be compatible with the continuance of those habitat and recreation areas.”

Bay Conservation and Development Commission

The McAteer-Petris Act, passed by the State of California in 1965, established the San Francisco Bay Conservation and Development Commission (BCDC) as the state agency responsible for regulating development in and around San Francisco Bay and mandated the planning effort that resulted in development of the San Francisco Bay Plan (Bay Plan) (Association of Bay Area Governments 1969, as amended). The Bay Plan describes the values associated with the Bay and presents polices and planning maps to guide future uses of the Bay and its shoreline. Under the Bay Plan, priorities for suitable uses of the shoreline include ports, water-related industry, airports, wildlife refuges, and water-related recreation. The Bay Plan also proposes adding land to the Bay refuge system; encourages public access via marinas, waterfront parks, and beaches; and requires the provision of maximum access along the waterfront and certain shorelines, except where public uses conflict with other significant uses or where public use is inappropriate because of safety concerns.

BCDC is responsible for implementing the policies of the Bay Plan. All projects proposing development within the Bay Area are required to apply to BCDC for a San Francisco Bay permit and to demonstrate compliance with the McAteer-Petris Act and the Bay Plan.

The CZMA encourages states to voluntarily develop coastal zone management programs (CZMPs) to preserve and protect the unique features of each coastal area. Partly in response to these federal recommendations, the California Coastal Act of 1976 established the California Coastal Commission (CCC) and recognized the BCDC as the state agency with primary responsibility.

Areas subject to jurisdiction of the BCDC extend to all areas of the Bay that are subject to tidal action, including a 100-foot shoreline band surrounding the Bay from the mean high-water mark. In addition, BCDC's San Francisco Bay jurisdiction includes subtidal areas, intertidal areas, and tidal marsh areas that are between mean high tide and 5 ft (1.5 m) above the mean sea level.

It is necessary to obtain BCDC approval prior to undertaking any of the following activities:

- Filling: Placing solid material, building pile-supported or cantilevered structures, disposing of material, or permanently mooring vessels in the Bay or in certain tributaries of the Bay.
- Dredging: Extracting material from the Bay bottom.
- Shoreline Projects: Nearly all work, including grading, on the land within 100 ft (30 m) of the Bay shoreline.
- Suisun Marsh Projects: Nearly all work, including land divisions, in the portion of the Suisun Marsh below the 10-foot-contour level.
- Other Projects: Any filling, new construction, major remodeling, substantial change in use, or many land subdivisions in the Bay, along the shoreline, in salt ponds, duck hunting preserves, or other managed wetlands adjacent to the Bay.
- Federal Projects: In addition to carrying out its regulatory authority under state law, the federal CZMA allows the BCDC to review federal projects and projects that require federal approval or are supported with federal funds. The BCDC carries out its "federal consistency" responsibilities by reviewing federal projects much like it does permit applications. However, the BCDC cannot require federal agencies to submit permit applications and cannot impose conditions in its federal consistency decisions. Nevertheless, federal agencies and applicants for federal approvals must provide the project details, data, and other material required by the form to ensure that the BCDC has the information it needs to evaluate federal projects. Work on a project needing BCDC authorization cannot begin until the necessary approval has been secured (San Francisco Bay Conservation and Development Commission 2006).

B. METHOD OF EVALUATION OF IMPACTS

Data Collection and Geographic Information System Mapping

The proposed HST Alignment Alternatives would cross a variety of biotic communities and could potentially result in impacts on many plant and wildlife species and many water resources. This discussion of impacts uses the plant taxonomy and nomenclature of Hickman (1993). The scientific nomenclature and common names of wildlife follow those of the most recent Special Animals List (California Department of Fish and Game 2006).

A land cover map was developed using the best available data appropriate for a regional assessment of the study region. The GIS data mapping methods for this project used methods developed for other large projects in the region, including the Land Cover GIS Metadata that were developed to aid in the development of the Pacific Gas & Electric operation and maintenance HCPs currently being prepared for the San Joaquin Valley and the Bay Area. The coverage of these two HCPs overlaps in the study region.

Data from eight sources were used to generate this land cover.

- San Francisco Estuary Institute (SFEI) Baylands Dataset: The SFEI published the Baylands dataset in 1998 as part of EcoAtlas, a digital product that contains both historical and current information about the natural resources around the Bay Area. This dataset contains primarily wetlands that surround the San Francisco Bay and Suisun Marsh. These data support a long-term monitoring effort of baylands and associated habitats. SFEI used a number of sources to produce the Baylands dataset, including high-resolution color infrared photos (San Francisco Estuary Institute 1998).

- California Department of Forestry and Fire Protection (CDF) Hardwood Rangeland Vegetation Dataset: The CDF Hardwood Rangeland Vegetation dataset comprises a series of maps of vegetation types for areas below 5,000 ft (1,524 m) in elevation. It was originally mapped in 1981 from 1:24,000-scale aerial photographs and then updated using 1990 LANDSAT TM imagery. It consists of 82-ft (25-m) pixel spacing coded with a cover type. For woodland and forest cover types, each pixel also is coded with a canopy closure class. CDF maintains this dataset (California Department of Forestry and Fire Protection 1994).
- CDFG's Wetland and Riparian Dataset: Ducks Unlimited produced the CDFG Wetland and Riparian dataset from multispectral satellite imagery to inventory wetlands, riparian woody areas, and surrounding land cover. This dataset is maintained by CDFG (California Department of Fish and Game 1997). Imagery from both the summer and winter was used to improve mapping accuracy.
- California Gap Analysis Program Dataset: The California Gap dataset comprises land cover maps for 10 major regions of the state. It was derived from satellite imagery, vector overlays of existing vegetation and land use maps, and forest inventory data. Upland types were mapped with a minimum mapping unit of 247 ac (100 ha), major wetlands were mapped with a minimum mapping unit of 99 ac (40 ha), and smaller wetlands were encoded as attributes of upland polygons (Davis et al. 1998).
- Important Farmland (DOC): For areas with modern soil surveys, this coverage maps grazing, farming, and urban lands (DOC 2000). It is based on aerial photographs of various scales and field reconnaissance and is updated biannually. Farmland and urban areas have a minimum mapping unit of 10 ac (4 ha), and urban is defined as a building density of at least 1 unit to 1.5 ac (0.6 ha), or approximately six structures to a 10-ac (4 ha) parcel. Only the urban categories were used in the land cover layer from this data set.
- Urban Boundaries (California Department of Water Resources [CDWR]): Only the urban land use types were used from this data set. The data cover a range of years (1994–1999) because individual counties are responsible for maintaining land use. These data were derived from aerial photo interpretation (scale not available) and extensive field visits.
- California Department of Forestry and Fire Protection (CDF) Development Footprint Dataset: This dataset, published by CDF in 2003, is based on census block group data, land ownership, and urbanized-area data from the 2000 U.S. Census. It is supplemented with 1990 National Landcover Data from the USGS. CDF maintains this dataset (California Department of Forestry and Fire Protection 2003a).
- CDF Land Cover Mapping and Monitoring Program Vegetation Dataset: The U.S. Forest Service prepared the source mapping for the CDF Land Cover Mapping and Monitoring Program (LCMMP) Vegetation Dataset between 1979 and 1981 (Parker and Matyas 1979). The mapping process involved photo interpretation of color infrared prints of multispectral satellite imagery acquired in the 1970s and updated in 1996. The CDF created the digital vegetation coverage by scanning the source maps. The minimum mapping unit of the CDF system is 2.5 ac (1 ha) (California Department of Forestry and Fire Protection 2003b).

As part of the data assembly process, a classification scheme was created for the study region based on a review of the land cover categories in each data set and the requirements of the land cover–based analyses in the study area. A hierarchical approach was used to assemble the land cover data for the study region. The various data sets described above were compiled in GIS. A classification system for land cover types was developed for the study area based on Holland (1986). This classification was designed to support the impact analysis for biological resources identified in the study area.

An aerial survey (gathered by plane, helicopter, and/or aerial images) was conducted along each alignment to supplement the GIS data and to verify the land cover types and extents identified during the mapping. The aerial survey was used to record small occurrences of land cover types not identified in the GIS analysis due to the minimum mapping unit data constraints in the GIS datasets (e.g., riparian and wetland habitats).

Wetlands were identified using the National Wetland Inventory (NWI) maintained by the USFWS. NWI digital data files are records of wetland locations and classification as developed by the USFWS. The NWI maps do not show all wetlands because data are derived from aerial photo interpretation with varying limitations due to scale, photo quality, inventory techniques, and other factors. Consequently, the maps tend to show wetlands that are readily photo-interpreted given consideration of photo and map scale. This level of information, though incomplete for some areas, provides a general overview of areas with potential sensitivity for impacts and where subsequent field work and wetland delineation would be conducted in the next phase of environmental evaluation.

Digitized information for vernal pools was obtained from the CDFG and included USFWS Holland vernal pools coverage with density classes and supporting metadata file; Northern San Joaquin Valley vernal pool complexes identified by California State University, Chico; and a vernal pool species layer showing critical habitat for a suite of vernal pool species.

Biological resources considered in the analysis of the proposed alternatives were compiled using the following sources:

- California Natural Diversity Database (CNDDB 2007) records.
- California Native Plant Society's (CNPS's) (2001) *Inventory of Rare and Endangered Vascular Plants of California*.
- Draft East Contra Costa County HCP/ Natural Community Conservation Plan (NCCP) and EIS/EIR (East Contra Costa County Habitat Conservation Plan Association 2005).
- Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service, October 2005).
- Recovery Plan for the California Red-Legged Frog (U.S. Fish and Wildlife Service 2002).
- Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California (U.S. Fish and Wildlife Service, November 2002).
- Recovery Plan for Upland Species of the San Joaquin Valley, California (U.S. Fish and Wildlife Service 1998).
- PG&E Operation and Maintenance HCPs for the San Joaquin Valley and Bay Area (in progress).
- Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area (U.S. Fish and Wildlife Service 1998).
- Recovery Plan for Coastal Plants (in progress).
- San Joaquin County Multi-Species Conservation Plan.
- Information on wildlife movement corridors obtained from the Missing Linkages report prepared by the California Wilderness Coalition (2000).

Biological Resources and Wetlands Impact Evaluation

The biological resources study area representing the potentially affected environment for the analysis and a representative impact area were consistently applied for each HST Alignment Alternative. The impact analysis area was 50 ft (15 m) width for aerial and at-grade configurations. No surface impact area was analyzed for tunnel sections because these sections would be underground, although tunnel portals were included as at-grade sections. The representative impact areas (project footprint) of proposed HST Alignments Alternatives were overlaid on the land cover data to determine the extent of land cover types potentially impacted. The acreages for each land cover type bisected by the alternative alignments were calculated.

Because of the nonuniform coverage of the NWI data, the California Spatial Information Library's Hydrographic database (water resources) was used to estimate the length of waters potentially impacted for each HST Alignment Alternative. This database provides the best indicator of the presence of wetlands for this program-level analysis. Comprehensive and complete information exists for the water resources and was readily applied for each alignment to determine the potential for impacting water resources. Vernal pools provide important habitat for many special-status plant and wildlife species and occur as small areas within grassland and other land cover types. GIS data for vernal pools were also used. At the project level, field surveys will provide areas of potential impact along the alignment alternatives carried forward for site-specific analysis.

Special-Status Species and Habitat Impacts Evaluation

For each species with potential to occur in the study area, information was gathered on status, distribution, threats, population trends, and conservation and management efforts. Species that are included in the analysis of impacts from the proposed project include species:

- Listed as threatened or endangered under ESA.
- Proposed for listing as threatened or endangered under ESA.
- Candidates for possible future listing as threatened or endangered under ESA (66 FR 54808, October 30, 2001).
- Considered by CNPS to be "rare, threatened or endangered in California".
- Listed as threatened or endangered under CESA.
- Fully protected in California (California Fish and Game Code Section 3511[birds], 4700 [mammals], and 5050 [reptiles and amphibians]).
- California species of special concern (CSC) (CDFG's Special Animals List 2006).
- Identified by CDFG and the Point Reyes Bird Observatory (PRBO) as a bird species of special concern in California (list developed in 2001 but not yet adopted).

Species were analyzed if one of the alternative alignments occurred in the range for the species. Special-status plant and special-status wildlife tables were developed for those species that have a potential to occur in the study areas. Information in the tables includes scientific and common name, status, distribution, habitat requirements, blooming period (plants), and the alignment alternative(s) the species could occur in. The distributions of these species were identified based on a review of the documents and literature listed above. No field or onsite surveys were conducted to identify sensitive species for this Program EIR/EIS.

The amount of suitable habitat (as identified by a land cover type) for special-status species that could be directly or indirectly affected by the HST Alignment Alternatives was calculated. Potential habitat fragmentation, impacts on wildlife movement corridors, and areas identified as critical habitat were also considered.

Determining the extent of habitat for covered plant species is complicated because the exact location of all populations is not known, and a complete set of habitat attributes is often not known for most species. Therefore, the focus of the analysis concentrated on habitat known to be occupied and habitat that possesses the necessary characteristics for the species in question but that is not known to be occupied because of a lack of surveys or reporting.

A habitat model was developed for covered plant species based on correlations among the known physical and biological attributes associated with each land cover type and the known biological and physical conditions that define each species' habitat. Information from known occurrences was used to determine the existing distribution of the species and habitat attributes.

C. CEQA SIGNIFICANCE CRITERIA

The significance criteria for identifying potential impacts on biological resources from proposed projects/actions are based on federal and state guidelines and general indicators of significance, including guidelines or criteria in NEPA, CEQA, CWA, CESA, ESA, and California Fish and Game Code. Site-specific criteria would be applied at the project level of environmental analysis when permits are being sought after a decision is made to proceed with a preferred alignment alternative, following this program-level analysis.

Based on the presence or absence of sensitive resources, an alignment alternative may have a significant impact on biological resources if its implementation would result in any of the following:

- Potential modification or destruction of habitat, movement/migration corridors, or breeding areas for endangered, threatened, rare, or other special-status species described above.
- Potential loss of a substantial number of any species that could affect the abundance or diversity of that species beyond the level of normal variability.
- Potential impacts on or measurable degradation of protected habitats, sensitive natural vegetation communities, wetlands, or other habitat areas plans, policies, or regulations.
- Potential conflict with the provisions of an adopted HCP, NCCP[2], or other approved local, regional, or state HCP.

3.15.2 Affected Environment

A. STUDY AREA DEFINED

The biological resources and wetlands study area for direct impacts is defined as 50 ft (15 m) on each side of the alignment. The study area for indirect impacts is 1,000 ft (305 m) in urban areas and 0.25 mile (0.41 km) in rural areas on each side of the alignment. The study area for direct impacts of stations is the station area, and the indirect impact study area for stations is 1,000 ft (305 m) in urban areas and 0.25 mile (0.41 km) of alignment centerlines and around station and facility areas in undeveloped areas, including biologically sensitive locations.

B. GENERAL DISCUSSION OF BIOLOGICAL RESOURCES AND WETLANDS

The following is a brief description of the resources and land cover types studied. A more detailed description of these resources and the sources of information used to obtain the descriptions are provided in Appendix 3.15-A. In addition, this section discusses HCPs, critical habitat[3] areas, and other conservation plans or areas that could potentially be affected by one or more of the alignments discussed in this document.

[2] The NCCP program of CDFG is an effort by the State of California and many private and public partners that takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. An NCCP identifies and provides for the regional or areawide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. CDFG and USFWS provide the necessary support, direction, and guidance to NCCP participants in these functions.

[3] Critical habitat refers to areas shown on maps developed by USFWS that provide habitat for threatened and endangered species.

Sensitive Vegetation Communities

Sensitive vegetation communities are natural communities (assemblages of species, both plant and wildlife, forming communities) and wildlife habitats that are unique, of relatively limited distribution in the region, or of particularly high wildlife value. Sensitive vegetation communities are afforded special protection by federal, state, and local regulations.

Sensitive Plant Species

Sensitive plant species include plant species that have been afforded special status and/or recognition by federal or state resource agencies, as well as private conservation organizations, because of documented or perceived decline or limitation of population size or geographical extent.

Sensitive Wildlife Species

Sensitive wildlife species include wildlife species that have been afforded special status by federal or state resource agencies, as well as private conservation organizations, because of documented or perceived decline or limitation of population size or geographical extent. Special-status species include wildlife, fish, or animals that are legally protected or that are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status species include species listed as state and/or federal threatened or endangered species under ESA or CESA, those that have been proposed for listing, those considered as candidates for listing, and those identified by CDFG as a California species of special concern.

Critical Habitats

Critical habitats are areas that are either occupied by species that are federally listed as threatened or endangered or areas that provide them with suitable habitat and within which are found the geographical and physical features that are essential to the conservation of the species. As defined under the ESA, conservation is defined as "any and all methods and procedures used to bring a species to recovery; the point at the protections of the ESA are no longer needed."

Core Areas for Recovery of Federally Listed Species

The USFWS has developed recovery plans for many federally listed species. In these plans, the USFWS has identified core areas for recovery of these listed species. These core areas are areas that provide essential habitat for these species and where recovery efforts will be focused.

Wildlife Movement/Migration Corridors

Wildlife movement/migration corridors link together areas of wildlife habitat that are otherwise separated by rugged terrain, changes in vegetation, or human disturbance. The fragmentation of open space areas by urbanization tends to create isolated islands of wildlife habitat. The fragmentation of wildlife habitat into isolated islands is especially detrimental to threatened or endangered species that are subject to localized extinctions due to natural or human-induced causes. Wildlife movement and migration corridors allow for the recolonization of areas that may have experienced greatly reduced populations or localized extinctions. Wildlife movement/migration corridors also allow for genetic mixing and flow between otherwise segregated populations of a species.

Wetlands and Other Waters of the United States

Wetlands and other waters of the United States, including lakes, rivers, and streams, are afforded protection under federal and state laws. Special aquatic resources, which include seasonal wetlands and vernal pools, are considered an important subset of these waters because of their importance to plant and wildlife species.

The following land cover types exist in the affected environment and were studied.

Seasonal Wetland

Seasonal wetlands support ponded or saturated soil conditions but generally only during winter and spring. The vegetation is composed of wetland generalists, such as hyssop loosestrife, cocklebur, Mediterranean barley, and Italian ryegrass, which typically occur in frequently disturbed sites, such as along streams. For the purposes of this analysis, vernal pools are included in this seasonal wetland category. Vernal pools include northern claypan and northern hardpan vernal pools as classified by Holland (1986). These communities are dominated by native annual species that germinate, grow, and flower as the pools dry up in the spring. Characteristic species include goldfields, downingia, meadowfoam, navarettia, and popcorn flower.

Agriculture

Agricultural lands within the project area may include orchards, vineyards, row crops, or grazing land. The land may or may not be flooded for part of the year. It may include land with very little vegetation present, including fallow or recently plowed fields.

Open Water

Open water land cover types include natural and human-made aquatic habitats that support submerged or floating vegetation, such as lakes, reservoirs, flood control basins, ponds (including stock ponds), sloughs, canals, and rivers. Many of the large water bodies include permanent and seasonal wetland and riparian communities along their edge.

Urban/Developed

Large areas of residential and commercial development occur throughout the study area and are present in some capacity along the alignment alternatives. In developed areas are small patches of disturbed open lands that are either unvegetated or vegetated with ruderal species. Because these areas are often fenced, occur in active commercial or residential areas, and are frequently disturbed, they are considered developed for the purposes of this analysis. Vegetation is restricted to landscaped areas and consists primarily of horticultural trees and shrubs, with finite areas of herbaceous flowering plants and turf grass.

Permanent Freshwater Wetland

This land cover type is similar to the Coastal and Valley Freshwater Marsh as classified by Holland (1986). Dominant vegetation in permanent freshwater wetlands includes cattails and tules and bulrushes.

Grassland

This land cover type is similar to the Non-Native Grassland as classified by Holland (1986). Nonnative grassland is a herbaceous community dominated by naturalized annual grasses with intermixed perennial and annual forbs. Annual grassland in the study area is likely to exhibit low levels of diversity and is dominated by the following species: ripgut brome, yellow star-thistle, Italian ryegrass, and wild oat. Some areas of annual grassland may also contain scattered oak woodlands and vernal pools.

Shrubland

This land cover type includes Northern Mixed Chaparral and Interior Coast Range Saltbush Scrub as classified by Holland (1986). It is made up of impenetrably dense, evergreen, leathery-leaved shrubs that are adapted to frequent fires, and it occurs on diverse substrates. Chaparral may be successional to conifer forests or oak woodlands, as tree seedlings can be found beneath the shrub canopies.

Bay Waters

Bodies of saltwater occurring in bays that are subject to tidal action.

Unvegetated Flats
Tidal flats, mud banks, and sand bars visible above the water level during summer.

Riparian Habitat
This community is dominated by several willow species, including sandbar willow and arroyo willow. Some riparian areas have an understory of Himalayan blackberry. Other species often observed in riparian areas are giant reed, pampas grass, button willow, Fremont's cottonwood, and interior live oak.

Montane Hardwood Forest
This land cover type is similar to the Broadleaved Upland Forest as classified by Holland (1986). Montane hardwood has a hardwood canopy layer with a sparse shrub layer. The dominant trees in the plan area are most likely canyon live oak, California Bay, and Pacific madrone.

Managed Bay Marsh
This land cover type is similar to the Northern Coastal Salt Marsh as classified by Holland (1986). It is found in areas of the Bay that are protected from the wave action and strong winds of the seashore. The soil is generally very wet and in some areas is periodically inundated with saltwater by tidal action. Plants often found in this habitat type include pickleweed, salt grass, and cord grass.

Saline-Brackish Permanent Wetland
This land cover type is similar to the Coastal Brackish Marsh as classified by Holland (1986). Saline-Brackish Permanent Wetland habitat is defined to include portions of San Francisco, San Pablo, and Suisun Bays and the Delta that support saline-tolerant emergent wetland plant species in the intertidal zone or on lands that historically were subject to tidal exchange (i.e., diked wetlands).

Oak Woodland/Foothill Pine
This land cover type is similar to the Digger Pine-Oak Woodland as classified by Holland (1986). Dominant species include foothill pine and blue oak. Understories may be open and herbaceous or closed and shrubby. This type occurs on a variety of sites below the conifer forests in California. Associated tree species in the oak woodland/foothill pine classification include interior live oak and California buckeye.

Salt Pond
Salt production in the Bay area involves the use of a series of salt ponds. As the water moves from one pond to the next, evaporation causes successive ponds to become saltier. Plant and animal species found in a given salt pond are determined by the concentration of salt.

Valley Oak Woodland
Valley oak woodland as classified by Holland (1986) is strongly dominated by valley oak but may also contain blue oak, California sycamore, black walnut, and box elder. The canopy layer is typically open, forming a savanna structure rather than woodland. Associated understory shrubs include elderberry, poison oak, toyon, and California blackberry. The herb layer is often dominated by leymus grass and includes a variety of annual and perennial grasses and forbs.

C. BIOLOGICAL RESOURCES IN THE BAY AREA TO CENTRAL VALLEY REGION

The following is a brief discussion of resources for the topics described above. Figures 3.15-1 and 3.15-2 show the general locations of sensitive habitat and wetlands in the study region. Figure 3.15-3 illustrates the wildlife movement corridors in this region.

San Francisco to San Jose Corridor

The San Francisco to San Jose Corridor includes the western portion of the San Francisco Bay Area from San Francisco (San Francisco County) south through eastern San Mateo County to San Jose

(Santa Clara County). The San Francisco Bay and the Santa Clara Valley geophysical features dominate the areas traversed by this corridor. The major watersheds that correspond to these geophysical features are the San Francisco Bay watershed, including the Guadalupe River and Coyote Creek. Elevation along the proposed HST alignment alternatives in this region ranges from sea level to around 200 ft (61 m).

Vegetation Communities

Vegetation communities in this corridor include seasonal wetland, agriculture, open water, urban/developed, permanent freshwater wetlands, grasslands, shrubland, Bay waters, and unvegetated flats.

Water Resources

The Cowardin system to classify wetlands and deepwater habitat systems was developed for the USFWS in 1979. Under this system, wetlands are of two basic types: coastal (also known as tidal or estuarine wetlands) and inland (also known as nontidal, freshwater, or palustrine wetlands). The Cowardin system is hierarchical and includes several layers of detail for wetland classification, such as a subsystem of water flow, classes of substrate types, subclasses of vegetation types and dominant species, and flooding regimes and salinity levels for each system. This system is appropriate for an ecologically based understanding of wetland definition. Following the Cowardin classification system, the water resources that could occur along the San Francisco to San Jose Corridor include estuarine, lacustrine, palustrine, and riverine systems. Vernal pools may be present, particularly on clear lake soils fringing San Francisco Bay.

Special-Status Species

Special-Status Plants

A number of special-status plant species could be present in the San Francisco to San Jose corridor. These include the San Mateo thorn-mint, Franciscan onion, bent-flowered fiddleneck, marsh sandwort, alkali milk-vetch, San Joaquin spearscale, Tiburon Indian paintbrush, Congdon's tarplant, Presidio clarkia, San Francisco collinsia, Santa Clara Valley dudleya, Hoover's button-celery, San Francisco gumplant, Marin western flax, Contra Costa goldfields, Crystal Springs lessingia, marsh microseris, white-rayed pentachaeta, slender-leaved pondweed, adobe sanicle, San Francisco campion, Santa Cruz microseris, saline clover, and San Francisco owl's-clover.

Special-Status Wildlife

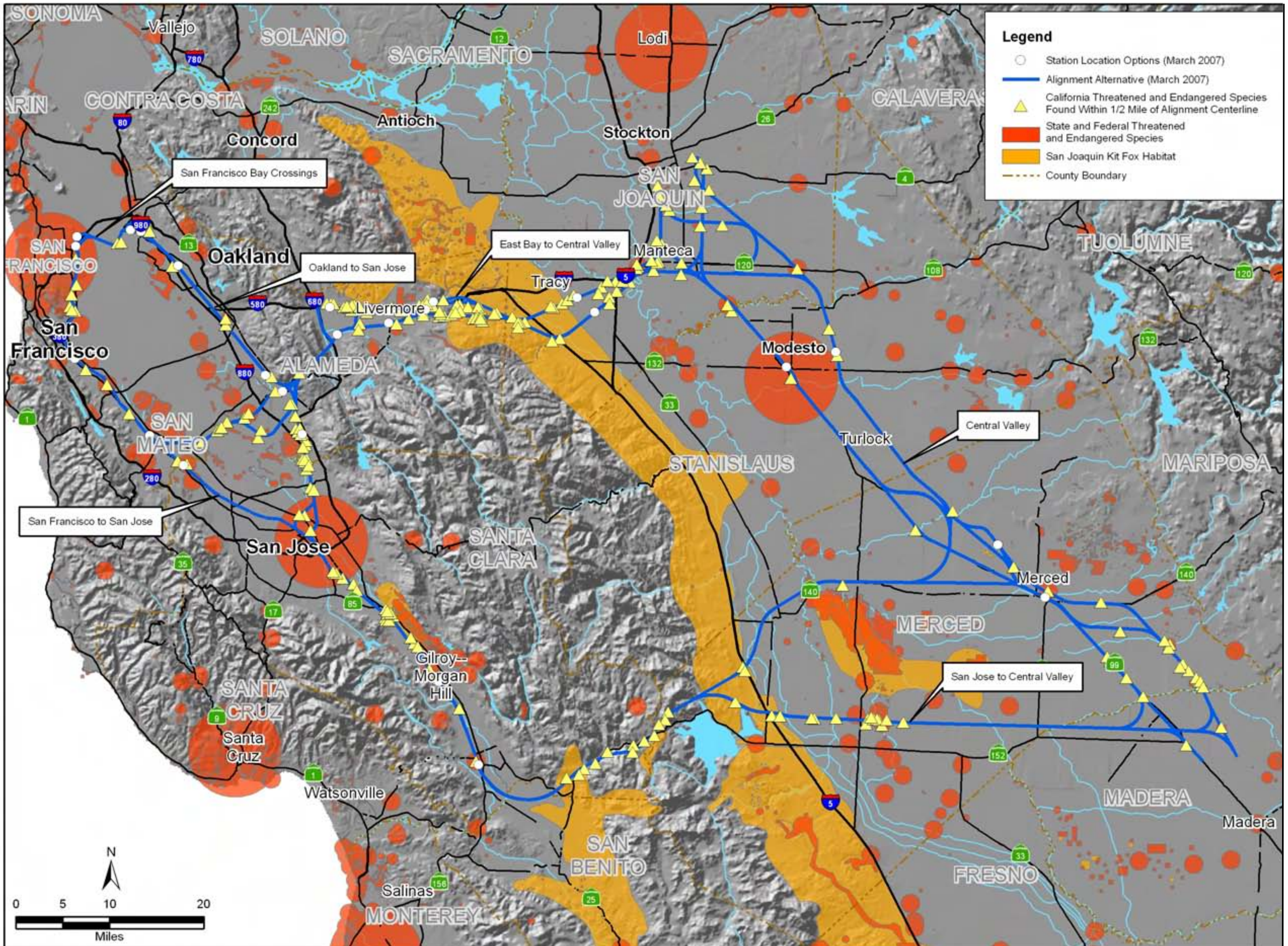
A number of special-status wildlife species could be present in the San Francisco to San Jose corridor. These include bay checkerspot butterfly, callippe silverspot, mission blue butterfly, San Bruno elfin butterfly, California red-legged frog, California horned lizard, northwestern pond turtle, San Francisco garter snake; nesting habitat for Alameda song sparrow, brown pelican, California black rail, California clapper rail, California least tern, Cooper's hawk, double-crested cormorant, loggerhead shrike, long-eared owl, northern harrier, salt marsh common yellowthroat, short-eared owl, western burrowing owl, white-tailed kite, and yellow warbler; and salt marsh harvest mouse, salt marsh wandering shrew, San Francisco dusky-footed woodrat, and several species of bats.

Wildlife Movement Corridors

The majority of the corridor is urbanized, and available data are limited on wildlife movement/migration corridors in this area. The riparian and stream corridors between the Santa Cruz Mountains and the San Francisco Bay provide corridors for wildlife movement. The western shore of the San Francisco Bay provides a critical movement corridor for nesting and foraging birds and other wildlife. The Wilderness Coalition has identified this as a critical linkage corridor (2000) (Figure 3.15-3).

Management Plans

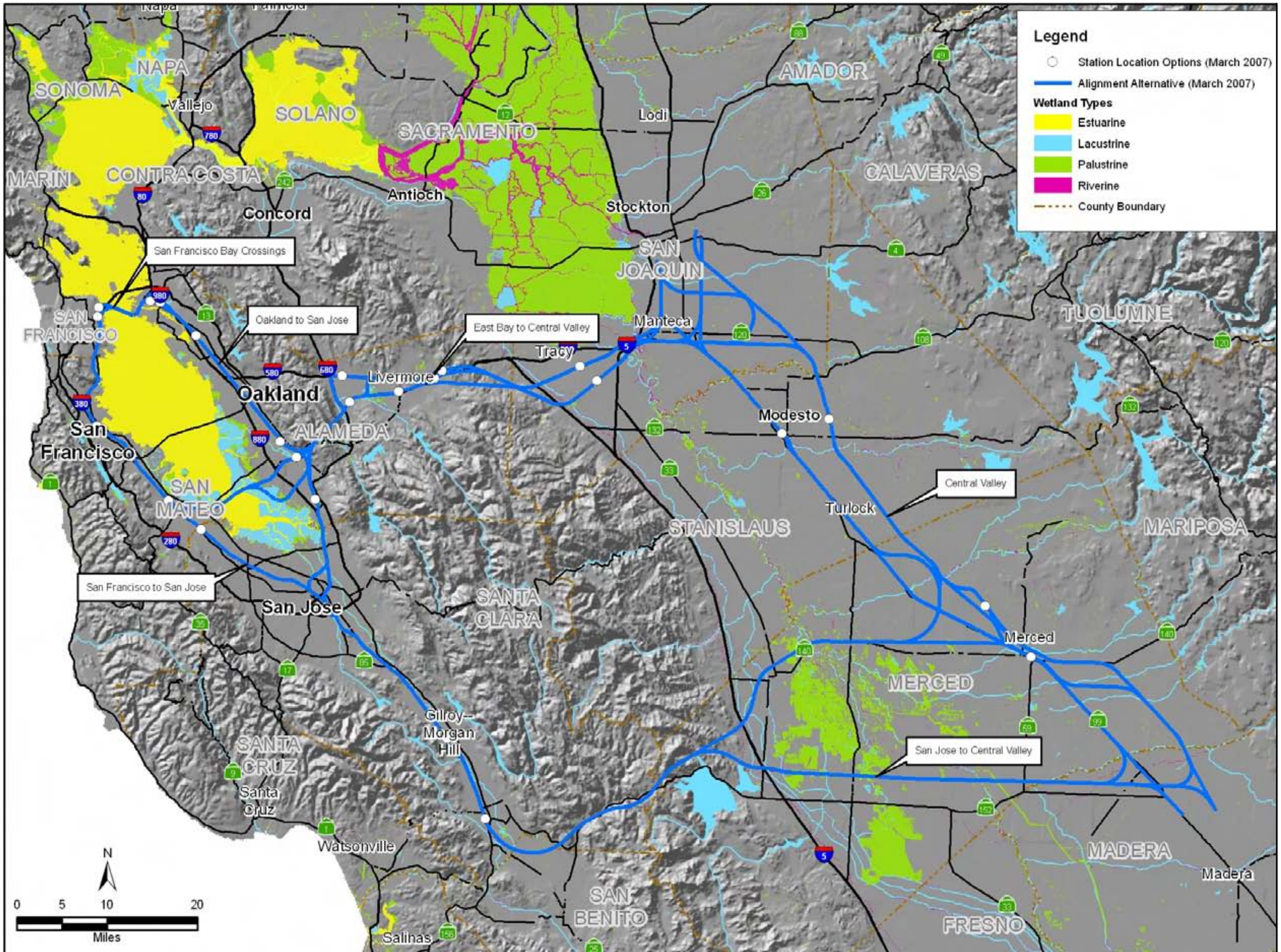
The USFWS has prepared the *San Bruno Elfin and Mission Blue Butterflies Recovery Plan* (1984). An HCP has been developed to allow development on San Bruno Mountain, while minimizing adverse



SOURCE: ESRI Streetmap USA (2005), California Department of Fish and Game, California Natural Diversity Database (2006), California High-Speed Rail Authority (2007)

U.S. Department of Transportation Federal Railroad Administration

Figure 3.15-1
Bay Area to Central Valley Habitat

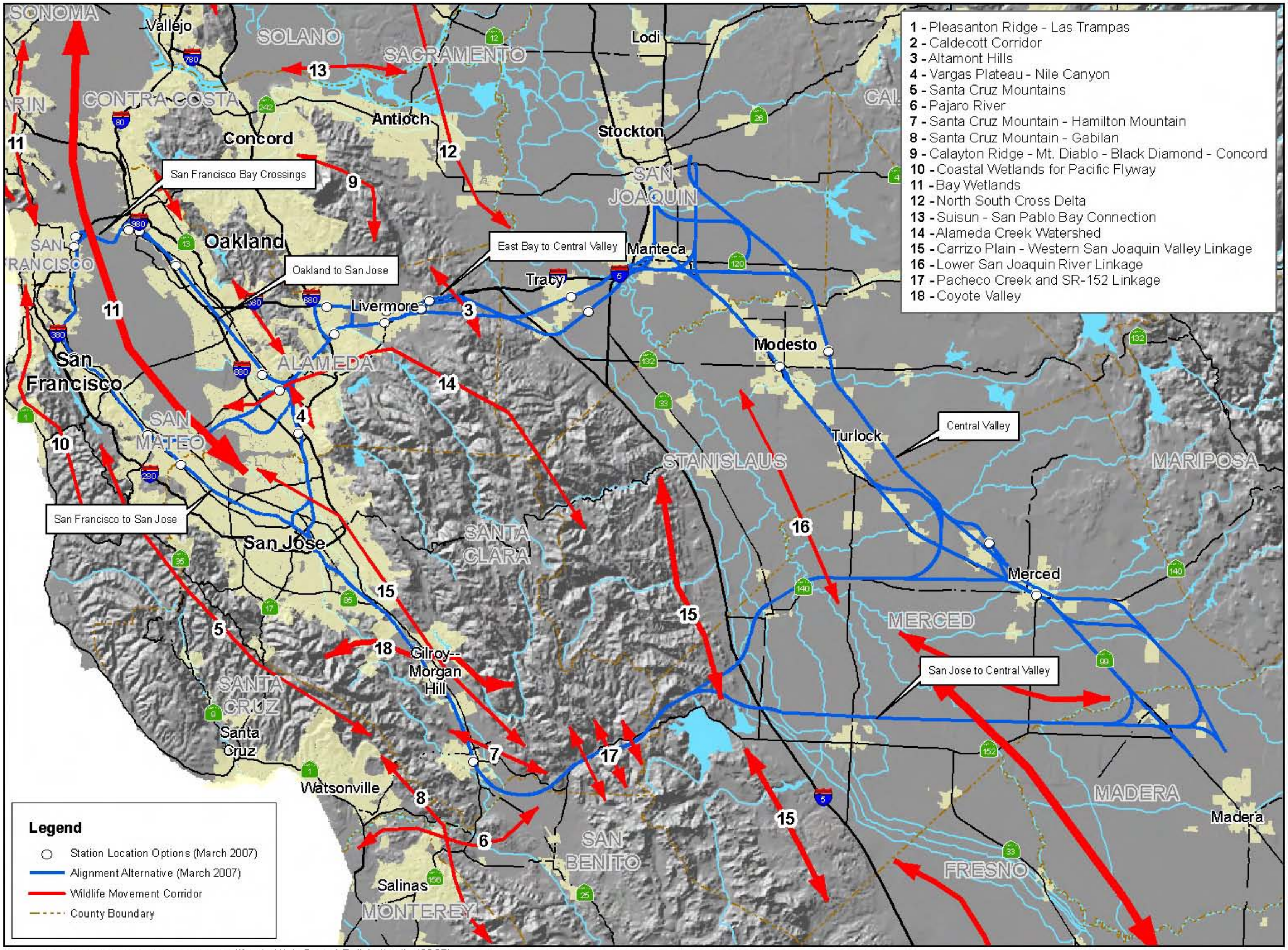


SOURCE: ESRI Streetmap USA (2005), California High-Speed Rail Authority (2007), California Resources Agency (2003)

FLY CALIFORNIA

U.S. Department of Transportation Federal Railroad Administration

Figure 3.15-2
Bay Area to Central Valley Wetlands



SOURCE: ESRI Streetmap USA (2005), California High-Speed Rail Authority (2007)

Figure 3.15-3
Bay Area to Central Valley
Wildlife Movement Corridors

effects on the San Bruno elfin butterfly and other rare species in the area. The USFWS is developing a recovery plan for the Callippe silverspot butterfly. The Bay checkerspot butterfly, fountain thistle, Metcalf Canyon jewelflower, presidio clarkia, and white-rayed pentachaeta were included in the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area*.

The USFWS has prepared the *Recovery Plan for the California Red-Legged Frog* (2002). The objective of the plan is to reduce threats to California red-legged frogs and to improve the population status sufficient to warrant delisting. The USFWS has identified several core areas where recovery plans will be focused. The core areas are distributed throughout the historical and current range of the California red-legged frog and represent a system of areas that, when protected and managed, will allow for long-term viability of existing populations and reestablishment of populations in the historical range.

The Tidal Marsh Ecosystem Recovery Plan, which is under development by USFWS, will include a number of federally listed species found in the San Francisco Bay, such as Suisun thistle, soft birds-beak, California clapper rail, and salt marsh harvest mouse. The plan is expected to outline strategies for the recovery of these species.

A Recovery Plan for the San Francisco Garter Snake (1985) was developed by the USFWS and is being updated.

The USFWS is preparing the Recovery Plan for Coastal Plants. The showy Indian clover is listed in this recovery plan.

A restoration plan, as part of the South Bay Salt Pond Restoration Project, is being developed by the California Coastal Conservancy, USFWS, and CDFG for the Cargill salt properties (South Bay Salt Pond Restoration Project) to restore salt marshes, as well as to provide public access and public recreation.

Oakland to San Jose Corridor

The Oakland to San Jose corridor includes the eastern portion of the San Francisco Bay Area from Oakland in Alameda County south through Fremont and Milpitas to San Jose. The San Francisco Bay, the Santa Clara Valley, and the Diablo Range geophysical features dominate the areas traversed by this corridor. The major watersheds that correspond to these geophysical features are the San Francisco Bay watershed, including the Guadalupe River and Coyote Creek. Elevation along the proposed HST Alignment Alternatives in this region ranges from sea level to around 200 ft (61 m).

Vegetation Communities

Vegetation communities in this corridor include seasonal wetland, agriculture, open water, urban/developed, riparian habitat, grasslands, shrubland, Montane hardwood forest, managed Bay marsh, saline-brackish permanent wetland, and unvegetated flats.

Water Resources

Following the Cowardin classification system, the water resources that could occur in the Oakland to San Jose corridor include estuarine, lacustrine, palustrine, and riverine systems. Vernal pools may be present, especially on Clear Lake soils fringing San Francisco Bay.

Special-Status Species

Special-Status Plants

A number of special-status plant species could occur in the Oakland to San Jose corridor. These include the bent-flowered fiddleneck, alkali milk-vetch, brittlescale, San Joaquin spearscale, big-scale balsamroot, Tiburon Indian paintbrush, Congdon's tarplant, Presidio clarkia, Hoover's button-celery, Contra Costa goldfields, prostrate navarretia, hairless popcorn flower, slender–leaved pondweed, adobe sanicle, *and* saline clover.

Special-Status Wildlife
A number of special-status wildlife species could occur in the Oakland to San Jose corridor. These include vernal pool tadpole shrimp, California red-legged frog, California horned lizard; northwestern pond turtle; nesting Alameda song sparrow, California black rail, California clapper rail, California least tern, Cooper's hawk, double-crested cormorant, loggerhead shrike, long-eared owl, northern harrier, salt marsh common yellowthroat, short-eared owl, western burrowing owl, white-tailed kite, and yellow warbler; and salt marsh harvest mouse, salt marsh wandering shrew, San Francisco dusky-footed woodrat, and several species of bats.

Special Management Areas
The 30,000-ac (12,140-ha) Don Edwards San Francisco Bay National Wildlife Refuge is the largest urban wildlife refuge in the nation. The refuge is located on the southeast side of the San Francisco Bay and preserves open bay, salt marsh, mud flats, vernal pools, and upland habitats. It is home to millions of shorebirds and waterfowl, with a total of 250 bird species, including the endangered California clapper rail, California least tern, and salt marsh harvest mouse.

Wildlife Movement Corridors
The riparian and stream corridors between the Diablo Range and the San Francisco Bay provide corridors for wildlife movement. The eastern shore of the San Francisco Bay provides movement corridors for small mammals, such as the salt marsh harvest mouse, as well as nesting and foraging birds. The Wilderness Coalition (2000) identified critical linkage corridors along the eastern shore of San Francisco, as well as a corridor linking the bay to the Diablo Range (Figure 3.15-3).

Management Plans
The restoration plan for the Cargill salt properties would be relevant to this corridor. Also, the Presidio clarkia was included in the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area*.

<u>San Jose to Central Valley Corridor</u>

The San Jose to Central Valley corridor includes the Santa Clara Valley from San Jose south through Morgan Hill and Gilroy, and east through the Coast Range into the Central Valley. The major geophysical regions include the Santa Clara Valley, the southern reaches of the Diablo Range, and the Central Valley. The major watersheds include the San Francisco Bay watershed, including the Guadalupe River and Coyote Creek, the Pajaro River watershed, and the San Joaquin River watershed. Elevation along the San Jose to Central Valley corridor ranges from 150 ft (46 m) to 1,200 ft (366 m).

Vegetation Communities
Vegetation communities in this corridor include seasonal wetland, agriculture, open water, urban/developed, riparian forest, nonnative annual grasslands, shrubland, Montane hardwood forest, oak woodland/foothill pine, and permanent freshwater wetland.

Water Resources
Following the Cowardin classification system, the water resources that could occur along the San Jose to the Central Valley corridor include lacustrine, palustrine, and riverine systems. Vernal pools may be present, especially on Central Valley terrace deposits.

Special-Status Species
Special-Status Plants
A number of special-status plant species could occur in the San Jose to Central Valley corridor. These include the bent-flowered fiddleneck, alkali milk-vetch, heartscale, brittlescale, San Joaquin spearscale, lesser saltscale, vernal pool smallscale, subtle orache, Tiburon Indian paintbrush, pink creamsacs, Lemmon's jewelflower, coyote ceanothus, Congdon's tarplant, Hoover's spurge, robust spineflower, San Francisco collinsia, hispid bird's-beak, Hoover's cryptantha, Hospital Canyon

larkspur, recurved larkspur, dwarf downingia, Santa Clara Valley dudleya, four-angled spikerush, round-leaved filaree, Delta button-celery, fragrant fritillary, Diablo helianthella, Loma Prieta hoita, Contra Costa goldfields, smooth lessingia, arcuate bush mallow, robust monardella, shining navarretia, Colusa grass, San Joaquin Valley orcutt grass, hairy orcutt grass, Metcalf Canyon jewel-flower, most beautiful jewel-flower, showy Indian clover, saline clover, and caper-fruited tropidocarpum.

Special-Status Wildlife

A number of special-status wildlife species could occur in the San Jose to Central Valley corridor. These include the bay checkerspot butterfly, conservancy fairy shrimp, longhorn fairy shrimp, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, California red-legged frog, California tiger salamander, foothill yellow-legged frog, California horned lizard, giant garter snake, San Joaquin whipsnake, southwestern pond turtle; nesting habitat for American peregrine falcon, California horned lark, Cooper's hawk, golden eagle, least Bell's vireo, loggerhead shrike, long-eared owl, northern harrier, prairie falcon, short-eared owl, Swainson's hawk, tricolored blackbird, western burrowing owl, white-tailed kite, willow flycatcher, yellow-breasted chat, and yellow warbler; and American badger, San Joaquin kit fox, and bat species.

Special Management Areas

The Grasslands Ecological Area (GEA), which is located north, east, and south of the city of Los Banos in Merced County, encompasses approximately 240,000 ac (97,125 ha) and is the largest wetland complex in California. It also contains the largest block of contiguous wetlands remaining in the Central Valley.[4] The GEA is a non-jurisdictional, non-regulatory, generally designated area used by the USFWS to identify an area for priority purchase of public easements for wetland preservation and enhancement. The boundary of the GEA encompasses a substantial area that includes two federal wildlife refuges, a state park, state wildlife management areas, and a block of privately managed wetlands. Lands in the GEA managed by public agencies include the Great Valley Grasslands State Park; CDFG North Grasslands Wildlife Area, Los Banos Wildlife Area, and Volta Wildlife Area; and the San Luis National Wildlife Refuge Complex, which includes the San Luis National Wildlife Refuge (includes the Kesterson unit) and Merced National Wildlife Refuge. Also in the GEA are numerous privately owned parcels and a large number of waterfowl hunting clubs. Activities and land uses in the GEA include hunting, fishing and other active and passive recreation, agriculture, and residential and associated land uses. The GEA was designated a wetlands of worldwide importance under the Ramsar Treaty in 2005, one of four sites in California.[5] This region is considered a critical component of the Central Valley wintering habitat for waterfowl and has been recognized as a resource of international significance. The USFWS manages the San Luis National Wildlife Refuge Complex to optimize wetland conditions for thousands of migratory birds that migrate through the Central Valley.

Within the area identified as the GEA is the USFWS Grasslands Wildlife Management Area (WMA), which was established to protect wetlands. Land in the WMA is privately owned and some is protected by conservation easements. The size of this management area as of the last expansion in 2005 is approximately 133,000 acres, with more than 70,000 acres protected through conservation agreements. Daily management of the easement area remains under private landowner control, the majority of the properties being managed for waterfowl hunting, cattle grazing, and agriculture.

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[4] Grasslands Water District, Land Use and Economics Study: Grasslands Ecological Area (July 2001), P. 2 (hereafter "Grassland Water District"). The area of the GEA increased from 180,000 ac to 240,000 ac to include the eastward expansion approved by USFWS between the publication of the Draft Program EIR/EIS and the Final Program EIR/EIS.

[5] RAMSAR Report for the Grassland Ecological Area. Accessed at http://www.wetlands.org/reports/output.cfm. 2005.

Henry Coe State Park, which is located northeast of Gilroy, is the largest state park in northern California, encompassing more than 87,000 ac (35,208 ha) and includes the 23,300-ac (9,429-ha) Orestimba Wilderness area. Henry Coe State Park is home to a variety of special-status species and wildlife, including an estimated 675 vascular plants. Other state owned or managed lands within this corridor include the Cañada De Los Osos Ecological Reserve south of Henry Coe State Park, and the San Luis Reservoir State Recreation Area, O'Neill Forebay Wildlife Area, Upper and Lower Cottonwood Creek Wildlife Area, San Luis Reservoir Wildlife Area, and Pacheco State Park located around the San Luis Reservoir.

The Nature Conservancy is pursuing conservation measures to protect more than 780 square mi (2,020 square km) of land in the Diablo Range to safeguard native species and natural habitats. This project was started in 1998 with the largest single private conservation project in northern California history—involving two ranches east of Mount Hamilton totaling 61,000 ac (24,686 ha). The Nature Conservancy's goal is to protect some 200,000 ac (80,937 ha) by 2007. This area would protect the San Joaquin kit fox, the California red-legged frog, valley oak savannas, blue oak woodlands, and native fish and amphibians.

Wildlife Movement Corridors

The natural and agricultural lands located within the Santa Clara Valley provide a movement corridor from the San Francisco Bay Area to natural areas to the south. The Diablo Range provides movement corridors for a number of species between the Santa Clara Valley and the Central Valley. Major drainages, such as Coyote Creek, the Pajaro River, and the Tres Pinos Creek, also provide wildlife movement corridors. On the west side of the Central Valley is a relatively extensive strip of annual (nonnative) grassland that lies between the irrigated fields and orchards of the valley floor and the oak and pine woodlands of the Diablo Range. This strip is about 10 mi (16 km) wide and provides a movement corridor for the San Joaquin kit fox.

Management Plans

The USFWS adopted the *Recovery Plan for Upland Species of the San Joaquin Valley* in 1998. The recovery plan was developed to delineate reasonable actions that would be required to recover and protect listed species found in the San Joaquin Valley. The plan covers 34 species of plants and animal, 11 of which are federally listed species: six plant species and five wildlife species. The remaining 23 species are either candidate species or species of special concern. The ultimate goal of the recovery plan is to delist the 11 listed species and ensure the long-term conservation of the 23 candidate and species of special concern. The California jewelflower has been included in this management plan.

A draft recovery plan has been developed for the least Bell's vireo, which outlines measures to help in the recovery of the species.

The USFWS developed the *Valley Elderberry Longhorn Beetle Recovery Plan* in 1984. The USFWS has also adopted *Conservation Guidelines for Valley Elderberry Longhorn Beetle* (1999).

The USFWS prepared the *Recovery Plan for Vernal Pool Ecosystems in California* (2005), which outlines strategies for the recovery and conservation of vernal pools and the federally listed plant and wildlife species that occur in these ecosystems. The USFWS identified vernal pool regions throughout California that are based on the geography and/or ecology of one or more of the vernal pool species identified in the recovery plan. Within each of the regions, core areas were identified where recovery actions will be focused because they provide the necessary features that are important to the recovery of a species. The hairy orcutt grass, Hoover's spurge, San Joaquin Valley orcutt grass, Colusa grass, and succulent owl's clover have all been listed under this management plan.

The *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* would be relevant to this corridor. The coyote ceanothus, Metcalf Canyon jewelflower, and Santa Clara Valley dudleya have been listed under this management plan.

The *Recovery Plan for Coastal Plants* that the USFWS is preparing would be relevant for this corridor. The showy Indian clover is listed under this management plan.

East Bay to Central Valley Corridor

The East Bay to Central Valley corridor includes the East San Francisco Bay near Union City (Alameda County) east to the Livermore Valley (Pleasanton and Livermore), and across Patterson Pass into the Central Valley. The dominant geophysical features traversed by this corridor include the San Francisco Bay, the Diablo Range, and the Central Valley. Major watersheds include the San Francisco Bay watershed, the Las Positas watershed, and the San Joaquin River watershed. Elevation along the East Bay to Central Valley Corridor ranges from 100 ft (30 m) to 1,300 ft (396 m).

Vegetation Communities

Vegetation communities in this corridor include seasonal wetland, agriculture, open water, urban/developed, riparian habitat, grasslands, shrubland, oak woodland/foothill pine, and permanent freshwater wetland.

Water Resources

Following the Cowardin classification system, the water resources that could occur along the East Bay to the Central Valley corridor include estuarine, lacustrine, palustrine, and riverine systems. Vernal pools may be present, especially on Clear Lake soils fringing San Francisco Bay, or on Central Valley terrace deposits.

Special-Status Species

Special-Status Plants

A number of special-status plant species could occur in the East Bay to Central Valley corridor. These include the bent-flowered fiddleneck, Suisun Marsh aster, alkali milk-vetch, heartscale, brittlescale, San Joaquin spearscale, lesser saltscale, big-scale balsamroot, *big tarplant,* Congdon's tarplant, slough thistle, Mt. Hamilton thistle, hispid bird's-beak, palmate-bracted bird's beak, Hospital Canyon larkspur, recurved larkspur, round-leaved filaree, Hoover's button-celery, Delta button-celery, diamond-petaled California poppy, Diablo helianthella, rose-mallow, Contra Costa goldfields, legenere, showy madia, robust monardella, prostrate navarretia, hairless popcorn flower, most beautiful jewel-flower, saline clover, caper-fruited tropidicarpum, and Greene's tuctoria.

Special-Status Wildlife

A number of special-status wildlife species could occur in the East Bay to Central Valley corridor. These include the longhorn fairy shrimp, valley elderberry longhorn beetle, vernal pool fairy shrimp; vernal pool tadpole shrimp, California red-legged frog, California tiger salamander, western spadefoot, Alameda whipsnake, California horned lizard, giant garter snake, northwestern pond turtle, San Joaquin whipsnake; nesting habitat for American peregrine falcon, California horned lark, Cooper's hawk, golden eagle, loggerhead shrike, long-eared owl, northern harrier, prairie falcon, short-eared owl, Swainson's hawk, tricolored blackbird, western burrowing owl, white-tailed kite, and yellow warbler; and American badger, San Joaquin kit fox, and several bat species.

Special Management Areas

The Mount Hamilton Project of The Nature Conservancy encompasses a 1,560-sq-mi (2,511-sq-km) area in this region that extends from south of the Pacheco Pass to north of the Altamont Pass, with large parts of the area protected by conservation easements. The East Bay Regional Park District (EBRPD) encompasses 98,000 ac (39,659 ha) of mostly undeveloped, natural, open space parklands in Alameda and Contra Costa Counties. EBRPD lands include grassland, shrubland, woodland, forest, lake, shoreline, riparian, and wetland environments, which provide habitat for plants and wildlife. The EACCS provide a blueprint for conservation in East Alameda County and streamline the environmental permitting process by providing guidance to project proponents on where and how to focus mitigation efforts to address potential adverse effects on species resulting from future development and infrastructure improvements. The EACCS facilitate ongoing conservation programs by providing a coordinated approach supported by local stakeholders and regulatory agencies.

Wildlife Movement Corridors

On the west side of the Central Valley is a relatively extensive strip of annual (nonnative) grassland that lies between the irrigated fields and orchards of the valley floor and the oak and pine woodlands of the Diablo Range. This strip is about 10 mi (16 km) wide and provides a movement corridor for the San Joaquin kit fox.

Management Plans

The San Francisco Public Utility Commission (SFPUC) is developing the *Alameda Watershed Habitat Conservation Plan* to ensure that its operation activities comply with the ESA. The plan covers 47,800 ac (19,344 ha) in Alameda County, including the entire 36,816 ac (14,898 ha) of land owned by the SFPUC.

San Joaquin County has developed the *San Joaquin County Multi-Species Habitat Conservation Plan*. The purpose of the plan is to provide a strategy to balance for the long-term management of plant, fish, and wildlife species, especially those that are state or federally listed, and the need to accommodate for controlled development.

The USFWS has developed the *Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California* (2002). Species covered under this recovery plan include the Alameda whipsnake and Berkeley kangaroo rat.

The *Recovery Plan for Upland Species of the San Joaquin Valley* would be relevant to this corridor. The palmate-bracted bird's-beak is listed under this management plan.

The *Valley Elderberry Longhorn Beetle Recovery Plan and Conservation Guidelines for Valley Elderberry Longhorn Beetle* would be relevant to this alignment.

San Francisco Bay Crossings

Existing Conditions

The San Francisco Bay Crossings include the San Francisco Bay Area from San Francisco east to Oakland and the San Francisco Bay Area from North Fair Oaks (San Mateo County) east to Union City. The major geophysical feature traversed is the San Francisco Bay and the major watershed is the San Francisco Bay watershed. Elevation ranges from sea level to 50 ft (15 m)

Vegetation Communities

Vegetation communities related to the Bay crossings include seasonal wetland, agriculture, open water, urban/developed, saline-brackish permanent wetland, nonnative grasslands, shrubland, oak woodland/foothill pine, Montane hardwood forest, salt pond, managed Bay marsh, and unvegetated flats.

Water Resources

Following the Cowardin classification system, the water resources that could occur along the San Francisco Bay Crossing corridor include estuarine and palustrine systems. Vernal pools may be present, especially on Clear Lake soils fringing San Francisco Bay.

Special-Status Species

Special-Status Plants

A number of special-status plant species could occur in the area of the San Francisco Bay Crossings. These include the San Mateo thorn-mint, Franciscan onion, bent-flowered fiddleneck, coastal marsh milk-vetch, alkali milk-vetch, brittlescale, San Joaquin spearscale, big-scale balsamroot, Congdon's tarplant, Presidio clarkia, San Francisco collinsia, Point Reyes bird's-beak, Hoover's button-celery, San Francisco gumplant, Marin western flax, Contra Costa goldfields, Crystal Springs lessingia, Prostrate navarretia, white-rayed pentachaeta, Adobe sanicle, California seablite, saline clover, and San Francisco owl's-clover.

Special-Status Wildlife

A number of special-status wildlife species could occur in the area of the San Francisco Bay Crossings. These include northwestern pond turtle; nesting habitat for Alameda song sparrow, brown pelican, California black rail, California clapper rail, California least tern, Cooper's hawk, double-crested cormorant, long-eared owl, loggerhead shrike, northern harrier, saltmarsh common yellowthroat, short-eared owl, western burrowing owl, white-tailed kite, and yellow warbler; and salt marsh harvest mouse, salt marsh wandering shrew, San Francisco dusky-footed woodrat, and several bat species.

Special Management Areas

The South Bay Salt Pond Restoration Project is a 25-sq-mi (65-sq-km) project to restore the wetlands from the San Mateo Bridge to the southern edge of the Bay. The California Coastal Conservancy, USFWS, and CDFG initiated this project in 2003. The EBRPD encompasses 98,000 ac (39,659 ha) of mostly undeveloped, natural, open space parklands in Alameda and Contra Costa Counties. EBRPD lands include grassland, shrubland, woodland, forest, lake, shoreline, riparian, and wetland environments, which provide habitat for plants and wildlife.

The Don Edwards San Francisco Bay National Wildlife Refuge is located on the southern reaches of the San Francisco Bay. The refuge is 30,000 ac (12,140 ha) of open bay, salt marsh, mud flats, vernal pools, and upland habitats.

Wildlife Movement Corridors

The San Francisco Bay Area provides a migration corridor for a many species of birds and aquatic species, such as Pacific herring, steelhead, Coho salmon, and Chinook salmon.

Management Plans

The restoration plan for the Cargill salt properties would be relevant to the crossings. Also, the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (1998) would be relevant to this corridor. The Presidio clarkia, fountain thistle, San Mateo woolly sunflower, and white-rayed pentachaeta are listed under this management plan.

Central Valley Corridor

The Central Valley corridor includes the Central Valley from Chowchilla (Madera County) and Merced (Merced County) north through Modesto (Stanislaus County) to Stockton (San Joaquin County). The major geophysical feature traversed by this corridor is the Central Valley. The major watershed traversed by this corridor is the San Joaquin River watershed. Elevation range for the Central Valley alternative ranges from 30 ft (9 m) to 250 ft to (76 m).

Vegetation Communities

Vegetation communities in this corridor include seasonal wetland, agriculture, open water, urban/developed, riparian habitat, grasslands, shrubland, oak woodland/foothill pine, Montane hardwood forest, Valley oak woodland, and permanent freshwater wetland.

Water Resources

Following the Cowardin classification system, the water resources that could occur along the Central Valley corridor include lacustrine, palustrine, and riverine systems. Vernal pools may be present, especially on Central Valley terrace deposits.

Special-Status Species

Special-Status Plants

A number of special-status plant species could occur in the Central Valley corridor. These include the alkali milk-vetch, heartscale, brittlescale, San Joaquin spearscale, lesser saltscale, vernal pool smallscale, subtle orache, *big tarplant*, Hoover's spurge, hispid bird's-beak, palmate-bracted bird's beak, Hoover's cryptantha, recurved larkspur, dwarf downingia, four-angled spikerush, round-leaved filaree, Delta button-celery, Boggs Lake hedge-hyssop, legenere, shining navarretia, prostrate navarretia, Colusa grass, San Joaquin Valley orcutt grass, hairy orcutt grass, and caper-fruited tropidicarpum.

Special-Status Wildlife

A number of special-status wildlife species could occur in the Central Valley corridor. These include the conservancy fairy shrimp, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, giant garter snake, southwestern pond turtle; nesting habitat for California horned lark, Cooper's hawk, loggerhead shrike, northern harrier, short-eared owl, Swainson's hawk, tricolored blackbird, western burrowing owl, and white-tailed kite; and American badger, riparian brush rabbit, riparian woodrat, San Joaquin kit fox, and several bat species.

Wildlife Movement Corridors

The San Joaquin River and its tributaries provide wildlife movement corridors in the Central Valley. The natural and agricultural areas along the eastern side of the Central Valley provide a movement corridor. The USFWS has identified areas where linkage corridors should be established through the acquisition and management of conservation easements, incentive programs to preserve suitable habitat, zoning, acquisition, and other mechanisms to prevent isolation of natural habitats (U.S. Fish and Wildlife Service 1998). These linkage corridors would connect the remaining habitat on the valley floor with habitat in the foothills surrounding the San Joaquin Valley. One such identified linkage corridor is in the vicinity of Sandy Mush Road in Merced County. This linkage corridor would connect the national wildlife refuges and state wildlife areas located in the GSA in Merced County with the northeastern edges of the San Joaquin Valley and with natural areas farther south in Madera and Fresno Counties. In conjunction with the linkage corridor, the USFWS has identified the natural lands and compatible farmlands in eastern Merced County as areas that should be maintained and preserved for San Joaquin kit fox dispersal habitat. These areas encompass a variety of habitats, including grasslands, vernal pool systems, wetlands, oak woodlands, and farmlands.

Management Plans

The *Recovery Plan for Upland Species of the San Joaquin Valley* would be relevant to this corridor. The California jewelflower and palmate-bracted bird's beak are included in this management plan.

The *Recovery Plan for Vernal Pool Ecosystems in California* (2005) would be relevant to this corridor. Hairy orcutt grass, Hoover's spurge, San Joaquin Valley orcutt grass, succulent owl's-clover, and Colusa grass have been included in this management plan.

The *San Joaquin County Multi-Species Habitat Conservation Plan* and the *Valley Elderberry Longhorn Beetle Recovery Plan and Conservation Guidelines for Valley Elderberry Longhorn Beetle* would be relevant to this corridor.

The University of California, Merced, is in the process of developing a management plan to conserve habitat for special-status plant and animal species, while allowing for the development of the university and supporting community. Covered species include succulent owl's clover, Hoover's spurge, Colusa grass, San Joaquin orcutt grass, hairy orcutt grass, Hartweg's golden sunburst, green tuctoria, conservancy fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, midvalley fairy shrimp, California tiger salamander, and San Joaquin kit fox.

3.15.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

The No Project Alternative assumes that, in addition to existing conditions, additional transportation improvements would be developed. The transportation improvements include projects that are programmed or funded to 2030 (as described in Chapter 2).

It was not possible as part of this study to identify or quantify the impacts on biological resources that would occur as a result of the transportation improvements in the No Project Alternative. For existing transportation facilities to be improved, impacts on biological resources have previously been addressed, and only small additional or increased impacts are expected from the future transportation improvement included in the No Project Alternative. In some cases, widening of existing corridors or similar improvements could result in additional impacts on biological resources.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

The proposed HST system would generally be located in or adjacent to existing transportation rights-of-way, such as highways or railroads, or would be in tunnels or elevated through mountain passes and sensitive habitat areas. HST Alignment Alternatives would include tunnels, which could avoid or substantially reduce surface impacts on sensitive biological resources, except at tunnel portal areas. Bridges across water bodies would use materials and designs to minimize the number of piles/columns in the water.

The potential impacts on biological resources and water resources/wetlands that could result from the HST Alignment Alternatives and station location options are summarized in Table 3.15-1. For more detail related to impacts of each alignment alternative segment see Appendix 3.15.

As discussed earlier, all comparisons are based on information available from existing databases. Field surveys, which would be performed during a subsequent environmental review, would provide more detailed information and could indicate an increase or a decrease in the potential impacts on biological resources from a proposed HST system, particularly along alignment alternatives that have not previously been the focus of field surveys or mapping by any of the regulatory agencies (such as CDFG or USFWS).

The discussion of impacts for the alignment alternatives is structured in the following manner: (1) impacts on sensitive vegetation communities/habitats; (2) impacts on special-status species, including marine/anadromous species; (3) impacts on wildlife movement corridors; (3) impacts on wetlands and non-wetland waters; and (4) conflicts with conservation plans or special management plans.

Figure 3.15-1 illustrates the potential locations of special-status species in relation to the HST Alignment Alternatives. Sensitive vegetation communities and those species that are federally or state listed as threatened or endangered would be of special concern because of the protection afforded them under the ESA and CESA. Additionally, species with limited habitats or ranges, such as aquatic species and butterfly species, would also be of special concern because of the adverse effects that even small impacts on their habitat could cause. Several special-status species, including the California red-legged frog and San Joaquin kit fox, would also be affected. Sensitive vegetation communities include seasonal and permanent freshwater wetlands, saline-brackish permanent wetlands, permanent freshwater marsh, riparian, Bay waters, eelgrass habitat, and oak woodlands.

Figure 3.15-2 illustrates the potential locations of non–jurisdictional waters and wetlands in relation to the HST Alignment Alternatives. The alignment alternatives would likely impact wetlands and waters at a level that would require an Individual Permit and Section 404(b)(1) Analysis of Alternatives, which would be addressed in a subsequent environmental review.

The HST Alignment Alternatives would have potential to affect wildlife movement/migration corridors throughout the study area. Figure 3.15-3 illustrates the known wildlife movement corridors throughout the study region and general areas where the movement corridors cross proposed HST alignment alternatives.

There are several HCPs and special management areas that would be affected by the HST Alignment Alternatives, including the Don Edwards National Wildlife Refuge along San Francisco Bay.

During construction, earthwork for the HST Alignment Alternatives would involve excavations and fill construction, producing potential erosion and sedimentation problems if not properly designed, constructed, and maintained. Stockpiles of excavated materials and imported fill, if properly managed, should not be sources of sedimentation. If, however, construction-related erosion and sedimentation were to occur, it could result in impacts on surface water quality and in potential impacts on biological resources. Dewatering operations for excavations could also result in discharge of sediments or pollutants to surface water bodies, thereby degrading water quality and affecting biological resources.

Table 3.15-1. Biological Resource Summary Data Table for Alignments and Station Location Option Comparisons

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	19	29	West side of San Francisco Bay and riparian and stream corridors	590	0.08 (0.03)	Y
	1 of 1	Dumbarton to San Jose	5	19	Riparian and stream corridors	672	-	Y
Station Location Options								
Transbay Transit Center			1	-	West side of San Francisco Bay and riparian and stream corridors	-	-	N
4th and King (Caltrain)			1	-	West side of San Francisco Bay and riparian and stream corridors	-	-	N
Millbrae/SFO			-	-	West side of San Francisco Bay and riparian and stream corridors	-	-	N
Redwood City (Caltrain)			-	-	West side of San Francisco Bay and riparian and stream corridors	-	-	N
Palo Alto (Caltrain)			-	1	Riparian and stream corridors	-	-	N

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	5	23	East side of San Francisco Bay and riparian and stream corridors	455	0.11 (0.04)	Y
		12th Street/City Center to Niles Junction	6	23	East side of San Francisco Bay and riparian and stream corridors	455	0.11 (0.04)	Y
	1 of 2	Niles Junction to San Jose via Trimble	6	25	East side of San Francisco Bay and riparian and stream corridors	958	1.27 (0.51)	Y
		Niles Junction to San Jose via I-880	5	25	East side of San Francisco Bay and riparian and stream corridors	1,080	1.80 (0.73)	Y
Station Location Options								
West Oakland/7th Street			-	-	East side of San Francisco Bay and riparian and stream corridors	-	-	N
12th Street/City Center			-	-	East side of San Francisco Bay and riparian and stream corridors	-	-	N
Coliseum/Airport			-	-	East side of San Francisco Bay and riparian and stream corridors	482	0.64 (0.26)	Y
Union City (BART)			-	-	East side of San Francisco Bay and riparian and stream corridors	-	-	N

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
Fremont (Warm Springs)			-	-	East side of San Francisco Bay and riparian and stream corridors	-	-	N
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	23	27	Between Santa Clara Valley and San Joaquin Valley	1,960	0.11 (0.4)	Y
	1 of 3	Henry Miller (UPRR Connection)	25	34	Along west side of San Joaquin Valley and San Joaquin River	10,588	11.61 (4.7)	N
		Henry Miller (BNSF Connection)	25	34	Along west side of San Joaquin Valley and San Joaquin River	10,312	11.48 (4.65)	N
		GEA North	22	34	Along west side of San Joaquin Valley and San Joaquin River	6,771	17.96 (7.27)	Y
Station Location Options								
San Jose (Diridon)			1	1	Between Santa Clara Valley and San Joaquin Valley	-	-	N
Morgan Hill (Caltrain)			-	-	Between Santa Clara Valley and San Joaquin Valley	-	-	N
Gilroy (Caltrain)			1	-	Between Santa Clara Valley and San Joaquin Valley	-	-	N

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	24	29	Along west side of San Joaquin Valley; riparian and stream corridors	2,380	0.66 (0.27)	Y
		I-580/ UPRR	24	29	Along west side of San Joaquin Valley; riparian and stream corridors	2,612	5.17 (2.1)	Y
		Patterson Pass/UPRR	20	28	Along west side of San Joaquin Valley; riparian and stream corridors	1,371	2.59 (1)	Y
		UPRR	20	28	Along west side of San Joaquin Valley; riparian and stream corridors	1,152	3.22 (1.3)	Y
	1 of 4	Tracy Downtown (BNSF Connection)	18	27	Along west side of San Joaquin Valley; riparian and stream corridors	6,291	4.36 (1.76)	Y
		Tracy ACE Station (BNSF Connection)	21	27	Along west side of San Joaquin Valley; riparian and stream corridors	7,678	3.63 (1.47)	Y
		Tracy ACE Station (UPRR Connection)	20	27	Along west side of San Joaquin Valley; riparian and stream corridors	5,326	2.60 (1)	Y
		Tracy Downtown (UPRR Connection)	22	27	Along west side of San Joaquin Valley; riparian and stream corridors	7,504	4.16 (1.68)	Y
	2 of 2	East Bay Connections	-	-	East side of San Francisco Bay and riparian and stream corridors	376	1.22 (0.49)	Y

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
Station Location Options								
Pleasanton (I-680/Bernal Rd)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	-	N
Pleasanton (BART)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	338	-	N
Livermore (Downtown)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	-	N
Livermore (I-580)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	1.02 (0.41)	N
Livermore (Greenville Road/UPRR)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	-	N
Livermore (Greenville Road/I-580)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	72	1.07 (0.43)	N
Tracy (Downtown)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	-	N
Tracy (ACE)			-	-	Along west side of San Joaquin Valley; riparian and stream corridors	-	0.08 (0.03)	N

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	1	-	West side of San Francisco Bay and riparian and stream corridors	-	22.83 (9.24)	Y
		Trans Bay Crossing – 4th & King	1	-	West side of San Francisco Bay and riparian and stream corridors	-	22.04 (8.92)	Y
	1 of 6	Dumbarton (High Bridge)	15	21	East and west shores of San Francisco Bay	2,361	33.9 (13.7)	Y
		Dumbarton (Low Bridge)	15	21	East and west shores of San Francisco Bay	2,361	33.9 (13.7)	Y
		Dumbarton (Tube)	15	21	East and west shores of San Francisco Bay	2,361	33.9 (13.7)	Y
		Fremont Central Park (High Bridge)	16	23	East and west shores of San Francisco Bay	3,117	55.35 (22.4)	Y
		Fremont Central Park (Low Bridge)	16	23	East and west shores of San Francisco Bay	3,117	55.35 (22.4)	Y
		Fremont Central Park (Tube)	16	23	East and west shores of San Francisco Bay	3,117	55.35 (22.4)	Y

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
Station Location Options								
Union City (Shinn)			-	-	East and west shores of San Francisco Bay	-	-	N
Central Valley	1 of 6	BNSF – UPRR	22	22	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	10,137	3.76 (1.52)	Y
		BNSF	22	22	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	10,528	3.41 (1.38)	Y
		UPRR N/S	22	21	None	7,161	3.04 (1.23)	Y
		BNSF Castle	19	22	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	9,094	3.11 (1.26)	Y
		UPRR – BNSF Castle	22	22	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	7,790	2.39 (0.97)	Y
		UPRR – BNSF	25	22	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	8,833	3.04 (1.23)	Y

Corridor	Possible Alignments	Alignment Alternative	Number of Special-Status Plant Species	Number of Special-Status Wildlife Species	Wildlife Movement Corridor	Non-Wetland Waters in Linear Feet	Wetlands in Acres (Hectares)	Marine/ Anadromous Fish Resources
Station Location Options								
Modesto (Downtown)			-	1	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	-	-	N
Briggsmore (Amtrak)			-	-	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	-	-	N
Merced (Downtown)			-	1	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	-	-	N
Castle AFB			-	-	East-west linkage corridor between valley floor natural lands and natural lands along east side of San Joaquin valley	315	-	N

San Francisco to San Jose Corridor

San Francisco to Dumbarton Alignment Alternative

The San Francisco to Dumbarton alignment alternative could have direct impacts on 1.97 ac (0.8 ha) of grasslands, 6.17 ac (2.5 ha) of open waters, 0.84 ac (0.34 ha) of saline-brackish permanent wetlands, 5.01 ac (2.03 ha) of seasonal wetlands, 0.41 ac (0.17 ha) of unvegetated flats, and 125.27 ac (50.7 ha) of urban/other developed areas. This alignment could have indirect impacts on 18.78 ac (7.6 ha) of bay waters, 49.60 ac (20.07 ha) of grasslands, 120.21 ac (48.65 ha) of open waters, 15.05 ac (6.09 ha) of saline-brackish permanent wetlands, 137.95 ac (55.83 ha) of seasonal wetlands, 11.78 ac (4.77 ha) of shrub lands, 14.52 ac (5.88 ha) of unvegetated flats, and 5,813.07 ac (2,352.48 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment are seasonal and permanent freshwater wetlands.

Special-Status Plants

The San Francisco to Dumbarton alignment alternative could adversely affect the habitat of 19 special-status plant species (Table 3.15-1). Those species that are federally or state listed as threatened or endangered would be of special concern because of the protection afforded them under the ESA and CESA.

Special-Status Wildlife

The San Francisco to Dumbarton alignment alternative could adversely affect the habitat of 29 special-status wildlife species, including several species of butterflies, amphibians, reptiles, shorebirds, and small mammals (Table 3.15-1). This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors

Most of the region is urbanized, and there are limited data available on wildlife movement/migration corridors in this area. All of the riparian and stream corridors between the Santa Cruz Mountains and the San Francisco Bay provide corridors for wildlife movement. There could be impacts on these streams and riparian corridors. The western shore of the San Francisco Bay provides a critical movement corridor for nesting and foraging birds and other wildlife. The Wilderness Coalition has identified this as a critical linkage corridor (2000) (Figure 3.15-3). Impacts on the western side of the San Francisco Bay are expected to be minimal.

Water Resources/Wetlands

The San Francisco to Dumbarton alignment alternative has the potential to impact approximately 590 ft (180 m) of potential non-wetland waters and approximately 0.08 ac (0.03 ha) of wetlands. This alignment is in proximity to the western shore of the San Francisco Bay and crosses several water resources, including Oyster Point Channel, San Mateo Creek, and other small streams.

Conservation Plans

The San Francisco to Dumbarton alignment alternative could adversely impact the South San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002). In addition, this alignment alternative could adversely affect designated critical habitat for the Bay checkerspot butterfly.

Dumbarton to San Jose Alignment Alternative

The Dumbarton to San Jose alignment alternative could have direct impacts on 1.08 ac (0.44 ha) of grasslands, 0.05 ac (0.02 ha) of open waters, 0.10 ac (0.04 ha) of shrub lands, and 108.56 ac (43.93 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 22.55 ac (9.13 ha) of grasslands, 1.66 ac (0.67 ha) of open waters, 7.28 ac (2.95 ha) of shrub lands, and 4,808.38 ac (1,945.89 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment are seasonal and permanent freshwater wetlands.

Special-Status Plants

The Dumbarton to San Jose Alignment could adversely affect the habitat of five special-status plant species (Table 3.15-1). These species would also be affected by the San Francisco to Dumbarton alignment alternative.

Special-Status Wildlife

The Dumbarton to San Jose alignment alternative could adversely affect the habitat of 19 special-status wildlife species, including species of amphibians, reptiles, birds, and small mammals (Table 3.15-1). This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors

Impacts on wildlife movement corridors for this alignment would be the same as the San Francisco to Dumbarton alignment alternative.

Water Resources/Wetlands

This alignment has the potential to impact approximately 672 ft (205 m) of potential non-wetland waters. This alignment alternative is also in proximity to the western shore of the San Francisco Bay and crosses San Francisquito/Los Trancos Creek, Matadero Creek, Adobe Creek, and other small streams.

Conservation Plans

Similar to the San Francisco to Dumbarton alignment alternative, this alignment alternative could adversely impact the South San Francisco Bay Core Area identified in the *Recovery Plan for the for California Red-legged Frog* (U.S. Fish and Wildlife Service 2002).

San Francisco to San Jose Corridor Stations

- Transbay Transit Center: This station could have direct impacts on 5.8 ac (2.35 ha) of urban/other developed lands. This station could have indirect impacts on 0.01 ac (0.004 ha) of Bay waters and 140 ac (56.66 ha) of urban/other developed lands. This station could adversely affect the habitat of one special-status plant species. Impacts on special-status wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location.
- 4th and King (Caltrain) Station: This station could have direct impacts on 32.8 ac (13.27 ha) of urban/other developed lands. This station could have indirect impacts on 2 ac (0.8 ha) of open water and 256 ac (103.6 ha) of urban/other developed lands. This station could adversely affect the habitat of one special-status plant species. Impacts on special-status wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location.
- Mlilbrae/SFO Station: This station could have direct impacts on 7.1 ac (2.87 ha) of urban/other developed lands. This station could have indirect impacts on 0.5 ac (0.2 ha) of grasslands, 26 ac (10.5 ha) of seasonal wetlands, and 122 ac (49.37 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated at this station location.
- Redwood City (Caltrain) Station: This station could have direct impacts on 3.2 ac (1.3 ha) of urban/other developed lands. This station could have indirect impacts on 0.2 ac (0.08 ha) of grasslands, 130 ac (52.6 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated at this station location.
- Palo Alto (Caltrain) Station: This station could have direct impacts on 14.2 ac (5.75 ha) of urban/other developed lands. This station could have indirect impacts on 0.8 ac (0.3 ha) of

grasslands and 204 ac (82.56 ha) of urban/other developed lands. This station could adversely affect the habitat of one special-status wildlife species. Impacts on special-status plant species, waters, wetlands, and marine/anadromous species are not anticipated with this station location.

Summary of San Francisco to San Jose Corridor Impacts

Sensitive Vegetation Communities

The sensitive vegetation communities in this corridor are seasonal and permanent freshwater wetlands.

Special-Status Plants

Both the alignment alternatives in the San Francisco to San Jose corridor could adversely affect the habitat of 19 special-status plant species.

Special-Status Wildlife

The San Francisco to Dumbarton alignment alternative could adversely affect habitat for the Bay checkerspot butterfly, callippe silverspot, mission blue butterfly, and San Bruno elfin butterfly; nesting habitat for brown pelican, black rail, California clapper rail, California least tern, double-crested cormorant, and salt marsh common yellowthroat; and salt marsh harvest mouse and salt marsh wandering shrew.

The Dumbarton to San Jose alignment alternative could adversely affect habitat for California tiger salamander.

Wildlife Movement Corridors

Both alignment alternatives would have minimal impact on wildlife movement corridors along the western shore of the San Francisco Bay.

Water Resources/Wetlands

This corridor has the potential to directly impact approximately 1,260 ft (384 m) of potential non-wetland waters and approximately 0.08 ac (0.03 ha) of wetlands.

Conservation Plans

Only the San Francisco to Dumbarton alignment alternative would have the potential to adversely affect designated critical habitat for the Bay checkerspot butterfly in the San Francisco to San Jose corridor. Both alignment alternatives could adversely impact the South San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002).

Oakland to San Jose Corridor

West Oakland to Niles Junction Alignment Alternative

The West Oakland to Niles Junction alignment alternative could have direct impacts on 0.47 ac (0.19 ha) of grasslands and 62.13 ac (25.14 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 123.40 ac (49.94 ha) of grasslands, 2.00 ac (0.81 ha) of open waters, 0.15 ac (0.06 ha) of shrub lands, 6.74 ac (2.73 ha) of unvegetated flats, and 2,913.18 ac (1,178.93 ha) of urban/other developed lands.

Sensitive Vegetation Communities

There are no sensitive vegetation communities in this alignment alternative.

Special-Status Plants

The West Oakland to Niles Junction alignment alternative could adversely affect the habitat of five special-status plant species (Table 3.15-1).

Special-Status Wildlife

The West Oakland to Niles Junction alignment alternative could adversely affect the habitat of 23 special-status wildlife species, including species of amphibians, reptiles, shorebirds, and small mammals (Table 3.15-1).

Wildlife Movement Corridors

All the riparian and stream corridors crossed by this alignment alternative provide corridors for wildlife movement between the Diablo Range and the San Francisco Bay. There could be impacts on these streams and riparian corridors. The Wilderness Coalition (2000) identified critical linkage corridors along the eastern shore of San Francisco Bay, as well as a corridor linking the San Francisco Bay to the Diablo Range (Figure 3.15-3). This alignment alternative is expected to have minimal impacts on the eastern shore of San Francisco Bay. This alignment alternative could have minor impacts on the corridor linking the San Francisco Bay to the Diablo Range. This alignment alternative also has the potential to impact marine/anadromous species.

Water Resources/Wetlands

This alignment alternative has the potential to directly impact approximately 455 ft (139 m) of potential non-wetland waters and approximately 0.11 ac (0.04 ha) of wetlands. This alignment is in proximity to the eastern shore of the San Francisco Bay and crosses or is adjacent to a number of water resources, including a tributary to Lake Merritt, San Leandro Creek, and several other small streams.

Conservation Plans

This alignment alternative would not affect habitats or species in any conservation plan.

12th Street/City Center to Niles Junction Alignment Alternative

The 12th Street/City Center to Niles Junction alignment alternative could have direct impacts on 0.47 ac (0.19 ha) of grasslands and 59.27 ac (23.99 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 123.10 ac (49.82 ha) of grasslands, 1.66 ac (0.67 ha) of open waters, 0.15 ac (0.06 ha) of shrub lands, 6.74 ac (2.73 ha) of unvegetated flats, and 2,658.42 ac (1,075.83 ha) of urban/other developed lands.

Sensitive Vegetation Communities

There are no sensitive vegetation communities in this alignment alternative.

Special-Status Plants

The 12th Street/City Center to Niles Junction alignment alternative could adversely affect the habitat of six special-status plant species (Table 3.15-1). Five of the species are the same as in the West Oakland to Niles Junction alignment alternative.

Special-Status Wildlife

The 12th Street/City Center to Niles Junction alignment alternative could adversely affect the habitat of the same 23 special-status wildlife species that the West Oakland to Niles Junction alignment alternative could affect. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors

Impacts on wildlife movement corridors from this alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative.

Water Resources/Wetlands

This alignment alternative would have the same potential impacts on non-wetland waters and wetlands.

Conservation Plans
This alignment would not affect habitats or species in any conservation plan.

Niles Junction to San Jose via Trimble Alignment Alternative
The Niles Junction to San Jose via Trimble alignment alternative could have direct impacts on 7.34 ac (2.97 ha) of grasslands, 0.71 ac (0.29 ha) of open water, 0.04 ac (0.01 ha) of riparian habitat, 2.28 ac (0.92 ha) of seasonal wetlands, and 79.46 ac (32.16 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 51.01 ac (20.64 ha) of agricultural lands, 380.72 ac (154.07 ha) of grasslands, 0.39 ac (0.16 ha) of managed bay lands, 30.12 ac (12.19 ha) of open waters, 0.37 ac (0.15 ha) of riparian habitat, 0.48 ac (0.19 ha) of saline-brackish permanent wetland, 96.71 ac (39.14 ha) of seasonal wetlands, 0.22 ac (0.09 ha) of shrub land, and 3,548.55 ac (1,436.46 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities in this alignment alternative are the riparian, seasonal wetlands, and saline-brackish permanent wetlands.

Special-Status Plants
The Niles Junction to San Jose via Trimble alignment alternative could adversely affect the habitat of six special-status plant species (Table 3.15-1).

Special-Status Wildlife
The Niles Junction to San Jose via Trimble alignment alternative could adversely affect the habitat of 25 special-status wildlife species, including species of aquatic invertebrates, amphibians, reptiles, shorebirds, and small mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates species, would be of special concern because of the adverse effects that even small impacts on their habitat could cause. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 958 ft (292 m) of potential non-wetland waters and approximately 1.3 ac (0.53 ha) of wetlands. This alignment alternative crosses or is adjacent to a number of water resources, including Lake Elizabeth, Coyote Creek, Guadalupe River, and several other small streams.

Conservation Plans
The Niles Junction to San Jose via Trimble alignment alternative could negatively impact the Southeast San Francisco Bay core area identified in the *Recovery Plan for Vernal Pool Ecosystems* (U.S. Fish and Wildlife Service 2005).

Special Management Areas
The Niles Junction to San Jose via Trimble alignment alternative could have negative impacts on the Don Edwards San Francisco Bay National Wildlife Refuge.

Niles Junction to San Jose via I-880 Alignment Alternative
The Niles Junction to San Jose via I-880 alignment alternative could have direct impacts on 8.09 ac (3.27 ha) of grasslands, 0.71 ac (0.29 ha) of open water, 0.04 ac (0.01 ha) of riparian habitat, 2.28 ac (0.92 ha) of seasonal wetlands, and 69.19 ac (28 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 51.01 ac (20.64 ha) of agricultural lands, 424.88 ac (171.94 ha) of grasslands, 0.39 ac (0.16 ha) of managed bay lands, 30.12 ac (12.19 ha) of open

waters, 0.37 ac (0.15 ha) of riparian habitat, 0.48 ac (0.19 ha) of saline-brackish permanent wetland, 96.71 ac (39.14 ha) of seasonal wetlands, 0.22 ac (0.09 ha) of shrub land, and 4,289.25 ac (1,753.81 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment alternative are the riparian, seasonal wetlands, and saline-brackish permanent wetlands.

Special-Status Plants

The Niles Junction to San Jose via I-880 alignment alternative could adversely affect the habitat of five special-status plant species (Table 3.15-1). These species are the same as those identified in the Niles Junction to San Jose via Trimble alignment alternative.

Special-Status Wildlife

The Niles Junction to San Jose via I-880 alignment alternative could adversely affect the habitat of the same 25 special-status wildlife species as the Niles Junction via Trimble alignment alternative. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors

Impacts on wildlife movement corridors from this alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative.

Water Resources/Wetlands

This alignment alternative has the potential to directly impact approximately 1,080 ft (329 m) of potential non-wetland waters and approximately 1.8 ac (0.73 ha) of wetlands. Similar to the Niles Junction to San Jose via Trimble alignment alternative, this alignment alternative crosses or is adjacent to several water resources, including Lake Elizabeth, Coyote Creek, Guadalupe River, and a number of other small streams.

Conservation Plans

Impacts on habitats and species identified in conservation plans from this alignment alternative would be the same as for the Niles Junction to San Jose via Trimble alignment alternative.

Special Management Areas

Impacts on special management areas from this alignment alternative would be the same as for the Niles Junction to San Jose via Trimble alignment alternative.

Oakland to San Jose Corridor Stations

- West Oakland/7th Street Station: This station location option could have direct impacts on 2.6 ac (1.05 ha) of urban/other developed lands. This station location option could have indirect impacts on 0.3 ac (0.12 ha) of grasslands and 121 ac (48.97 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated at this station location.
- 12th Street/City Center Station: This station location option could have direct impacts on 9.9 ac (4 ha) of urban/other developed lands. This station location option could have indirect impacts on 0.2 ac (0.08 ha) of grasslands, 0.6 ac (0.24 ha) of open waters, and 126 ac (51 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated at this station location option.
- Coliseum/Airport Station: This station location option could have direct impacts on 10.5 ac (4.25 ha) of urban/other developed lands. This station location option could have indirect impacts on 0.2 ac (0.08 ha) of grasslands, 6.5 ac (2.63 ha) of unvegetated flats, and 162 ac (65.56 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species

are not anticipated at this station location. This station could impact 482 linear ft (147 m) of waters and 0.6 ac (0.24 ha) of wetlands and potentially impact marine/anadromous species.

- Union City (BART) Station: This station location option could have direct impacts on 1.1 ac (0.45 ha) of grasslands and 47 ac (19 ha) of urban/other developed lands. This station location option could have indirect impacts on 6.6 ac (2.67 ha) of grasslands, 0.05 ac (0.02 ha) of open waters, and 251 ac (101.58 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated at this station location option.
- Union City (Shinn) Station: This station location option could have direct impacts on 0.4 ac (0.16 ha) of grasslands and 12 ac (4.86 ha) of urban/other developed lands. This station location option could have indirect impacts on 7.2 ac (2.91 ha) of grasslands, 15 ac (6.07 ha) of open water, and 152 ac (61.51 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated at this station location.
- Freemont (Warm Springs) Station: This station location option could have direct impacts on 20 ac (8.09 ha) of grasslands and 51 ac (20.64 ha) of urban/other developed lands. This station location option could have indirect impacts on 71 ac (28.73 ha) of grasslands, 4 ac (1.62 ha) of open water, and 266 ac (107.65 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated at this station location.

Summary of Oakland to San Jose Corridor Impacts

Sensitive Vegetation Communities

The sensitive vegetation communities in this corridor were identified in the Niles Junction to San Jose via I-880 and San Jose via Trimble alignment alternatives and were riparian, seasonal wetlands, and saline-brackish permanent wetlands.

Special-Status Plants

All of the special-status plant species that have the potential to be affected in the West Oakland to Niles Junction alignment alternative would also be affected in the 12th Street/City Center to Niles Junction alignment alternative. The same is true for the Niles Junction to San Jose via I-880 alignment alternative, as compared to the San Jose via Trimble alignment alternative. Both the 12th Street/City Center to Niles Junction and San Jose via Trimble alignment alternatives include one additional species.

Special-Status Wildlife

The special-status wildlife species that have the potential to be affected by the West Oakland to Niles Junction and the 12th Street/City Center to Niles Junction alignment alternatives are the same. The special-status wildlife that have the potential to affected by the Niles Junction to San Jose via I-880 and the Niles Junction to San Jose via Trimble alignment alternatives are the same.

Wildlife Movement Corridors

Both the West Oakland to Niles Junction and the 12th Street/City Center to Niles Junction alignment alternatives would have minimal impact on the east shore of San Francisco Bay. These alignment alternatives could impact the streams and riparian corridors linking the Bay to the Diablo Range. Both the Niles Junction to San Jose via I-880 and the Niles Junction to San Jose via Trimble alignment alternatives could impact the wildlife movement corridor along the eastern shore of San Francisco Bay. These alignment alternatives could also have impacts on the streams and riparian corridors linking the Bay to the Diablo Range.

Water Resources/Wetlands
This potential nonwetland jurisdictional waters and wetlands that could be affected by either the West Oakland to Niles Junction or 12th Street/City Center to Niles Junction alignment alternatives would be similar. The Niles Junction to San Jose via I-880 alignment alternative would have slightly greater impacts on waters and wetlands compared to the Niles Junction to San Jose via Trimble alignment alternative.

Conservation Plans
Both the Niles Junction to San Jose via I-880 alignment alternative and the Niles Junction to San Jose via Trimble alignment alternative could negatively impact the Southeast San Francisco Bay core area identified in the *Recovery Plan for Vernal Pool Ecosystems* (U.S. Fish and Wildlife Service 2005).

Special Management Areas
Both the Niles Junction to San Jose via I-880 and the Niles Junction to San Jose via Trimble alignment alternatives could negatively impact the Don Edwards San Francisco Bay National Wildlife Refuge.

San Jose to Central Valley Corridor

Pacheco Alignment Alternative
The Pacheco alignment alternative could have direct impacts on 85.45 ac (34.58 ha) of agricultural lands, 64.04 ac (25.92 ha) of grasslands, 11.55 ac (4.67 ha) of oak woodland/foothill pine, 4.06 ac (1.64 ha) of shrub lands, and 123.91 ac (50.14 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 4,716.43 ac (1,908.68 ha) of agricultural lands, 3,968.53 ac (1,606.01 ha) of grasslands, 925.92 ac (374.71 ha) of oak and foothill pine woodlands, 32.98 ac (13.35 ha) of open waters, 243.11 ac (98.38 ha) of shrub lands, and 4,689.15 ac (1,897.64 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community in this alignment alternative is oak woodlands.

Special-Status Plants
The Pacheco alignment alternative could adversely affect the habitat of 23 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The Pacheco alignment alternative could adversely affect the habitat of 27 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors, and mammals (Table 3.15-1). This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The streams, and associated riparian habitats, flowing from the Diablo Range and the Santa Cruz Mountains that would be crossed by the Pacheco alignment alternative provide movement corridors for fish and wildlife species. The alignment alternative would bisect movement corridors through the Diablo Range. Because the alignment alternative would be elevated over drainages, it is not anticipated to impact the major drainages, such as Coyote Creek, the Pajaro River, Tres Pinos Creek, the Pacheco Creek, and other drainages, which provide wildlife movement corridors.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 1,960 ft (597 m) of potential nonwetland jurisdictional waters and approximately 0.11 ac (0.04 ha) of wetlands. The Pacheco alignment alternative crosses or is adjacent to a number of water resources, including Coyote Creek, Los Gatos Creek, Miller Slough, and the Pajaro River, and a number of other small streams.

Conservation Plans
The Pacheco alignment alternative could adversely impact designated critical habitat for the Bay checkerspot butterfly and the California tiger salamander. This alignment alternative could also adversely impact the South San Francisco Bay Core Area identified in the *Recovery Plan for the for California Red-Legged Frog* (U.S. Fish and Wildlife Service 2002).

Special Management Areas
The Pacheco alignment alternative would not traverse through the Henry Coe State Park, located northeast of Gilroy, or the Pacheco State Park near San Luis Reservoir, and there are no anticipated impacts on these state parks as a result of this alignment alternative. This alignment alternative would traverse lands that have been protected by the Nature Conservancy as part of its Mount Hamilton Project and could have adverse impacts on these protected lands. It would extend through the CDFG Upper Cottonwood Creek Wildlife Area resulting in adverse impacts where the alignment is not in tunnel. The alignment would be in tunnel approximately 1.1 miles, or about 46%, within the wildlife area as shown on Figure 3.15-4.

Henry Miller (UPRR Connection) Alignment Alternative
The Henry Miller (UPRR Connection) alignment alternative could have direct impacts on 211.90 ac (85.75 ha) of agricultural lands, 121.06 ac (49 ha) of grasslands, 6.25 ac (2.53 ha) of oak woodland/foothill pine, 2.24 ac (0.91 ha) of open waters, 1.34 ac (0.54 ha) of permanent freshwater wetlands, 0.59 ac (0.24 ha) of riparian habitat, 2.32 ac (0.94 ha) of seasonal wetlands, 0.11 ac (0.04 ha) of shrub lands, and 33.97 ac (13.75 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 11,987.68 ac (4,851.26 ha) of agricultural lands, 6,430.46 ac (2,602.33 ha) of grasslands, 0.15 ac (0.06 ha) of montane hardwood forest, 314.30 ac (127.19 ha) of oak and foothill pine woodlands, 164.36 ac (66.51 ha) of open waters, 121.78 ac (49.28 ha) of permanent freshwater wetlands, 11.03 ac (4.46 ha) of riparian habitat, 134.04 ac (54.24 ha) of seasonal wetlands, 6.96 ac (2.82 ha) of shrub lands, and 1,453.91 ac (588.39 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities within this alignment alternative are seasonal wetlands, permanent freshwater wetlands, riparian, and oak woodlands.

Special-Status Plants
The Henry Miller (UPRR Connection) alignment alternative could adversely affect the habitat of 25 special-status plant species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1).

Special-Status Wildlife
The Henry Miller (UPRR Connection) alignment alternative could adversely affect the habitat of 34 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates, and those with limited nesting ranges, such as willow flycatcher and least Bell's vireo, would be of special concern because of the adverse effects that even small impacts on their habitat could cause.

Wildlife Movement Corridors
The Henry Miller (UPRR Connection) alignment alternative would bisect the major San Joaquin kit fox movement corridor between the southern portion of its range and the northern portion of its range along the west side of the San Joaquin Valley. The Henry Miller (UPRR Connection) alignment alternative also crosses the San Joaquin River, which is a movement corridor for fish and bird species.

Water Resources/Wetlands

This alignment alternative has the potential to directly impact approximately 10,590 ft (3,228 m) of potential non-wetland waters and approximately 11.6 ac (4.69 ha) of wetlands. The Henry Miller (UPRR Connection) alignment alternative crosses the San Joaquin River, sloughs, and creeks.

Conservation Plans

Similar to the Pacheco alignment alternative, the Henry Miller (UPRR Connection) alignment alternative could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the for California Red-legged Frog* (U.S. Fish and Wildlife Service 2002).

Special Management Areas

Similar to the Pacheco alignment alternative, the Henry Miller (UPRR Connection) alignment alternative would traverse lands that have been protected by the Nature Conservancy as part of its Mount Hamilton Project and could have adverse impacts on these protected lands. This alignment alternative would also adversely impact the GEA. The alignment would pass north of the San Luis Reservoir State Recreation Area and O'Neill Forebay Wildlife Area. It would also traverse the area known as the GEA, but it would not result in direct impacts on the CDFG Volta Wildlife Area or the San Luis National Wildlife Refuge Complex as shown on Figure 3.15-4. The Henry Miller alignment alternative would extend immediately adjacent to and elevated above the roadway where it crosses the Los Banos Wildlife Area.

Henry Miller (BNSF Connection) Alignment Alternative

The Henry Miller (BNSF Connection) alignment alternative could have direct impacts on 227.68 ac (92.14 ha) of agricultural lands, 118.84 ac (48.09 ha) of grasslands, 2.54 ac (1.03 ha) of hardwood forests, 7.53 ac (3.05 ha) of oak woodland/foothill pine, 2.43 ac (0.98 ha) of open waters, 1.34 ac (0.54 ha) of permanent freshwater marsh, 0.19 ac (0.08 ha) of riparian habitat, 1.54 ac (0.62 ha) of seasonal wetlands, 0.52 ac (0.21 ha) of shrub lands, and 31.01 ac (12.55 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 12,428.32 ac (5,028.59 ha) of agricultural lands, 6,649.80 ac (2,691.09 ha) of grasslands, 111.97 ac (45.31 ha) of montane hardwood forest, 431.69 ac (174.7 ha) of oak and foothill pine woodlands, 166.52 ac (67.39 ha) of open waters, 123.61 ac (50.02 ha) of permanent freshwater wetlands, 3.92 ac (1.59 ha) of riparian habitat, 134.18 ac (54.3 ha) of seasonal wetlands, 20.72 ac (8.39 ha) of shrub lands, and 1,358.76 ac (549.87 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities within this alignment alternative are seasonal wetlands, permanent freshwater wetlands, permanent freshwater marsh, riparian, and oak woodlands.

Special-Status Plants

The Henry Miller (BNSF Connection) alignment alternative could adversely affect the habitat of the same 25 special-status plant species that the Henry Miller (UPRR Connection) alignment alternative could affect.

Special-Status Wildlife

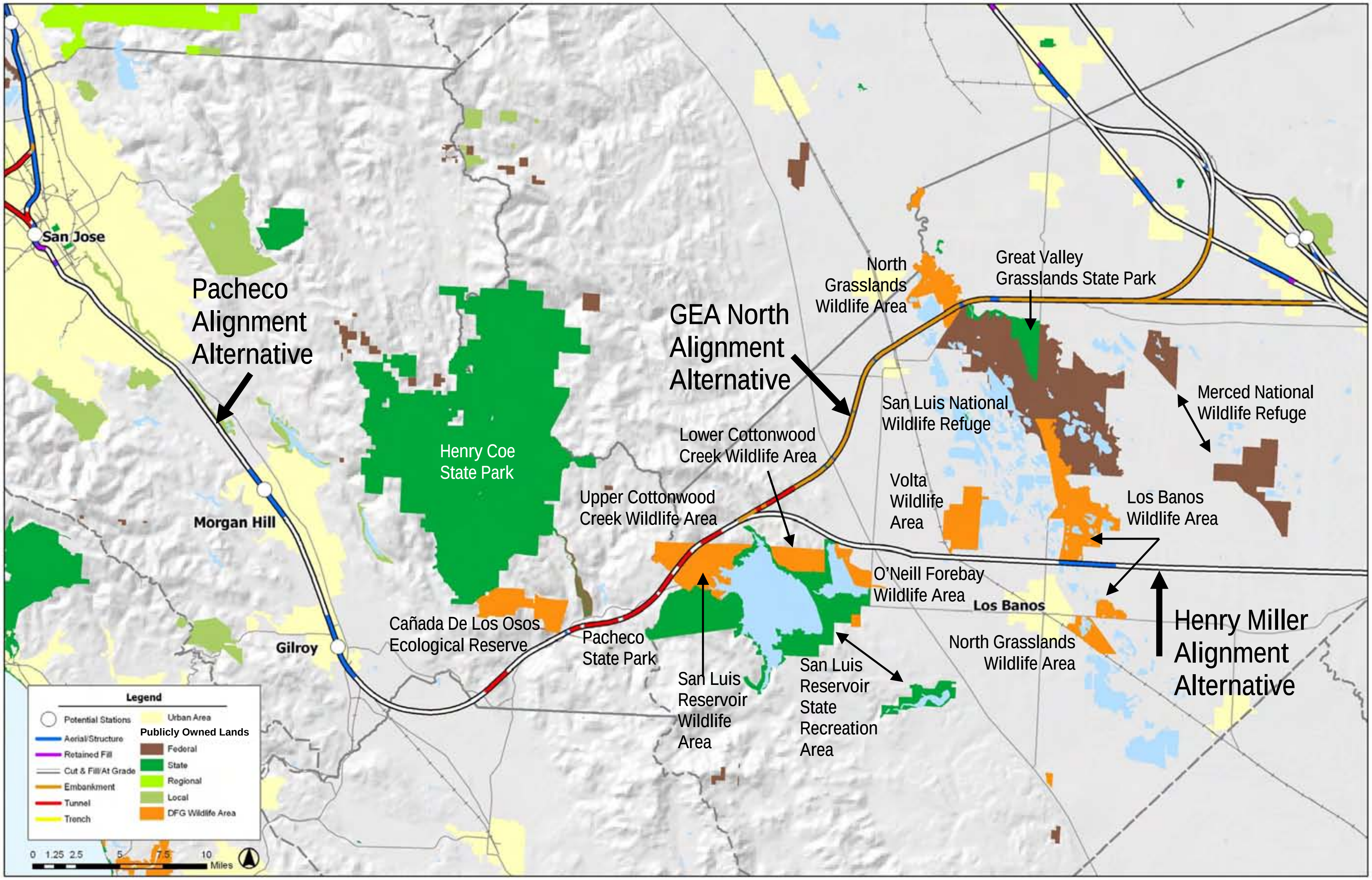
The Henry Miller (BNSF Connection) alignment alternative could adversely affect the habitat of the same 34 special-status wildlife species as the Henry Miller (UPRR Connection) alignment alternative.

Wildlife Movement Corridors

Impacts on wildlife movement corridors from this alignment alternative would be the same as those for the Henry Miller (UPRR Connection) alignment alternative.

Water Resources/Wetlands

Similar to the Henry Miller (UPRR Connection) alignment alternative, this alignment alternative has the potential to directly impact approximately 10,315 ft (3,144 m) of potential non-wetland waters



Source: USBR, BLM, CDPR, CDFG, (former) Teale Data Center, USFS, California GAP Analysis Project, and the Wildlands Conservancy

Figure 3.15-4
Public Lands – San Jose to Central Valley Corridor

and approximately 11.5 ac (4.65 ha) of wetlands. The Henry Miller (BNSF Connection) alignment alternative crosses the San Joaquin River, sloughs, and creeks.

Conservation Plans

Impacts on habitats and species identified in conservation plans from this alignment alternative would be the same as for the Henry Miller (UPRR Connection) alignment alternative.

Special Management Areas

Impacts on special management areas from this alignment alternative would be the same as for the Henry Miller (UPRR Connection) alignment alternative.

GEA North Alignment Alternative

The GEA North alignment alternative could have direct impacts on 200.03 ac (80.95 ha) of agricultural lands, 123.43 ac (49.95 ha) of grasslands, 2.89 ac (1.17 ha) of oak woodland/foothill pine, 1.21 ac (0.49 ha) of open waters, 3.17 ac (1.28 ha) of permanent freshwater marsh, 1.26 ac (0.51 ha) of riparian habitat, and 32.75 ac (13.26 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 11,631.04 ac (4,707.08 ha) of agricultural lands, 6,385.21 ac (2,584.09 ha) of grasslands, 280.35 ac (113.46 ha) of oak and foothill pine woodlands, 107.41 ac (43.47 ha) of open waters, 131.78 ac (53.33 ha) of permanent freshwater wetlands, 33.71 ac (13.64 ha) of riparian habitat, 16.31 ac (6.60 ha) of seasonal wetlands, 3.10 ac (1.25 ha) of shrub lands, and 1,408.79 ac (570.14 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities within this alignment alternative are seasonal wetlands, permanent freshwater wetlands, permanent freshwater marsh, riparian, and oak woodlands.

Special-Status Plants

The GEA North alignment alternative could adversely affect the habitat of 22 special-status plant species (Table 3.15-1).

Special-Status Wildlife

The GEA North alignment alternative could adversely affect the habitat of 34 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates, and those with limited nesting range, such as willow flycatcher and least Bell's vireo, would be of special concern, as would be the California tiger salamander.

Wildlife Movement Corridors

Impacts on wildlife movement corridors from this alignment alternative would be the same as for the Henry Miller (UPRR Connection) alignment alternative.

Water Resources/Wetlands

This alignment alternative has the potential to directly impact approximately 6,771 ft (2,347 m) of potential non-wetland waters and approximately 17.96 ac (7.27 ha) of wetlands, the highest of the alignment alternatives within this corridor. The GEA North alignment alternative crosses the San Joaquin River twice, sloughs, and creeks but is further north of the Henry Miller alignment alternatives and minimizes impacts on water crossings compared to either of the Henry Miller alignment alternatives.

Conservation Plans

The GEA North alignment alternative could adversely affect the GEA. The GEA has been identified as a core area of recovery in the *Recovery Plan for Vernal Pool Ecosystems* (U.S. Fish and Wildlife Service 2005).

The GEA North alignment alternative could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002).

Special Management Areas

Impacts on special management areas from this alignment alternative include the San Luis National Wildlife Area, North Grasslands Wildlife Area, and the Great Valley Grasslands State Park, which provide habitat for a number of special-status plant and wildlife species.

San Jose to Central Valley Corridor Stations

- San Jose-Diridon Station: This station location option could have direct impacts on 13 ac (5.26 ha) of urban/other developed lands. This station location option could have indirect impacts on 0.4 ac (0.16 ha) of grasslands, 0.2 ac (0.08 ha) of open waters, and 191 ac (77.3 ha) of urban/other developed lands. This station location option could adversely affect the habitat of one special-status plant and one wildlife species. Impacts on waters, wetlands, and marine/anadromous species are not anticipated with this station location.
- Morgan Hill Station: This station location option could have direct impacts on 2 ac (0.81 ha) of agricultural land, 2.2 ac (0.89 ha) of grasslands and 2.5 ac (1.01 ha) of urban/other developed lands. This station location option could have indirect impacts on 33 ac (13.35 ha) of agricultural lands, 27 ac (10.93 ha) of grasslands, 98 ac (39.66 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location.
- Gilroy Station: This station location option could have direct impacts on 3.7 ac (1.5 ha) of agricultural land, 0.1 ac (0.04 ha) of grasslands, and 30 ac (12.14 ha) of urban/other developed lands. This station location option could have indirect impacts on 28 ac (11.33 ha) of agricultural lands, 7 ac (2.83 ha) of grasslands, and 192 ac (77.7 ha) of urban/other developed lands. This station location option could adversely affect the habitat of one special-status plant species. Impacts on special-status wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location.

Summary of San Jose to Central Valley Corridor Impacts

Sensitive Vegetation Communities

The sensitive vegetation communities within this corridor are seasonal wetlands, permanent freshwater wetlands, permanent freshwater marsh, riparian, and oak woodlands.

Special-Status Plants

The Henry Miller alignment alternatives have the potential to impact a greater number of special-status plant species than the GEA North alignment alternative. Both of the Henry Miller alignment alternatives have the potential to impact the same special-status plant species.

Special-Status Wildlife

Both of the Henry Miller alignment alternatives have the potential to impact the same special-status wildlife species. The special-status wildlife species that will be impacted by the Henry Miller and the GEA North alignment alternatives are essentially the same.

Wildlife Movement Corridors

Both the GEA North and the Henry Miller alignment alternatives would bisect the major San Joaquin kit fox movement corridor between the southern portion of its range and the northern portion of its range along the west side of the San Joaquin Valley.

Water Resources/Wetlands

This corridor has the potential to directly impact between approximately 8,731 ft and 12,548 ft of potential non-wetland waters and between approximately 11.7 ac (5.1 ha) and 18.07 ac (7.31 ha) of wetlands. Both of the Henry Miller alignment alternatives have the potential to affect more jurisdictional waters than the GEA North alignment alternative, but the GEA North alignment alternative has the potential to impact more wetland areas.

Conservation Plans
The GEA North and the Henry Miller alignment alternatives could adversely affect core areas that have been identified for the recovery of the California red-legged frog.

Special Management Areas
The Pacheco alignment alternative would have adverse impacts on the Cottonwood Creek Wildlife Area where it is not in a tunnel. The GEA North and the Henry Miller alignment alternatives would traverse lands that have been protected by the Nature Conservancy as part of its Mount Hamilton Project and could have adverse impacts on these protected lands. Both the GEA North and Henry Miller alignment alternatives would adversely impact the GEA. The Henry Miller alignment alternative would extend immediately adjacent to and elevated above the roadway where it crosses the Los Banos Wildlife Area.

The GEA North alignment alternative would adversely affect special management areas within the GEA, including the San Luis National Wildlife Refuge, North Grasslands Wildlife Area, and the Great Valley Grasslands State Park, which provide habitat for a number of special-status plant and wildlife species.

East Bay to Central Valley Corridor

I-680/I-580/UPRR Alignment Alternative
The I-680/I-580/UPRR alignment alternative could have direct impacts on 0.17 ac (0.07 ha) of agricultural lands, 48.82 ac (19.76 ha) of grasslands, 4.57 ac (1.85 ha) of oak woodland/foothill pine, 0.01 ac (0.004 ha) of shrub lands, and 96.02 ac (38.86 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 408.03 ac (165.12 ha) of agricultural lands, 4,016.15 ac (1,625.29 ha) of grasslands, 183.89 ac (74.42 ha) of oak and foothill pine woodlands, 4.58 ac (1.85 ha) of open waters, 1.74 ac (0.7 ha) of shrub lands, and 3,275.32 ac (1,325.48 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community within this alignment alternative is oak woodlands.

Special-Status Plants
The I-680/I-580/UPRR alignment alternative could adversely affect the habitat of 24 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The I-680/I-580/UPRR alignment alternative could adversely affect the habitat of 29 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates, would be of special concern because of the adverse effects that even a small impact to their habitat could cause. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The I-680/I-580/UPRR alignment alternative would bisect the major San Joaquin kit fox movement corridor between the southern portion of its range and the northern portion of its range along the west side of the San Joaquin Valley.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 6,290 ft (1,917.19 m) of potential nonwetland jurisdictional waters and approximately 4.4 ac (1.78 ha) of wetlands. The I-

680/I-580/UPRR alignment alternative crosses or is adjacent to Arroyo Las Positas, Cayetano Creek, as well as other streams and water bodies.

Conservation Plans
The I-680/580/UPRR alignment alternative could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002) and the Altamont Hills core area identified in the *Recovery Plan for Vernal Pool Ecosystems* (U.S. Fish and Wildlife Service 2005).

I-580/UPRR Alignment Alternative
The I-580/UPRR alignment alternative could have direct impacts on 0.11 ac (0.04 ha) of agricultural lands, 47.29 ac (19.14 ha) of grasslands, 0.88 ac (0.36 ha) of oak woodland/foothill pine, 4.30 ac (1.74 ha) of open waters, and 71.92 ac (29.11 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 367.11 ac (148.56 ha) of agricultural lands, 3,669.00 ac (1,484.80 ha) of grasslands, 59.35 ac (24.02 ha) of oak and foothill pine woodlands, 158.71 ac (64.23 ha) of open waters, 1.64 ac (0.66 ha) of shrub lands, and 2,584.57 ac (1,045.94 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community within this alignment alternative is oak woodlands.

Special-Status Plants
The I-580/UPRR alignment alternative could adversely affect the habitat of the same 24 special-status plant species as the I-680/I-580/UPRR alignment alternative.

Special-Status Wildlife
The I-580/UPRR alignment alternative could adversely affect the habitat of the same 29 special-status wildlife species that the I-680/I-580/UPRR alignment alternative could affect. This alignment also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as for the I-680/580/UPRR alignment alternative.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 2,610 ft (795.53 m) of potential nonwetland jurisdictional waters and approximately 5.2 ac (2.1 ha) of wetlands. The I-580/UPRR alignment alternative crosses or is adjacent to gravel pits filled with water as well as Arroyo Las Positas, Cayetano Creek, and other streams and water bodies.

Conservation Plans
Impacts on habitats and species identified in conservation plans from this alignment alternative would be the same as those for the I-680/580/UPRR alignment alternative.

Patterson Pass/UPRR Alignment Alternative
The Patterson Pass/UPRR alignment alternative could have direct impacts on 63.54 ac (25.71 ha) of grasslands, 0.88 ac (0.36 ha) of oak woodland/foothill pine, and 61.64 ac (24.94 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 3,503.56 ac (1,417.85 ha) of grasslands, 59.35 ac (24.02 ha) of oak and foothill pine woodlands, 62.57 ac (25.32 ha) of open waters, 1.27 ac (0.51 ha) of shrub lands, and 2,731.29 ac (1,105.32 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community within this alignment alternative is oak woodlands.

Special-Status Plants
The Patterson Pass/UPRR alignment alternative could adversely affect the habitat of 20 special-status plant species (Table 3.15-1). These 20 species are also in the I-680/580/UPRR and I-580/UPRR alignment alternatives.

Special-Status Wildlife
The Patterson Pass/UPRR alignment alternative could adversely affect the habitat of 28 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as for the I-680/580/UPRR alignment alternative.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 1,370 ft (417.58 m) of potential non-wetland waters and approximately 2.6 ac (1.05 ha) of wetlands.

Conservation Plans
Similar to the I-680/580/UPRR alignment alternative, the Patterson Pass/UPRR alignment alternative could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002).

UPRR Alignment Alternative
The UPRR alignment alternative could have direct impacts on 57.43 ac (23.24 ha) of grasslands, 0.88 ac (0.37 ha) oak woodland/foothill pine, and 64.90 ac (26.26 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 8,341.09 ac (3,375.53 ha) of agricultural lands, 3,665.27 ac (1,483.29 ha) of grasslands, 2.32 ac (0.94 ha) of oak and foothill pine woodlands, 50.81 ac (20.56 ha) of open waters, 9.78 ac (3.96 ha) of permanent freshwater wetlands, 34.32 ac (13.89 ha) of riparian habitat, 10.32 ac (4.18 ha) of seasonal wetlands, and 14,568.51 ac (5,895.69 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community within this alignment alternative is oak woodlands.

Special-Status Plants
The UPRR alignment alternative could adversely affect the habitat of 20 special-status plant species (Table 3.15-1). These 20 species are also in the I-680/580/UPRR and I-580/UPRR alignment alternatives.

Special-Status Wildlife
Similar to the I-680/580/UPRR alignment alternative, the UPRR alignment alternative could adversely affect the habitat of the same 28 special-status wildlife species that the Patterson Pass/UPRR alignment alternative could affect. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as for the I-680/580/UPRR alignment alternative.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 1,150 ft (350.52 m) of potential nonwetland jurisdictional waters and approximately 3.2 ac (1.29 ha) of wetlands. The

UPRR alignment alternative is adjacent to gravel pits filled with water, as well as Arroyo Mocho and other streams and water bodies.

Conservation Plans

The UPRR alignment alternative could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2002).

Tracy Downtown (BNSF Connection) Alignment Alternative

The Tracy Downtown (BNSF Connection) alignment alternative could have direct impacts on 150.02 ac (60.71 ha) of agricultural lands, 62.57 ac (25.32 ha) of grasslands, 0.09 ac (0.04 ha) of oak woodland/foothill pine, 1.26 ac (0.51 ha) of open waters, 0.05 ac (0.02 ha) of permanent freshwater marsh, 0.14 ac (0.06 ha) of riparian habitat, 0.50 ac (0.20 ha) of seasonal wetlands, and 90.23 ac (36.51 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 8,644.54 ac (3,498.34 ha) of agricultural lands, 3,749.38 ac (1,517.33 ha) of grasslands, 3.41 ac (1.38 ha) of oak and foothill pine woodlands, 80.72 ac (32.67 ha) of open waters, 11.48 ac (4.65 ha) of permanent freshwater wetlands, 5.53 ac (2.24 ha) of riparian habitat, 34.55 ac (13.98 ha) of seasonal wetlands, 0.15 ac (0.06 ha) of shrub lands, and 3,563.73 ac (1,442.2 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment alternative are oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, and seasonal wetlands.

Special-Status Plants

The Tracy Downtown (BNSF Connection) alignment alternative could adversely affect the habitat of 18 special-status plant species (Table 3.15-1).

Special-Status Wildlife

The Tracy Downtown (BNFS Connection) alignment alternative could adversely affect the habitat of 27 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). This is the same as the Tracy ACE (BNSF Connection) and Tracy ACE (UPRR Connection) alignment alternatives. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors

Impacts on wildlife movement corridors from this alignment alternative would be the same as for the I-680/580/UPRR alignment alternative.

Water Resources/Wetlands

This alignment alternative has the potential to directly impact approximately 6,290 ft of potential nonwetland jurisdictional waters and approximately 4.4 ac (1.78 ha) of wetlands. The Tracy Downtown (BNFS Connection) alignment alternative crosses the San Joaquin River twice and crosses or is adjacent to several streams, canals, and other water bodies.

Conservation Plans

The Tracy Downtown (BNSF Connection) alignment alternative would not adversely affect habitats or species identified in any conservation plans.

Tracy ACE Station (BNSF Connection) Alignment Alternative

The Tracy ACE Station (BNSF Connection) alignment alternative could have direct impacts on 137.74 ac (55.74 ha) of agricultural lands, 84.62 ac (34.24 ha) of grasslands, 0.34 ac (0.14 ha) of oak woodland/foothill pine, 3.22 ac (1.3 ha) of open waters, 0.33 ac (0.13 ha) of permanent freshwater marsh, 0.45 ac (0.18 ha) of riparian habitat, 1.03 ac (0.42 ha) of seasonal wetlands, and 78.18 ac

(31.64 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 8,123.27 ac (3,287.38 ha) of agricultural lands, 4,816.88 ac (1,949.33 ha) of grasslands, 7.11 ac (2.88 ha) of oak and foothill pine woodlands, 170.86 ac (69.14 ha) of open waters, 19.84 ac (8.03 ha) of permanent freshwater wetlands, 31.04 ac (12.56 ha) of riparian habitat, 38.98 ac (15.77 ha) of seasonal wetlands, and 3,402.73 ac (1,377.04 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment alternative are oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, and seasonal wetlands.

Special-Status Plants

The Tracy ACE Station (BNSF Connection) alignment alternative could adversely affect the habitat of 21 special-status plant species (Table 3.15-1). Of the 21 species identified, 18 are also in the Tracy Downtown (BNSF Connection) alignment alternative.

Special-Status Wildlife

The Tracy ACE Station (BNSF Connection) alignment alternative could adversely affect the habitat of 27 special-status wildlife species, including species of invertebrates, amphibians, reptiles, raptors and other birds, and mammals (Table 3.15-1). This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors

Impacts on wildlife movement corridors from this alignment alternative would be the same as for the I-680/580/UPRR alignment alternative.

Water Resources/Wetlands

This alignment alternative has the potential to directly impact approximately 7,678 ft (2,340 m) of potential nonwetland jurisdictional waters and approximately 3.6 ac (1.46 ha) of wetlands. The Tracy ACE Station (BNSF Connection) alignment alternative also crosses the San Joaquin River twice and crosses or is adjacent to several streams, canals, and other water bodies.

Conservation Plans

The Tracy ACE Station (BNSF Connection) alignment alternative would not adversely affect habitats or species identified in any conservation plans.

Tracy ACE Station (UPRR Connection) Alignment Alternative

The Tracy ACE Station (UPRR Connection) alignment alternative could have direct impacts on 50.16 ac (20.3 ha) of agricultural lands, 52.63 ac (21.3 ha) of grasslands, 0.09 ac (0.04 ha) of oak woodland/foothill pine, 2.73 ac (1.1 ha) of open waters, 0.13 ac (0.05 ha) of permanent freshwater marsh, 0.31 ac (0.13 ha) of riparian habitat, 0.53 ac (0.21 ha) of seasonal wetlands, and 72.65 ac (29.4 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 2,951.15 ac (1,194.29 ha) of agricultural lands, 3,264.93 ac (1,321.28 ha) of grasslands, 6.63 ac (2.68 ha) of oak and foothill pine woodlands, 90.89 ac (36.78 ha) of open waters, 8.39 ac (3.4 ha) of permanent freshwater wetlands, 17.99 ac (7.28 ha) of riparian habitat, 13.63 ac (5.52 ha) of seasonal wetlands, and 3,202.19 ac (1,295.89 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment alternative are oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, and seasonal wetlands.

Special-Status Plants

The Tracy ACE Station (UPRR Connection) alignment alternative could adversely affect the habitat of 20 special-status plant species (Table 3.15-1). Of the 20 species identified, 18 are also in the Tracy

Downtown (BNSF Connection) alignment alternative and 18 are in the Tracy ACE Station (BNSF Connection) alignment alternative.

Special-Status Wildlife
The Tracy ACE Station (UPRR Connection) alignment alternative could adversely affect the habitat of the same 27 special-status wildlife species as the Tracy ACE (BNSF Station) alignment alternative. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as for the I-680/580/UPRR alignment alternative.

Water Resources/Wetlands
This alignment has the potential to directly impact approximately 5,325 ft (1,623 m) of potential nonwetland jurisdictional waters and approximately 2.6 ac (1.05 ha) of wetlands. The Tracy ACE Station (UPRR Connection) alignment alternative crosses the San Joaquin River, Tom Paine Slough, and several other streams, canals, and water bodies.

Conservation Plans
The Tracy ACE Station (UPRR Connection) alignment alternative would not adversely affect habitats or species identified in any conservation plans.

Tracy Downtown (UPRR Connection) Alignment Alternative
The Tracy Downtown (UPRR Connection) alignment alternative could have direct impacts on 76.16 ac (30.82 ha) of agricultural lands, 39.36 ac (15.93 ha) of grasslands, 0.09 ac (0.04 ha) of oak woodland/foothill pine, 1.26 ac (0.51 ha) of open waters, 0.05 ac (0.02 ha) of permanent freshwater marsh, 0.14 ac (0.06 ha) of riparian habitat, 0.06 ac (0.02 ha) of seasonal wetlands, and 99.69 ac (40.34 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 4,389.32 ac (1,776.3 ha) of agricultural lands, 2,661.16 ac (1,076.94 ha) of grasslands, 4.30 ac (1.74 ha) of oak and foothill pine woodlands, 73.34 ac (29.68 ha) of open waters, 6.79 ac (2.75 ha) of permanent freshwater wetlands, 5.53 ac (2.24 ha) of riparian habitat, 17.79 ac (7.2 ha) of seasonal wetlands, 0.15 ac (0.06 ha) of shrub lands, and 3,939.67 ac (1,594.33 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities in this alignment alternative are oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, and seasonal wetlands.

Special-Status Plants
The Tracy Downtown (UPRR Connection) alignment alternative could adversely affect the habitat of 22 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The Tracy Downtown (UPRR Connection) alignment alternative could adversely affect the habitat of the same 27 special-status wildlife species as the Tracy ACE (BNSF Connection), Tracy ACE (UPRR Connection), and Tracy Downtown (BNSF Connection) alignment alternative. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as for the I-680/580/UPRR alignment alternative.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 7,500 ft (2,286 m) of potential nonwetland jurisdictional waters and approximately 4.2 ac (1.7 ha) of wetlands. The Tracy Downtown (UPRR Connection) alignment alternative crosses the San Joaquin River twice, Tom Paine Slough, and a number of other streams, canals, and water bodies.

Conservation Plans
The Tracy Downtown (UPRR Connection) alignment alternative would not adversely affect habitats or species identified in any conservation plans.

East Bay Connections Alignment Alternative

The East Bay Connections alignment alternative could have direct impacts on 16.2 ac (6.56 ha) of grasslands, 48.8 ac (19.75 ha) of grasslands, 4.6 ac (1.86 ha) of oak woodland/foothill pine, 1.0 ac (0.4 ha) of shrub lands, and 18.4 ac (7.44 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 310 ac (125.45 ha) of grasslands, 116.1 ac (46.98 ha) of oak and foothill pine woodlands, 17.8 ac (7.2 ha) of shrub lands, and 397.4 ac (160.82 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities in this alignment alternative are oak woodlands.

Special-Status Plants
The East Bay Connections alignment alternative would not adversely affect the habitat of any special-status plant species.

Special-Status Wildlife
The East Bay Connections Alignment would not adversely affect the habitat of any special-status wildlife species.

Wildlife Movement Corridors
Impacts on wildlife movement corridors from this alignment alternative would be the same as the West Oakland to Niles Junction alignment alternative.

Water Resources/Wetlands
This alignment has the potential to directly impact approximately 375 ft (114 m) of potential nonwetland jurisdictional waters and approximately 1.2 ac (0.49 ha) of wetlands. The East Bay Connections alignment alternative crosses Niles Canyon and Morrison Canyon.

Conservation Plans
Impacts on habitats and species identified in conservation plans from this alignment would be the same as for the I-680/580/UPRR alignment alternative.

East Bay to Central Valley Corridor Stations

- Pleasanton (I-680/Bernal) Station: This station location option could have direct impacts on 6.4 ac (2.59 ha) of urban/other developed lands. This station location option could have indirect impacts on 10 ac (4.04 ha) of grasslands, 0.05 ac (0.02 ha) of shrubland, and 147 ac (59.49 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location option.
- Pleasanton (BART) Station: This station location option could have direct impacts on 2.1 ac (0.85 ha) of grasslands and 9.4 ac (3.8 ha) of urban/other developed lands. This station location option could have indirect impacts on 98 ac (39.66 ha) of grasslands and 143 ac (57.87 ha) of urban/other developed lands. This station location option could adversely affect the habitat of one special-status plant species. This station location option could impact 482 linear ft (147 m)

of waters. Impacts on special-status plant and wildlife species, wetlands, and marine/anadromous species are not anticipated with this station location option.

- Livermore (Downtown): This station location option could have direct impacts on 9.8 ac (3.97 ha) of urban/other developed lands. This station location option could have indirect impacts on 0.1 ac (0.04 ha) of open water, 1 ac (0.4 ha) of grasslands, and 148 ac (59.89 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location option.
- Livermore (I-580) Station: This station location option could have direct impacts on 3 ac (1.21 ha) of grasslands and 4.9 ac (1.98 ha) urban/other developed lands. This station location option could have indirect impacts on 25 ac (10.11 ha) of agricultural land, 114 ac (46.13 ha) of grasslands, and 152 ac (61.51 ha) of urban/other developed lands. This station could impact 1 ac (0.4 ha) of potential wetlands. Impacts on special-status plant and wildlife species, waters, and marine/anadromous species are not anticipated with this station location option.

Livermore (Greenville Road/UPRR) Station: This station location option could have direct impacts on 2.12 ac (0.86 ha) of grasslands and 7.94 ac (3.21 ha) of urban/other developed lands. This station option could have indirect impacts on 62.09 ac (25.13 ha) of grasslands, and 124.6 ac (50.43 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location option.

- Livermore (Greenville Road/I-580) Station: This station location option could have direct impacts on 4.5 ac (1.82 ha) of grasslands and 4 ac (1.61 ha) of urban/other developed lands. This station could have indirect impacts on 10 ac (4.04 ha) of agricultural lands, 139 ac (56.25 ha) of grasslands, and 145 ac (58.68 ha) of urban/other developed lands. This station could impact 72 linear ft (22 m) of waters and 1.07 ac (0.43 ha) of potential wetlands. Impacts on special-status plant and wildlife species and marine/anadromous species are not anticipated with this station location option.
- Tracy (Downtown) Station: This station location option could have direct impacts on 7.5 ac (3.04 ha) of urban/other developed lands. This station location option could have indirect impacts on 11 ac (4.45 ha) of agricultural lands, 0.2 ac (0.08 ha) of grasslands, and 146 ac (59.08 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location option.
- Tracy (ACE) Station: This station location option could have direct impacts on 0.2 ac (0.08 ha) of agricultural lands and 10 ac (4.04 ha) of urban/other developed lands. This station location option could have indirect impacts on 86 ac (34.8 ha) of agricultural lands, 35 ac (14.16 ha) of grasslands, and 133 ac (53.82 ha) of urban/other developed lands. This station location option could impact 0.08 ac (0.03 ha) of potential wetlands. Impacts on special-status plant and wildlife species, waters, and marine/anadromous species are not anticipated with this station location option.

Summary of East Bay to Central Valley Corridor Impacts

Sensitive Vegetation Communities

The sensitive vegetation communities in the I-680/580/UPRR, I-580/UPRR, Patterson Pass/UPRR, and UPRR alignment alternatives are the same and include oak woodlands. The sensitive vegetation communities in the Tracy Downtown and Tracy ACE alignment alternatives are the same and include oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, and seasonal wetlands.

Special-Status Plants

The I-680/I-580/UPRR and I-580/UPRR alignment alternatives could adversely affect the greatest number of special-status plant species. The Patterson Pass/UPRR alignment alternative would not adversely affect the Mt. Hamilton thistle, the recurved larkspur, the rose-mallow, or the showy madia. The UPRR alignment alternative would not adversely affect the palmate-bracted bird's-beak.

Special-Status Wildlife
The I-680/I-580/UPRR and I-580/UPRR alignment alternatives could adversely affect the greatest number of special-status wildlife species. The Patterson Pass/UPRR and UPRR alignment alternatives would not adversely affect potential habitat for longhorn fairy shrimp, but the I-680/I-580/UPRR and I-580/UPRR alignment alternatives could adversely affect this habitat.

The Tracy ACE (BNSF Connection), Tracy ACE (UPRR Connection), Tracy Downtown (UPRR Connection), and Tracy Downtown (BNSF Connection) alignment alternatives could adversely impact the same special-status wildlife species.

Wildlife Movement Corridors
The I-680/I-580/UPRR, I-580/UPRR, Patterson Pass/UPRR, and UPRR alignment alternatives would bisect the major San Joaquin kit fox movement corridor between the southern portion of its range and the northern portion of its range along the west side of the San Joaquin Valley. This also applies to the Tracy ACE Station (BNSF Connection), Tracy ACE Station (UPRR Connection), Tracy Downtown (BNSF Connection), and Tracy Downtown (UPRR Connection) alignment alternatives.

Water Resources
This corridor has the potential to directly impact between approximately 7,075 ft (2,156 m) and 10,660 ft (3,249 m) of potential nonwetland jurisdictional waters and between approximately 4.5 ac (1.82 ha) and 10.8 ac (4.37 ha) of wetlands.

Conservation Plans
The I-680/I-580/UPRR and the I-580/UPRR alignment alternatives could adversely affect the Altamont Hills core area identified in the *Recovery Plan for Vernal Pool Ecosystems*, but the Patterson Pass/UPRR and the UPRR alignment alternatives would not adversely affect this core area. All four of these alignment alternatives could adversely impact the East San Francisco Bay Core Area identified in the *Recovery Plan for the California Red-Legged Frog*.

The Tracy ACE Station (BNSF Connection), Tracy ACE Station (UPRR Connection), Tracy Downtown (BNSF Connection), and Tracy Downtown (UPRR Connection) alignment alternatives are not anticipated to affect habitats or species identified in any conservation plans.

<u>San Francisco Bay Crossings</u>

Trans Bay Crossing – Transbay Transit Center Alignment Alternative
The Trans Bay Crossing – Transbay Transit Center alignment alternative extends in a tube from the Oakland Inner Harbor to the City of San Francisco, crossing San Francisco Bay en route. If this alignment alternative were not constructed as a bored tunnel, it could have direct impacts on 22.1 ac (8.94 ha) of bay waters, 0.11 ac (0.04 ha) of grasslands, 1.6 ac (0.65 ha) of saline-brackish permanent wetlands, and 17.3 ac (7 ha) of urban/other developed lands. This alignment alternative could also have indirect impacts on 1,320.6 ac (534.46 ha) of bay waters, 0.22 ac (0.09 ha) of grasslands, 1.3 ac (0.52 ha) of open waters, 44.3 ac (17.93 ha) of saline-brackish permanent wetlands, and 659 ac (266.69 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community in this alignment alternative is the saline-brackish permanent wetlands. If this alignment alternative were constructed in a tunnel, impacts would likely not occur. Depending on construction technique, this alignment alternative may impact eelgrass habitat in the San Francisco Bay. The habitat for eelgrass is generally located at a depth of 2 m.

Special-Status Plants
The Trans Bay Crossing – Transbay Transit Center alignment alternative could adversely affect the habitat of one special-status plant species, the beach layia. As noted above, and if this alignment alternative were constructed in a tunnel, impacts on this species would likely not occur.

Special-Status Wildlife
This alignment alternative is not anticipated to adversely affect the habitat of special-status wildlife species or impact marine/anadromous species if it were constructed in a tunnel. Other tube construction methods could result in impacts on marine/anadromous species.

Wildlife Movement Corridors
The Trans Bay Crossing – Transbay Transit Center alignment alternative is not anticipated to impact wildlife movement corridors if constructed as a bored tunnel. If constructed as a trench on the floor of San Francisco Bay, sediment disturbance from construction could affect some fish species, including the Pacific herring. This alignment alternative could also adversely impact the movement corridors along the west and east shores of the San Francisco Bay.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 22.83 ac (9.24 ha) of wetlands. Depending on construction methods, such as trenching, the crossing could result in substantial impacts on Bay waters and wetlands.

Conservation Plans
The Trans Bay Crossing – Transbay Transit Center alignment alternative would not adversely impact areas identified in conservation plans.

Trans Bay Crossing –4th & King Alignment Alternative
Similar to the Trans Bay Crossing – Transbay Transit Center alignment alternative, the Trans Bay Crossing – 4th & King alignment alternative extends in a tube from the Oakland Inner Harbor to the City of San Francisco, crossing San Francisco Bay en route. This alignment alternative could have direct impacts on 20.07 ac (8.12 ha) of bay waters, 0.11 ac (0.04 ha) of grasslands, 1.62 ac (0.66 ha) of saline-brackish permanent wetlands, and 17.75 ac (7.18 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 1,240.83 ac (502.15 ha) of bay waters, 0.22 ac (0.09 ha) of grasslands, 1.34 ac (0.54 ha) of open waters, 44.34 ac (17.94 ha) of saline-brackish permanent wetlands, and 682.06 ac (276.02 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation community in this alignment alternative is the saline-brackish permanent wetlands and eelgrass habitat.

Special-Status Plants
The Trans Bay Crossing – 4th & King alignment alternative could adversely affect the habitat of one special-status plant species, the beach layia (Table 3.15-1).

Special-Status Wildlife
This alignment alternative is not anticipated to adversely affect the habitat of special-status wildlife species or impact marine/anadromous species if the alignment is constructed in a tunnel.

Wildlife Movement Corridors
Similar to the Trans Bay Crossing-Transbay Transit Center Alignment, this alignment alternative is not anticipated to impact wildlife movement corridors if constructed as a bored tunnel. If constructed as a trench on the floor of San Francisco Bay, sediment disturbance from construction could affect some fish species, including the Pacific herring. This alignment alternative could also adversely impact the movement corridors along the west and east shores of the San Francisco Bay.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 22.04 ac (8.92 ha) of wetlands. Regardless of construction methods, the crossing would still result in substantial impacts on Bay waters and wetlands.

Conservation Plans
The Trans Bay Crossing – 4th & King alignment alternative would not adversely impact areas identified in conservation plans.

Dumbarton (High Bridge, Low Bridge, and Tube) Alignment Alternative
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative could have direct impacts on 3.8 ac (1.54 ha) of bay waters, 6.2 ac (2.51 ha) of grasslands, 1.9 ac (0.77 ha) of oak woodland/foothill pine, 0.7 ac (0.28 ha) of open waters, 14.6 ac (5.91 ha) of saline-brackish permanent wetlands, 5.3 ac (2.14 ha) of salt flats, 4.3 ac (1.74 ha) of seasonal wetlands, 0.16 ac (0.06 ha) of shrub lands, 5.4 ac (2.19 ha) of unvegetated flats, and 70.6 ac (28.57 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 213.5 ac (86.4 ha) of bay waters, 322.0 ac (130.31 ha) of grasslands, 7.1 ac (2.87 ha) of managed bay marsh, 81.1 ac (32.82 ha) of oak and foothill pine woodlands, 59.4 ac (24.04 ha) of open waters, 599.8 ac (242.73 ha) of saline-brackish permanent wetlands, 416.1 ac (168.39 ha) of salt ponds, 138.6 ac (56.09 ha) of seasonal wetlands, 25.3 ac (10.24 ha) of shrub lands, 215.6 ac (87.25 ha) of unvegetated flats, and 3,145.5 ac (1,272.94 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities in this alignment alternative include eelgrass habitat in the Bay and oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, saline-brackish permanent, and seasonal wetlands.

Special-Status Plants
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative could adversely affect the habitat of 15 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative could adversely affect the habitat of 21 special-status wildlife species, including species of reptiles, shorebirds, and small mammals (Table 3.15-1). This alignment also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative could adversely impact the movement corridors in San Francisco Bay and along the west and east shores of the San Francisco Bay.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 2,360 ft (719 m) of potential nonwetland jurisdictional waters and approximately 34 ac (13.76 ha) of wetlands. Regardless of type of construction, either bridge or tube, the crossing would still result in substantial impacts on Bay waters and wetlands.

Conservation Plans
The Dumbarton (High Bridge, Low Bridge, and Tube) alignment alternative would not adversely impact areas identified in conservation plans.

Fremont Central Park (High Bridge, Low Bridge, and Tube) Alignment Alternative

The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative could have direct impacts on 4.48 ac (1.81 ha) of agricultural lands, 3.84 ac (1.55 ha) of bay lands, 3.20 ac (1.29 ha) of grasslands, 4.82 ac (1.95 ha) of open waters, 14.02 ac (5.67 ha) of saline-brackish permanent wetlands, 14.61 ac (5.91 ha) of salt flats, 3.07 ac (1.24 ha) of seasonal wetlands, 0.04 ac (0.02 ha) of shrub lands, 5.39 ac (2.18 ha) of unvegetated flats, and 53.93 ac (21.82 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 191.21 ac (77.38 ha) of agricultural lands, 213.53 ac (86.41 ha) of bay waters, 130.82 ac (52.94 ha) of grasslands, 7.10 ac (2.87 ha) of managed bay marsh, 267.81 ac (108.38 ha) of open waters, 615.21 ac (248.97 ha) of saline-brackish permanent wetlands, 903.90 ac (365.80 ha) of salt ponds, 104.39 ac (42.25 ha) of seasonal wetlands, 0.17 ac (0.07 ha) of shrub land, 215.24 ac (87.10 ha) of unvegetated flats, and 2,300.08 ac (930.81 ha) of urban/other developed lands.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment alternative include eelgrass habitat in the Bay and oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, saline-brackish permanent wetlands, and seasonal wetlands.

Special-Status Plants

The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative could adversely affect the habitat of 16 special-status wildlife species (Table 3.15-1).

Special-Status Wildlife

The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative could adversely affect the habitat of 23 special-status wildlife species, including species of aquatic invertebrates, amphibians, reptiles, shorebirds, and small mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates, would be of special concern because of the adverse effects that even a small impact to their habitat could cause. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors

The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative could adversely impact the movement corridors in San Francisco Bay and along the west and east shores of the San Francisco Bay.

Water Resources/Wetlands

This alignment alternative has the potential to directly impact approximately 3,120 ft (951 m) of potential nonwetland jurisdictional waters and approximately 55.4 ac (22.42 ha) of wetlands. Similar to the Dumbarton alignment alternative, both the bridge and tube crossing would result in substantial impacts on Bay waters and wetlands.

Conservation Plans

The Fremont Central Park (High Bridge, Low Bridge, and Tube) alignment alternative would not adversely impact any areas identified in conservation plans.

Special Management Areas

The Fremont Central Park alignment alternative could adversely impact areas of the Don Edwards San Francisco Bay National Wildlife Refuge.

Summary of San Francisco Bay Crossings Impacts

Sensitive Vegetation Communities

Both of the Transbay Crossing alignment alternatives have the potential to impact Bay waters, saline-brackish permanent wetlands, and eelgrass habitat. As noted above, and if these alignment alternatives are constructed in a tunnel, impacts would likely not occur.

The sensitive vegetation communities within the Dumbarton and Freemont Central Park alignment alternatives include eelgrass, oak woodlands, riparian, permanent freshwater marsh, permanent freshwater wetlands, saline-brackish permanent, and seasonal wetlands

Special-Status Plants and Wildlife
The Trans Bay Crossing alignment alternatives could adversely affect the habitat of one special-status plant species. If either of these alignment alternatives were constructed in a tunnel, impacts on this species would likely not occur. These alignment alternatives are not anticipated to adversely affect the habitat of special-status wildlife species if constructed in a tunnel.

The Fremont Central Park alignment alternatives would have a greater direct and indirect impact to the natural areas on the east side of San Francisco Bay than the Dumbarton alignment alternatives. These natural areas include Bay lands, saline-brackish permanent wetlands, salt flats, salt ponds, and unvegetated flats. These habitats are crucial for a number of special-status plant and wildlife species that occur around the San Francisco Bay, including salt marsh harvest mouse and California clapper rail. The Fremont Central Park alignment alternatives could also adversely affect habitat for vernal pool tadpole shrimp and California tiger salamander, while the Dumbarton alignment alternatives would not.

Wildlife Movement Corridors
The Trans Bay Crossing alignment alternatives and the Dumbarton and Fremont Central Park alignment alternatives could adversely affect the wildlife movement corridors along the west and east shores of the San Francisco Bay as well as the Bay itself.

Water Resources/Wetlands
The Trans Bay Crossing – Transbay Transit Center alignment alternative has the potential to directly affect slightly more wetlands than the Trans Bay Crossing – 4th & King alignment alternative. Regardless of construction methods such as trenching, either crossing could result in substantial impacts on Bay waters and wetlands.

The Freemont Central Park alignment alternative would result in higher potential impacts to Bay waters and wetlands than the Dumbarton alignment alternative.

Conservation Plans
The Trans Bay Crossing alignment alternatives and the Dumbarton and Fremont Central Park alignment alternatives are not anticipated to adversely impact any areas identified in conservation plans. Each of these alignment alternatives would be subject to BCDC requirements and be coordinated with on-going Bay planning efforts.

Special Management Areas
The Fremont Central Park alignment alternative could have negative impacts on the Don Edwards San Francisco Bay National Wildlife Refuge, while the Dumbarton alignment alternatives would not.

Central Valley Corridor

BNSF – UPRR Alignment Alternative
The BNSF – UPRR alignment alternative could have direct impacts on 190.89 ac (77.25 ha) of agricultural lands, 69.27 ac (28.03 ha) of grasslands, 2.00 ac (0.81 ha) of open waters, 0.13 ac (0.05 ha) of permanent freshwater marsh, 0.67 ac (0.27 ha) of riparian habitat, 0.20 ac (0.08 ha) of seasonal wetlands, and 262.51 ac (106.23 ha) of urban/other developed lands. This alignment could have indirect impacts on 15,115.94 ac (6,116.01 ha) of agricultural lands, 4,353.57 ac (1,761.83 ha) of grasslands, 114.42 ac (46.30 ha) of open waters, 17.88 ac (7.24 ha) of permanent freshwater wetlands, 69.75 ac (28.22 ha) of riparian habitats, 27.13 ac (10.98 ha) of seasonal wetlands, and 8,353.92 ac (3,380.73 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities within this alignment alternative are riparian, permanent freshwater marsh, permanent freshwater wetlands, and seasonal wetlands.

Special-Status Plants
The BNSF-UPRR alignment alternative could adversely affect the habitat of 22 special-status plant species (Table 3.15-1).

Special-Status Wildlife
The BNSF-UPRR alignment alternative could adversely affect the habitat of 22 special-status wildlife species, including species of aquatic invertebrates, amphibians, reptiles, shorebirds, and small mammals (Table 3.15-1). Species with limited habitats or ranges, such as the aquatic invertebrates and the riparian brush rabbit, would also be of special concern because of the adverse effects that even a small impact to their habitat could cause. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The BNSF-UPRR alignment alternative would bisect an east-west linkage corridor between the natural lands of the Central Valley (GEA and associated wildlife refuges) with the natural lands along the eastern side of the San Joaquin Valley.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 10,140 ft (3,091 m) of potential nonwetland jurisdictional waters and approximately 3.8 ac (1.54 ha) of wetlands. The BNSF-UPRR alignment alternative crosses the Stanislaus River, San Joaquin River, Tuolumne River, Merced River, Chowchilla River, and a several streams, canals, and other water bodies.

Conservation Plans
The BNSF-UPRR alignment alternative would not adversely impact areas identified in conservation plans.

BNSF Alignment Alternative
The BNSF alignment alternative could have direct impacts on 262.26 ac (106.13 ha) of agricultural lands, 70.03 ac (28.34 ha) of grasslands, 0.59 ac (0.24 ha) of montane hardwood, 4.43 ac (1.79 ha) of oak woodland/foothill pine, 1.62 ac (0.66 ha) of open waters, 0.12 ac (0.05 ha) of permanent freshwater marsh, 0.67 ac (0.27 ha) of riparian habitat, 0.20 ac (0.08 ha) of seasonal wetlands, 1.22 ac (0.49 ha) of shrub lands, and 205.08 ac (82.99 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 17,311.87 ac (7,005.89 ha) of agricultural lands, 4,341.78 ac (1,757.06 ha) of grasslands, 97.60 ac (39.50 ha) of montane hardwood, 187.85 ac (76.02 ha) of oak and foothill pine woodlands, 104.22 ac (42.18 ha) of open waters, 15.13 ac (6.12 ha) of permanent freshwater wetlands, 62.73 ac (25.79 ha) of riparian habitats, 24.51 ac (9.92 ha) of seasonal wetlands, 44.60 ac (18.04 ha) of shrub lands, and 7,306.42 ac (2,956.82 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities within this alignment alternative are riparian, permanent freshwater marsh, permanent freshwater wetlands, oak woodlands, and seasonal wetlands.

Special-Status Plants
The BNSF alignment alternative could adversely affect the habitat of 22 special-status plant species (Table 3.15-1). Of the 22 species identified, 21 would the same as for the BNSF-UPRR alignment alternative.

Special-Status Wildlife
The BNSF alignment alternative could adversely affect the habitat of the same 22 special-status wildlife species as the BNSF-UPRR alignment alternative. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
Impacts to wildlife movement corridors for this alignment alternative would be the same as for the BNSF alignment alternative.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 10,140 ft (3,090.67 m) of potential nonwetland jurisdictional waters and approximately 3.8 ac (1.54 ha) of wetlands. Similar to the BNSF-UPRR alignment alternative, this alignment alternative crosses the Stanislaus River, San Joaquin River, Tuolumne River, Merced River, Chowchilla River, and several streams, canals, and other water bodies.

Conservation Plans
The BNSF alignment alternative would not adversely impact areas identified in conservation plans.

UPRR N/S Alignment Alternative
The UPRR N/S alignment alternative could have direct impacts on 66.87 ac (27.06 ha) of agricultural lands, 42.28 ac (17.11 ha) of grasslands, 0.61 ac (0.25 ha) of open waters, 0.01 ac (0.004 ha) of permanent freshwater marsh, and 419.56 ac (169.79 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 8,341.09 ac (3,375.53 ha) of agricultural lands, 3,665.27 ac (1,483.29 ha) of grasslands, 2.32 ac (0.94 ha) of oak and foothill pine woodlands, 50.81 ac (20.56 ha) of open waters, 9.79 ac (3.96 ha) of permanent freshwater wetlands, 34.32 ac (13.89 ha) of riparian habitats, 10.32 ac (4.18 ha) of seasonal wetlands, 14,568.51 ac (5,895.69 ha) of urban/other developed lands, and 0.15 ac (0.06 ha) of valley oak woodland.

Sensitive Vegetation Communities
The sensitive vegetation communities in this alignment alternative are riparian, permanent freshwater marsh, permanent freshwater wetlands, oak woodlands, and seasonal wetlands.

Special-Status Plants
The UPRR N/S alignment alternative could adversely affect the habitat of 22 special-status plant species (Table 3.15-1). Of the 22 species identified, 14 would the same as for the BNSF-UPRR alignment alternative.

Special-Status Wildlife
The UPRR N/S alignment alternative could adversely affect the habitat of 21 special-status wildlife species, including species of aquatic invertebrates, amphibians, reptiles, shorebirds, and small mammals (Table 3.15-1). This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The UPRR N/S alignment alternative would not disrupt any crucial wildlife movement corridors.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 7,160 ft (2,182 m) of potential nonwetland jurisdictional waters and approximately 3.0 ac (1.21 ha) of wetlands. Similar to the BNSF-UPRR alignment alternative, this alignment alternative crosses the Stanislaus River, San Joaquin River, Tuolumne River, Merced River, Chowchilla River, and several other streams, canals, and water bodies.

Conservation Plans
The UPRR N/S alignment alternative would not adversely impact areas identified in conservation plans.

BNSF Castle Alignment Alternative

The BNSF Castle alignment alternative could have direct impacts on 254.46 ac (102.98 ha) of agricultural lands, 69.67 ac (28.19 ha) of grasslands, 0.39 ac (0.16 ha) of montane hardwood, 4.71 ac (1.91 ha) of oak woodland/foothill pine, 1.93 ac (0.78 ha) of open waters, 0.21 ac (0.08 ha) of permanent freshwater marsh, 0.83 ac (0.34 ha) of riparian habitat, 0.20 ac (0.08 ha) of seasonal wetlands, 1.13 ac (0.46 ha) of shrub lands, and 220.27 ac (89.14 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 16,963.29 ac (6,864.83 ha) of agricultural lands, 4,422.35 ac (1,789.67 ha) of grasslands, 93.65 ac (37.90 ha) of montane hardwood, 203.77 ac (82.46 ha) of oak and foothill pine woodlands, 91.85 ac (37.17 ha) of open waters, 14.51 ac (5.87 ha) of permanent freshwater wetlands, 57.76 ac (23.37 ha) of riparian habitats, 24.51 ac (9.92 ha) of seasonal wetlands, 53.76 ac (21.76 ha) of shrub land, and 7,700.82 ac (3,116.42 ha) of urban/other developed lands.

Sensitive Vegetation Communities
The sensitive vegetation communities in this alignment alternative are riparian, permanent freshwater marsh, permanent freshwater wetlands, oak woodlands, and seasonal wetlands.

Special-Status Plants
The BNSF Castle alignment alternative could adversely affect the habitat of 19 special-status plant species (Table 3.15-1). Of the 19 species identified, 18 would be the same as for the BNSF-UPRR alignment alternative.

Special-Status Wildlife
The BNSF Castle alignment alternative could adversely affect the habitat of the same 22 special-status wildlife species as the BNSF-UPRR and BNSF alignment alternatives. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
The BNSF Castle alignment alternative would bisect an east-west linkage corridor between the natural lands of the Sacramento Valley (GEA and associated wildlife refuges) and the natural lands along the eastern side of the San Joaquin Valley.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 9,095 ft (2,772 m) of potential nonwetland jurisdictional waters and approximately 3.1 ac (1.25 ha) of wetlands. Similar to the BNSF-UPRR alignment alternative, this alignment alternative crosses the Stanislaus River, San Joaquin River, Tuolumne River, Merced River, Chowchilla River, and several other streams, canals, and water bodies.

Conservation Plans
The BNSF Castle alignment alternative would not adversely impact areas identified in conservation plans.

UPRR-BNSF Castle Alignment Alternative

The UPRR-BNSF Castle alignment alternative could have direct impacts on 162.30 ac (65.68 ha) of agricultural lands, 50.85 ac (20.58 ha) of grasslands, 0.39 ac (0.16 ha) of montane hardwood, 4.71 ac (1.91 ha) of oak woodland/foothill pine, 0.53 ac (0.21 ha) of open waters, 0.09 ac (0.04 ha) of permanent freshwater marsh, 0.24 ac (0.1 ha) of riparian habitat, 1.13 ac (0.46 ha) of shrub lands, and 338.99 ac (137.18 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 11,468.80 ac (4,641.28 ha) of agricultural lands, 3,934.37 ac (1,592.19 ha) of grasslands, 93.65 ac (40.33 ha) of montane hardwood, 206.09 ac (83.40 ha) of oak and foothill pine woodlands, 48.52 ac (19.64 ha) of open waters, 8.21 ac (3.32 ha) of permanent freshwater wetlands, 28.32 ac (11.46 ha) of riparian habitats, 8.05 ac (3.26 ha) of seasonal wetlands, 53.76 ac (21.76 ha) of shrub lands, 12,879.80 ac (5,212.29 ha) of urban/other developed lands, and 0.15 ac (0.06 ha) of valley oak woodland.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment alternative are riparian, permanent freshwater marsh, permanent freshwater wetlands, oak woodlands, and seasonal wetlands.

Special-Status Plants

The UPRR-BNSF Castle alignment alternative could adversely affect the habitat of 22 special-status plant species (Table 3.15-1). Of the 22 species identified, 16 would the same as for the BNSF-UPRR alignment alternative.

Special-Status Wildlife

The UPRR-BNSF Castle alignment alternative could adversely affect the habitat of the same 22 special-status wildlife species as the BNSF-UPRR, BNSF, BNSF Castle, and UPRR-BNSF alignment alternatives. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors

Impacts on wildlife movement corridors would be the same as for the BNSF Castle alignment alternative.

Water Resources/Wetlands

This alignment alternative has the potential to directly impact approximately 7,790 ft (2,374 m) of potential nonwetland jurisdictional waters and approximately 2.4 ac (0.97 ha) of wetlands. Similar to the BNSF-UPRR alignment alternative, this alignment alternative crosses the Stanislaus River, San Joaquin River, Tuolumne River, Merced River, Chowchilla River, and several other streams, canals, and water bodies.

Conservation Plans

The UPRR-BNSF Castle alignment alternative would not adversely impact areas identified in conservation plans.

UPRR-BNSF Alignment Alternative

The UPRR-BNSF alignment alternative could have direct impacts on 98.74 ac (39.96 ha) of agricultural lands, 50.45 ac (20.42 ha) of grasslands, 0.61 ac (0.25 ha) of open waters, 0.01 ac (0.004 ha) of permanent freshwater marsh, 0.09 ac (0.04 ha) of riparian habitat, and 381.22 ac (154.27 ha) of urban/other developed lands. This alignment alternative could have indirect impacts on 9,621.45 ac (3,893.68 ha) of agricultural lands, 3,865.59 ac (1,564.36 ha) of grasslands, 2.32 ac (0.94 ha) of oak and foothill pine woodlands, 71.09 ac (28.77 ha) of open waters, 11.58 ac (4.69 ha) of permanent freshwater wetlands, 40.32 ac (16.32 ha) of riparian habitats, 10.66 ac (4.31 ha) of seasonal wetlands, 13,532.90 ac (5,476.59 ha) of urban/other developed lands, and 0.15 ac (0.06 ha) of valley oak woodland.

Sensitive Vegetation Communities

The sensitive vegetation communities in this alignment alternative are riparian, permanent freshwater marsh, permanent freshwater wetlands, oak woodlands, and seasonal wetlands.

Special-Status Plants

The UPRR-BNSF alignment alternative could adversely affect the habitat of 25 special-status plant species (Table 3.15-1). Of the 25 species identified, 19 would the same as for the BNSF-UPRR alignment alternative.

Special-Status Wildlife
The UPRR-BNSF alignment alternative could adversely affect the habitat of the same 22 special-status wildlife species as the BNSF-UPRR, BNSF, and BNSF Castle alignment alternatives. This alignment alternative also has the potential to impact marine/anadromous species.

Wildlife Movement Corridors
Impacts on wildlife movement corridors would be the same as for the BNSF Castle alignment alternative.

Water Resources/Wetlands
This alignment alternative has the potential to directly impact approximately 8,835 ft (2,693 m) of potential nonwetland jurisdictional waters and approximately 3.0 ac (1.21 ha) of wetlands. Similar to the BNSF-UPRR alignment alternative, this alignment alternative crosses the Stanislaus River, San Joaquin River, Tuolumne River, Merced River, Chowchilla River, and several other streams, canals, and water bodies.

Conservation Plans
The UPRR-BNSF alignment alternative would not adversely impact areas identified in conservation plans.

Central Valley Corridor Stations

- Modesto Downtown Station: This station location option could have direct impacts on 4.7 ac (1.9 ha) of urban/other developed lands and indirect impacts on 147 ac (59.49 ha) of urban/other developed lands. This station location option could impact one special-status wildlife species. Impacts on special-status plant species, waters, wetlands, and marine/anadromous species are not anticipated with this station location option.
- Amtrak Briggsmore Station: This station location option could have direct impacts on 1.7 ac (0.69 ha) of agricultural lands, 4 ac (1.62 ha) of grasslands, and 4.2 ac (1.7 ha) of urban/other developed lands. This station location option could have indirect impacts on 41 ac (16.59 ha) of agricultural lands, 81 ac (32.78 ha) of grasslands, and 115 ac (46.54 ha) of urban/other developed lands. Impacts on special-status plant and wildlife species, waters, wetlands, and marine/anadromous species are not anticipated with this station location option.
- Merced (Downtown) Station: This station location option could have direct impacts on 8.4 ac (3.4 ha) of urban/other developed lands and indirect impacts on 143 ac (57.87 ha) of urban/other developed lands. This station could impact one special-status wildlife species. Impacts on special-status plant species, waters, wetlands, and marine/anadromous species are not anticipated with this station location option.
- Castle AFB Station: This station location option could have direct impacts on 8.4 ac (3.4 ha) of agricultural lands, 1 ac (0.4 ha) of grasslands, and 3.3 ac (1.34 ha) of urban/other developed lands. This station location option could have indirect impacts on 150 ac (60.70 ha) of agricultural lands, 22 ac (8.9 ha) of grasslands, and 88 ac (35.61 ha) of urban/other developed lands. This station location option could impact 315 linear ft (96 m) of waters. Impacts on special-status plant and wildlife species, wetlands, and marine/anadromous species are not anticipated with this station location option.

Summary of Central Valley Corridor Impacts

Sensitive Vegetation Communities
Each of the alignment alternatives in this corridor would have similar sensitive vegetation communities, including riparian, permanent freshwater marsh, permanent freshwater wetlands, and seasonal wetlands. In addition, all of the alignment alternatives would also have oak woodlands, except for the BNSF-UPRR alignment alternative.

Special-Status Plants
The UPRR-BNSF alignment alternative would have the potential to impact the greatest number of special-status plants. The BNSF Castle alignment alternative would have the potential to impact the least number of special-status plants.

Special-Status Wildlife
The BNSF, BNSF-UPRR, BNSF Castle, UPRR-BNSF Castle, and UPRR-BNSF alignment alternatives all have the potential to impact the same special-status wildlife species, including San Joaquin kit fox. The UPRR N/S alignment alternative is the only alignment that does not have the potential to impact the San Joaquin kit fox.

Wildlife Corridor
All of the alignment alternatives in this corridor would bisect a major linkage corridor between the natural lands of the Sacramento Valley (GEA and associated wildlife refuges) and the natural lands along the eastern side of the San Joaquin Valley.

Water Resources
This corridor has the potential to directly impact between approximately 7,160 ft (2,182 m) and 10,530 ft (3,210 m) of potential nonwetland jurisdictional waters and between approximately 2.4 ac (0.97 ha) and 3.8 ac (1.54 ha) of wetlands.

Conservation Plans
None of the alignment alternatives in this corridor is anticipated to adversely impact areas identified in conservation plans.

3.15.4 Role of Design Practices in Avoiding and Minimizing Effects

The Authority is committed to pursuing agreements with existing owners/rail operators to place the HST alignment within existing rail rights-of-way, which would avoid or minimize potential impacts on biological resources. A large percentage of the HST system would be either within or adjacent to a major existing transportation corridor (existing railroad or highway right-of-way). These existing transportation corridors, along which the HST system would be placed, have already impacted biological resources, so additional impacts would be minimized. Moreover, portions of the HST system would be on aerial structures or in tunnels. A smaller portion of the HST system would be in new at-grade rail corridors (not on aerial structure or in tunnel) and not within or adjacent to an existing transportation right-of way). It is in these areas where there would be the greatest potential to impact biological resources. To lessen the effects on biological resources at these locations, culverts would be constructed at regular intervals to allow for the movement of wildlife species, such as San Joaquin kit fox, mountain lion, and deer. The alignment alternatives located in the mountain passes would include tunnels, which would avoid or substantially reduce surface impacts on sensitive biological resources, except at the tunnel portal areas. The HST system would be placed on bridges or elevated railways across water bodies or sensitive natural communities. The new bridges would replace older bridges whenever possible, and the new bridges would use materials and designs to minimize the number of piles/columns in the water. Additionally, the HST right-of-way width could also be reduced in constrained areas to minimize impacts on biological resources.

3.15.5 Mitigation Strategies and CEQA Significance Conclusions

Constructing the proposed HST has many environmental advantages over constructing a roadway in the same corridor, including the following.

- The track-bed is constructed so that water drains away, which maintains a dry environment that prevents unwanted vegetation from establishing.

- The track-bed has a porous, stable base that prevents runoff from concentrating, which keeps erosion to a minimum and filters out particulates and chemical pollutants.
- A service road, or other narrow access strip running alongside the track-bed, prevents spoils from shifting beyond the toe of the track-bed slope.
- Drainage ditches parallel to the track-bed prevent uncontrolled erosion, act as sediment traps, filter railway runoff, and insulate adjoining lands from uncontrolled channel flow.
- HST construction usually has a significantly smaller footprint than road construction.
- HST corridors are narrower than a road, so animals are more willing to cross under them.
- It is more feasible to elevate a HST system on a pile-supported structure than to elevate a road.

However, based on the analysis above, and considering the design practices described in Section 3.15.4, each of the HST Alignment Alternatives would have significant impacts on biological resources. Direct and indirect impacts on biological resources, including wetlands and other sensitive natural communities and special-status plant and wildlife species would be expected with each alignment alternative and at some of the station location options, although the extent of the impacts differs, as described in the text and Table 3.15-1.

The HST Alignment Alternatives could also pose a significant barrier to the movement of wildlife in areas where it severs wildlife movement corridors, such as those in the East Bay to Central Valley and the San Jose to Central Valley corridors.

The HST Alignment Alternatives could also conflict with conservation and restoration plans and special management areas.

At this programmatic level of analysis, it is not possible to know precisely the location, extent, and particular characteristics of biological resources that would be affected or the precise impacts on those resources. The impacts are therefore considered significant for each alignment alternative and all but 12 of the station location options. Mitigation strategies, as well as the design practices discussed above, would be implemented to reduce the impacts.

Mitigation of potentially major impacts on biological resources would be based first on avoidance. The strategy that would be followed early in the conceptual design stage of the project would be to avoid sensitive biological resources wherever feasible. Where potential impacts on biological resources are unavoidable, the strategy would focus on reducing the potential impact.

Resource agencies have expressed interest in helping to develop and participate in a mitigation planning and monitoring program to determine impacts and mitigation effectiveness for sensitive species in the lagoon areas. This approach could include site-specific baseline conditions, monitoring mitigation effectiveness as various HST elements are constructed, and adjusting mitigation measures as needed based on effectiveness and compatibility with lagoon restoration programs.

Because specific biological resource impacts cannot be predicted with certainty at this program level of analysis, specific mitigation measures also cannot be developed at this time. However, mitigation strategies are described below from which specific mitigation measures can be developed once the extent of direct and indirect biological resource impacts has been determined at the project level.

The following mitigation strategies would be applied at the project level for potential impacts on biological resources, when such strategies where appropriate and feasible, as determined by project-level analysis.

- Plant Communities: Mitigation strategies for affected plant communities include construction monitoring, onsite and/or offsite revegetation/restoration, and purchase of credits from an existing mitigation bank. Mitigation ratios will vary, depending on the quality of the plant community affected and whether it provides habitat for sensitive plant or wildlife species. Regulatory agencies will be consulted to determine appropriate mitigation ratios. Onsite mitigation will be preferred to offsite mitigation whenever possible. Offsite mitigation will be located in the same watershed or in proximity to the impact area, where feasible.

- Biological Resources Management Plans: Biological Resources Management Plans (BRMP) specify the design and implementation of biological resources mitigation measures, including habitat replacement and revegetation, protection during construction, performance (growth) standards, maintenance criteria, and monitoring requirements. The USFWS, CDFG, and USACE will review draft BRMPs.

  The primary goal of a BRMP is to ensure the long-term perpetuation of the existing diversity of habitats in the project area and adjacent urban interface zones. BRMPs will contain the following information.

  a. Specific measures for the protection of sensitive amphibian, mammal, bird, and plant species during construction.

  b. Identification and quantification of habitats to be removed, along with the locations where these habitats are to be restored or relocated.

  c. Procedures for vegetation analyses of adjacent protected habitats to approximate their relative composition, site preparation (clearing, grading, weed eradication, soil amendment, topsoil storage), irrigation, planting (container plantings, seeding), and maintenance (weed control, irrigation system checks, replanting). This information will be used to determine the requirements of the revegetation areas.

  d. Sources of plant materials and methods of propagation.

  e. Specific parameters for the determination of the amount of replacement habitat for temporary disturbance areas.

  f. Specification of parameters for maintenance and monitoring of re-established habitats, including weed control measures, frequency of field checks, and monitoring reports for temporary disturbance areas.

  g. Specification of performance standards for growth of re-established plant communities and cut-and-fill slopes.

  h. Remedial measures to be taken if performance standards are not met.

  i. Methodologies and requirements for monitoring of the restoration/replacement efforts.

  j. Measures to preserve topsoil and control erosion control.

  k. Design of protective fencing around environmentally sensitive areas (ESAs) and the construction staging areas.

  l. Specification of location and quantities of gallinaceous guzzlers (catch basin/artificial watering structures, if needed); specification of monitoring of water levels in guzzlers.

  m. Location of trees to be protected as wildlife habitat (roosting sites) and locations for planting of replacement trees.

  n. Specification of the purpose, type, frequency, and extent of chemical use for insect and disease control operations as part of vegetative maintenance within sensitive habitat areas.

o. Specific construction monitoring programs for sensitive species.

p. Specific measures for the protection of sensitive habitats to be preserved. These measures may include (i.e., are not limited to) erosion and siltation control measures, protective fencing guidelines, dust control measures, grading techniques, construction area limits, and biological monitoring requirements.

q. Provisions for biological monitoring during construction activities to ensure compliance and success of protective measures. The monitoring procedures would (1) identify specific locations of wildlife habitat and sensitive species to be monitored, (2) identify the frequency of monitoring and the monitoring methodology (for each habitat and sensitive species to be monitored), (3) list required qualifications of biological monitor(s), and (4) identify reporting requirements.

- Sensitive Plant Species: Mitigation strategies for sensitive plant communities include preconstruction focused surveys, construction monitoring, relocation of plants, seed collection, plant propagation, outplanting to a suitable mitigation site, and participation in an existing HCP. Prior to construction, focused surveys will be conducted for sensitive plant species identified as occurring in the study area. Locations of sensitive plant species observed will be mapped on construction drawings. Research must be conducted on appropriate methods to use on a species-by-species basis. Some plant species may require transplantation, whereas others may germinate from seed, and still others may need to be propagated in a greenhouse prior to planting on an appropriate mitigation site. Also, see reference to BRMP, above.
- Weed Prevention: Specific mitigation measures will be developed to minimize or avoid the spread of weeds during construction and operation. Preventive measures during construction include identification of areas with existing weed problems and measures to control traffic moving out of those areas (e.g., cleaning construction vehicles, limiting movement of fill). Mitigation for operational impacts would also be developed.
- Sensitive Wildlife Species: Mitigation strategies for sensitive wildlife species include preconstruction focused surveys, construction monitoring, restoration of suitable breeding and foraging habitat, purchase of credits from an existing mitigation bank, and participation in an existing HCP. Prior to construction, focused surveys will be conducted for sensitive wildlife species identified as occurring in the study area. Locations of sensitive wildlife species observed will be mapped on construction drawings. Construction could be phased around the breeding season for sensitive wildlife species. Also, see reference to BRMP, above.
- Wildlife Movement/Migration Corridors: Wildlife crossings would be of a design, shape, and size to be sufficiently attractive to encourage wildlife use. Overcrossings and undercrossings for wildlife would be appropriately vegetated to afford cover and other species requirements. Functional corridors would be established to provide connectivity to protected land zoned for uses that provide wildlife permeability. The following process would be used in design of corridors:
  - Identify the habitat areas the corridor is designed to connect.
  - Select several species of interest from the species present in these areas.
  - Evaluate the relevant needs of each selected species.
  - For each potential corridor, evaluate how the area will accommodate movement by each selected species.
  - Draw the corridors on a map.
  - Design a monitoring program.
- Jurisdictional Waters and Wetlands: The amount of mitigation required will be assessed on an acreage basis, with ratios depending on the nature and condition of the jurisdictional areas

located in the impact areas. When appropriate, onsite mitigation will be preferred. Offsite mitigation will be located in the same watershed or as close to the area of impact as possible. Mitigation options for unavoidable impacts on state and federal jurisdictional waters will include onsite or offsite restoration, creation, or enhancement; mitigation banking; or in-lieu fee payments, as described below.

- Restoration—To return degraded habitat to a preexisting condition.
- Creation—To convert a persistent nonwetland habitat into wetland (or other aquatic) habitat. The created habitat may be self-sustaining or dependent on artificial irrigation.
- Enhancement—To increase one or more functions through activities, such as planting or eradicating nonnative vegetation.
- Passive Revegetation—To allow a disturbed area to naturally revegetate without plantings.
- Mitigation banking—To purchase units of wetland or waters habitat that have been restored or enhanced in a larger managed conservation area. The units are typically known as *credits* and are usually sold on an acreage basis.
- In-Lieu Fee Program—A monetary payment made to an agency-approved entity that provides habitat conservation or restoration. For instance, the Nature Conservancy may receive in-lieu fee payments for impacts in all watersheds.

Current federal and state policy emphasizes a "no net loss" of wetlands habitats policy, which is usually achieved through restoration of areas subject to temporary impacts or creation of wetlands to offset permanent impacts. However, the January 27, 2003, Special Public Notice for Mitigation and Monitoring Guidelines states that the USACE favors the use of approved mitigation banks or in-lieu fee programs in cases where they result in more regional or watershed benefit than onsite compensatory mitigation. Approved mitigation and in-lieu fee programs would include measures that ensure the no net loss of wetlands policy is met.

Site-specific impacts would need to be assessed and evaluated in a project-level environmental review, and specific mitigation measures for impacts on biological resources would be considered, such as preparing a wetland delineation; compensating for impacts on wetlands; conducting protocol-level surveys for listed species, surveys for nesting birds, and species-specific surveys; and compensating for temporary and permanent impacts on listed species. Site-specific mitigation measures will be developed through consultation with state and federally resource agencies. During project-level review, where the agencies determine that mitigation is required to address site-specific impacts from the HST system, one strategy may be to purchase easements to preserve habitat for sensitive biological resources. The Authority will coordinate with private land preservation trusts, local programs, and mitigation banks to help identify needs for habitat protection. The Authority will also coordinate with resource agencies to identify additional measures to limit impacts on, or otherwise protect, biological resources.

The feasibility of any mitigation strategy would have to be evaluated at the project-specific level and would depend on such factors as an assessment of the habitat impacted, the number of voluntary participants in local or regional programs, and the cost of acquiring easements. Possible mitigation strategies for severance of wildlife movement corridors could include alternative access, HST realignment, or overcrossings at select locations.

The above mitigation strategies are expected to substantially lessen or avoid impacts on biological resources in many circumstances. Sufficient information is not available at this programmatic level, however, to conclude with certainty that the above mitigation strategies will reduce impacts on biological resources to a less-than-significant level in all circumstances. This document, therefore, concludes that impacts on biological resources would remain significant, even with the application of mitigation strategies. Additional environmental assessment will allow a more precise evaluation in the second-tier project-level analysis.

As indicated earlier, the above analysis does not provide a parcel-specific potential impact analysis for impacts on biological resources. Subsequent project-level analysis would address local issues once the potential alignment alternatives are defined in more detail. Subsequent project-level environmental documentation would include more detailed information on existing habitat conditions, the presence/absence of special-status plant and wildlife species, the presence of sensitive natural communities, and the acreage of wetlands affected.

In order to address the impacts of the project on the unique assemblage of migratory birds, sensitive species, wetlands and habitat values within the approximately 240,000 ac (97,125 ha) designated as the GEA, this Final EIR/EIS indicates that certain measures are necessary to mitigate impacts identified at the program-level and the Authority would commit to the measures listed below in its decision documents. These measures have also been developed to address the following goals:

- Satisfy the future requirements of the resource agencies (e.g., USFWS, CDFG, and USACE) at the project level to offset impacts to wetlands, sensitive plant and animal species, and other biological resources in and around the GEA;
- Anticipate future pressures for growth in and around the GEA and provide a mechanism to prevent further impacts by forestalling that growth and preserving the habitat and scenic open space values in and around the GEA; and
- Provide assurance that project-level impacts on the GEA will be evaluated at the appropriate level of detail in the project-level EIR/EIS.

The following specific measures are necessary to mitigate program level impacts:

a. An appropriate field survey of biological resources within areas of the GEA directly affected by proposed HST tracks or facilities, including San Joaquin kit fox, giant garter snake and important waterfowl nesting and breeding habitat to be included in the project-level environmental analysis.

b. Project-level evaluation of the potential impacts to biological resources in the GEA from HST construction, operation and maintenance, including, but not limited to, ecosystem fragmentation impacts, impacts to wildlife movement corridors, impacts to waterfowl flight patterns, noise impacts, startle and vibration impacts, collision impacts, electrocution impacts, glare impacts, water quality and water flow impacts, impacts on waterfowl nesting and breeding, impacts on migratory habits, impacts from construction traffic, impacts of equipment storage and laydown areas, impacts from blasting and pile-driving, and impacts from temporary disruption of water supply deliveries.

c. Minimize the footprint of necessary HST facilities to the extent feasible in the HST alignment crossing the GEA.

d. In consultation with the CDFG, the USFWS, and the Grassland Water District, an evaluation in the project-level environmental analysis of the timing of construction activities within the GEA and measures to minimize disturbance during nesting and flooding seasons.

e. In consultation with the CDFG, the USFWS, and the Grassland Water District, an evaluation in the project level environmental analysis of non-glare and directed lighting and appropriate measures to avoid disturbance impacts to sensitive species in areas of the GEA directly affected by proposed HST facilities.

f. Acquisition from willing sellers by the Authority, or by other entities designated and supported by the Authority, of agricultural, conservation and/or open space easements encompassing at least 10,000 ac (4,047 ha) and generally located along or in the vicinity of the HST alignment and within or adjacent to the designated GEA. This measure would reduce impacts to and support conservation of wetlands and sensitive ecological areas, as well as limit urban encroachment in the vicinity of the HST through the GEA. The focus for these easements would be in areas undergoing development pressures, such as the areas around Los Banos and Volta, and/or areas that would be most appropriate for ecological conservation or restoration. The eventual locations and total acreage for these easements would be determined in conjunction with the project-level environmental analysis and decisions addressing the Gilroy to Merced portion of the HST system and in consultation with the CDFG, the USFWS, and the Grassland Water District.

3.16 Section 4(f) and 6(f) Resources (Public Parks and Recreation)

Section 4(f) and 6(f) resources analyzed in this Program EIR/EIS include publicly owned parklands, recreation lands, wildlife and waterfowl refuges, and historic sites that are covered by Section 4(f) of the DOT Act of 1966 and Section 6(f) of the Land and Water Conservation Fund Act of 1965. This section describes the existing Section 4(f) and 6(f) resources within the Bay Area to Central Valley region and identifies the potential uses of and potential impacts on Section 4(f) and 6(f) resources for each alignment alternative[1]. In this program-level environmental document, the potential uses of Section 4(f) and 6(f) resources are identified and compared for the alignment alternatives being considered, while detailed evaluation is deferred to future project-level environmental analyses, when site-specific information would be available for project alignment alternatives and station location options. See Section 3.12 also for analysis of historic and archaeological resources. See Chapter 7 for information on Network Alternatives.

3.16.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY PROVISIONS

Section 4(f)

Federal law 49 USC § 303, formerly Section 4(f) of DOT Act of 1966 (49 USC § 303), states the following:

(a) It is the policy of the United States government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites.

(b) The Secretary of Transportation shall cooperate and consult with the Secretaries of the Interior, Housing and Urban Development, and Agriculture, and with the States, in developing transportation plans and programs that include measures to maintain or enhance the natural beauty of lands crossed by transportation activities or facilities.

(c) The Secretary may approve a transportation program or project (other than any project for a park road or parkway under Section 204 of Title 23) requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site) only if--

(1) there is no prudent and feasible alternative to using that land; and

(2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use.

Implementing regulations recently issued by the FHWA and FTA describe the appropriate documentation of Section 4(f) in a programmatic (Tier I) EIS: "When the first-tier, broad-scale EIS is prepared, the detailed information necessary to complete the Section 4(f) approval may not be available at that stage in the development of the action. In such cases, the documentation should address the potential impacts that a proposed action will have on Section 4(f) property and whether those impacts could have a bearing on the decision to be made." [23 CFR 774.7(e)(1)]

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

Similarly, CEQA requires agencies to consider the impacts of projects on parks and recreational resources and California law requires a state agency that proposes a project which may result in adverse effects on historical resources listed or eligible for listing in the NRHP or the CRHR to consult with the State Historic Preservation Office and to identify feasible and prudent measures that would eliminate or mitigate the adverse effects (California Public Resources Code §§ 5024 and 5024.5; CEQA Guidelines § 15064.5, and Appendix G.)

Section 6(f)

State and local governments often obtain grants through the Land and Water Conservation Fund Act to acquire or make improvements to parks and recreation areas (16 U.S.C. §§ 460-4 through 460-11, September 3, 1964, as amended 1965, 1968, 1970, 1972–1974, 1976–1981, 1983, 1986, 1987, 1990, 1991, 1993–1996). Section 6(f) of the act prohibits the conversion of property acquired or developed with these grants to a nonrecreational purpose without the approval of the U.S. Department of the Interior's (DOI's) National Park Service. Section 6(f) directs DOI to ensure that replacement lands of equal value (monetary), location, and usefulness are provided as conditions to such conversions. Consequently, where such conversions of Section 6(f) lands are proposed for transportation projects, replacement lands must be provided.

California statutes similarly require replacement lands. The California Public Park Preservation Act of 1971 (California Public Resources Code § 5400 *et seq.)* provides that a public agency that acquires public parkland for nonpark use must either pay compensation that is sufficient to acquire substantially equivalent substitute parkland or provide substitute parkland of comparable characteristics.

B. METHOD OF EVALUATION OF IMPACTS

This program-level evaluation of potential impacts on Section 4(f) and 6(f) resources focuses on identifying existing historical, cultural, parkland, and wildlife resources, and potential uses of and impacts on these resources under the No Project and HST alternatives. The goal at this tier of environmental analysis is to identify Section 4(f) and 6(f) resources on or close to the proposed HST Alignment Alternatives and to assess the relative differences in potential impacts of the alignment alternatives on these resources. At this stage of environmental review, it is not practical to study or measure the severity of each potential impact identified. No fieldwork was conducted as part of this analysis, and no Section 4(f) determination is practical or required for this Program EIR/EIS. At the conclusion of this program environmental process, corridor alignments and station locations may be selected for further design and environmental review; however, no construction and therefore no uses of Section 4(f) and 6(f) resources will be approved. In subsequent project-level analysis, Section 4(f) and 6(f) resources, potential uses and impacts, and appropriate avoidance and mitigation measures would be evaluated in detail and determinations made.

Various sources were consulted to identify potential resources in each corridor, including available databases, studies, and other documents. These documents are listed in the references chapter of this document. To identify and quantify the potential impacts by resource type, the improvements included under each alignment alternative (HST Alignment Alternatives and HST station location options) were overlaid on available databases and maps. Two types of potential impacts on Section 4(f) and 6(f) resources were identified: direct and proximity.

- Direct Impact: A physical feature of a proposed improvement would directly intersect with a portion or all of the resource and require the use of property from that resource.
- Proximity Impact: A physical feature of a proposed improvement has the potential to impact the resource as a result of its proximity to the resource.

Potential impacts were assigned a qualitative ranking of high, medium, or low based on the proximity of the resource to the centerline of the proposed improvement. The rankings are summarized in Table 3.16-1.

Table 3.16-1
Rankings for Potential Direct and Proximity Impacts
on Section 4(f) and 6(f) Resources

Ranking	Distance of Resource from Alignment Centerline	Potential Impact
High	0 to 150 ft (0 to 46 m)	Direct
Medium	150 to 450 ft (46 to 137 m)	Proximity
Low	450 to 900 ft (137 to 274 m)	Proximity

Potential uses of historical sites under Section 4(f) and 6(f) were assigned a qualitative ranking of high, medium, or low. This is based on the total number of sites within the APE of each alignment alternative being divided by the total length of the alignment alternative being evaluated to arrive at an average number of sites (or proportion of sites) per mile. The APE is defined in Section 3.12, "Cultural Resources and Paleontological Resources."

That average was then translated to the qualitative rankings of high, medium, or low impacts as follows:

- Low: 0.00-0.25 sites per mile.
- Medium: 0.26-0.75 sites per mile.
- High: More than 0.76 sites per mile.

3.16.2 Affected Environment

A. STUDY AREA DEFINED

The study area for the analysis of Section 4(f) and 6(f) resources encompasses the area within 900 ft (274 m) on either side of the centerline of each alignment alternative and within a 900 ft (274 m) radius of the stations for each alternative.

Because the proposed HST system would cross urbanized, developed, and rural areas, a variety of Section 4(f) and 6(f) resources could be affected. The proposed HST alignment alternatives were developed with the intent of avoiding these resources to the extent feasible. However, there are potential locations within the proposed HST system where Section 4(f) and 6(f) resources would not be avoided. These are discussed in the environmental consequences section below.

B. GENERAL DESCRIPTION OF SECTION 4(f) AND 6(f) RESOURCES

Section 4(f) and 6(f) resources refer to publicly owned lands of a park, recreation area, or wildlife and waterfowl refuge or to land of a historical site of national, state, or local significance (as determined by the federal, state, regional, or local officials having jurisdiction over the park, recreation area, refuge, or site).

Historically, urban and suburban development follows the establishment of transportation corridors and facilities. In California in the late nineteenth and early twentieth centuries, most cities formed around ports and rail lines, the primary modes for transporting people and goods. After World War II, in the early 1950s, highways and the automobile became the dominant mode of transportation, bringing urban and suburban development to areas along highways that were formerly farm-to-market roads connecting rural areas to cities.

The location and identification of Section 4(f) and 6(f) resources reflect this historic transportation corridor and urban development pattern. Today, in the urban areas that developed around the railroads at the turn of the century, there is a high concentration of historical resources. In many California cities, the railroad station is one of the oldest historical resources in the city. In the suburban and rural areas where development followed highways, some open space and natural areas have been preserved as public parks. In addition to these passive park[2] areas, new public parks and playgrounds have been built as part of residential developments. All of these historical resources and public parks are considered potential Section 4(f) and 6(f) resources. Therefore, in urban areas, an alternative would be more likely to affect historical and archeological resources, while in suburban, wilderness, or remote areas (e.g., mountain crossings), an alternative would be more likely to affect public parks and recreation lands and wildlife and waterfowl refuges.

Section 4(f) and 6(f) Resources by Corridor

The most significant Section 4(f) and 6(f) resources in each region (except historical and archaeological resources) are identified below. (See Section 3.12, “Cultural Resources and Paleontological Resources,” for information on historical and archeological resources.)

San Francisco to San Jose Corridor

This corridor extends from the areas on the west side of the San Francisco Bay along the Caltrain rail line from the City of San Francisco to the City of San Jose. This corridor contains a wide variety of Section 4(f) and 6(f) resources, including the San Bruno Mountain State and County Park and many local parks and playgrounds. The historic rail stations in Burlingame, Santa Clara, and San Jose typify many of the historical resources that can be found throughout the corridor.

Oakland to San Jose Corridor

This corridor extends from the areas on the east side of the San Francisco Bay along I-880 and an existing UPRR alignment from the City of Oakland to the City of San Jose. A number of 4(f) and 6(f) resources are contained within the corridor, including regional parks and many local parks. The historic downtown district in the City of Oakland typifies the historical resources that can be found throughout the corridor.

San Jose to Central Valley Corridor

The San Jose to Central Valley corridor includes the areas from the City of San Jose south to the City of Gilroy and east across the Diablo Range to the Central Valley. Section 4(f) resources within this corridor are found to the west along the Pacheco alignment alternative and include many local parks within the San Jose and Morgan Hill city limits and historical resources such as the historic rail station in the City of Gilroy. The resources include Henry Coe State Park, Great Valley Grasslands State Park, Upper Cottonwood Creek Wildlife Area, and the Los Banos Wildlife Area. There are no Section 6(f) resources within the study area of this corridor.

East Bay to Central Valley Corridor

This corridor includes the areas from the City of Fremont east through Niles Canyon and into the cities of Pleasanton, Dublin, and Livermore. East of the City of Livermore, the alignment alternatives in this corridor continue through the Altamont Pass and into the Central Valley via the cities of Tracy and Manteca. A number of 4(f) and 6(f) resources are contained within the corridor, including regional parks and trails (Pleasanton Ridge, Vargas Plateau, and Shadow Cliffs), public golf courses (Las Positas and Springtown), and a number of local parks.

[2] *Passive park* refers to a park that is used for picnicking or passive water sports; it also describes zoos and arboretums. An *active park* is a park that includes facilities such as children’s play equipment, playing fields, tennis or basketball courts, etc.

San Francisco Bay Crossings

These crossing alternatives include the San Francisco Bay crossings between the cities of San Francisco and Oakland near the San Francisco/Oakland Bay Bridge and between the cities of East Palo Alto and Newark south of the Dumbarton Bridge and into the City of Fremont. Section 4(f) resources (there are no Section 6(f) resources within this alignment alternative) are contained within the corridor, including one prominent national park (Don Edwards San Francisco Bay National Wildlife Refuge), a regional park (Quarry Lakes Regional Park), and many local parks.

Central Valley Corridor

The Central Valley corridor includes the areas of the Central Valley from the City of Stockton south to the northern areas of Madera County. There are two alignment alternatives within the Central Valley corridor that traverse along the existing UPRR and BNSF rail lines. A number of 4(f) resources are contained within the corridor, including two regional parks (Tuolumne River Regional Park and Jacob Meyer Regional Park), the Stanislaus County Fairgrounds, and numerous local parks.

3.16.3 Environmental Consequences

A. NO PROJECT ALTERNATIVE

The existing conditions are based on transportation infrastructure that was identified as part of the alternatives definition process. The No Project Alternative is based on existing conditions and the funded and programmed transportation improvements that are projected to be developed and in operation by 2030. It is not possible as part of this study to identify or quantify the potential uses and impacts expected to occur by 2030 with implementation of the No Project Alternative. Rather, it is assumed that the improvements to be developed and implemented under the No Project Alternative would undergo typical design and construction practices that would avoid or greatly limit potential impacts. Additionally, each improvement associated with the No Project Alternative would be subject to a project-level environmental document that would identify potential uses and impacts, as well as measures to avoid, minimize, or mitigate the impacts. Although it is expected that there may be additional changes in conditions by 2030, it would speculative to attempt to estimate or quantify such changes. Thus, no additional impacts beyond the existing conditions are quantified under the No Project Alternative.

B. HIGH-SPEED TRAIN ALIGNMENT ALTERNATIVES

Table 3.16-2 summarizes the number of potential high impacts as identified in Section 3.16.1B on Section 4(f) and 6(f) resources by corridor.

Table 3.16-2
Number of Potential High Impacts on Section 4(f) and 6(f) Resources by Corridor

Corridor	Potential High Impacts on Section 4(f) Resources	Potential High Impacts on Section 6(f) Resources	Total Potential High Impacts
San Francisco to San Jose	6	0	6
Oakland to San Jose	10–11	2–4	12–15
San Jose to Central Valley	5–6	0	5–6
East Bay to Central Valley	4–6	1	5–7
San Francisco Bay Crossings	0–4	0	0–4
Central Valley	4–6	0	4–6

Source: Parsons 2007.

C. COMPARISON OF ALTERNATIVES BY CORRIDOR

This section outlines the potential impacts of the HST on Section 4(f) and 6(f) resources by alignment alternative. Differences in potential impacts between HST alignment alternatives are also discussed. Appendix 3.16-A provides summary tables showing a more detailed comparison of the different alternatives and their potential impacts on Section 4(f) and 6(f) resources. Table 3.16-3 provides the number of resources by corridor and alignment alternative for each rating category (H, M, L). The number of historical resources within 900 ft (274 m) of the proposed alignment alternative and its sensitivity rating (H, M, L) is also listed in Table 3.16-3. Publically owned lands near the HST alignment are shown in Figure 3.16-1.

Table 3.16-3
Summary of Potential Impacts on Section 4(f) and 6(f) Resources

Corridor	Possible Alignments	Alignment Alternative	Section 4(f) Parks/ Recreational Resources (H,M,L)	Section 6(f) Water Conservation Fund Properties	Known Historical Resources Within 500 Feet of Centerline and Overall Ranking of Alignment Alternative (H,M,L)
San Francisco to San Jose: Caltrain	1 of 1	San Francisco to Dumbarton	4-H, 8-M, 5-L	0-H, 0-M, 2-L	51 – H
	1 of 1	Dumbarton to San Jose	6-H, 4-M, 3-L	0-H, 0-M, 1-L	34 – H
Station Location Options					
Transbay Transit Center			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – H
4th and King (Caltrain)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – H
Millbrae/SFO			0-H, 0-M, 0-L	0-H, 0-M, 0-L	1 – H
Redwood City (Caltrain)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
Palo Alto (Caltrain)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	1 – M
Oakland to San Jose: Niles/I-880	1 of 2	West Oakland to Niles Junction	5-H, 9-M, 3-L	1-H, 1-M, 1-L	24 – M-L
		12th Street/City Center to Niles Junction	6-H, 8-M, 5-L	2-H, 0-M, 2-L	32 – H
	1 of 2	Niles Junction to San Jose via Trimble	5-H, 1-M, 2-L	2-H, 0-M, 0-L	31 – H
		Niles Junction to San Jose via I-880	5-H, 1-M, 1-L	1-H, 0-M, 0-L	4 – L
Station Location Options					
West Oakland/7th Street			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
12th Street/City Center			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – M
Coliseum/Airport			0-H, 1-M, 0-L	0-H, 0-M, 0-L	0 – L
Union City (BART)			0-H, 1-M, 0-L	0-H, 0-M, 0-L	0 – L

U.S. Department of Transportation Federal Railroad Administration

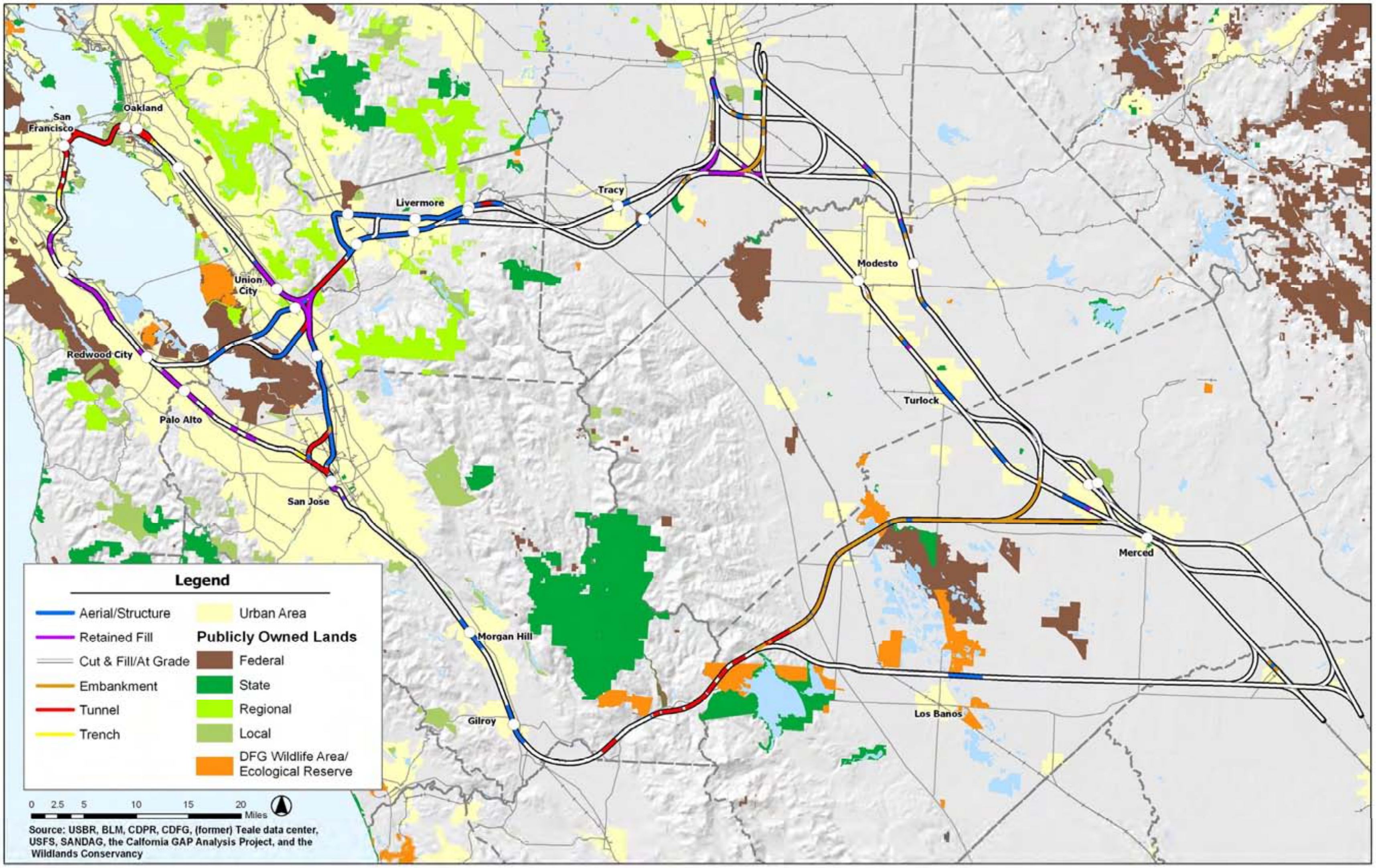


Figure 3.16-1
Publicly Owned Lands

Corridor	Possible Alignments	Alignment Alternative	Section 4(f) Parks/ Recreational Resources (H,M,L)	Section 6(f) Water Conservation Fund Properties	Known Historical Resources Within 500 Feet of Centerline and Overall Ranking of Alignment Alternative (H,M,L)
Fremont (Warm Springs)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
San Jose to Central Valley: Pacheco Pass	1 of 1	Pacheco	3-H, 1-M, 4-L	0-H, 0-M, 1-L	11 – M
	1 of 3	Henry Miller (UPRR Connection)	2-H, 0-M, 0-L	0-H, 0-M, 0-L	5 – M
		Henry Miller (BNSF Connection)	2-H, 0-M, 0-L	0-H, 0-M, 0-L	5 – M
		GEA North	3-H, 0-M, 0-L	0-H, 0-M, 0-L	9 – M
San Jose (Diridon)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	1 – M
Morgan Hill (Caltrain)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
Gilroy (Caltrain)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
East Bay to Central Valley: Altamont Pass	1 of 4	I-680/ 580/UPRR	6-H, 3-M, 2-L	1-H, 0-M, 1-L	20 – M
		I-580/ UPRR	4-H, 4-M, 0-L	1-H, 0-M, 0-L	17 – M
		Patterson Pass/UPRR	4-H, 5-M, 1-L	1-H, 0-M, 0-L	6 – L
		UPRR	4-H, 5-M, 1-L	1-H, 0-M, 0-L	6 – L
	1 of 4	Tracy Downtown (BNSF Connection)	0-H, 2-M, 5-L	0-H, 0-M, 0-L	14 – L
		Tracy ACE Station (BNSF Connection)	0-H, 2-M, 0-L	0-H, 0-M, 0-L	15 – L
		Tracy ACE Station (UPRR Connection)	0-H, 2-M, 0-L	0-H, 0-M, 0-L	12 – L
		Tracy Downtown (UPRR Connection)	0-H, 2-M, 5-L	0-H, 0-M, 0-L	11 – L
	2 of 2	East Bay Connections	1-H, 2-M, 0-L	0-H, 0-M, 0-L	0 – L
Station Location Options					
Pleasanton (I-680/Bernal Rd)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
Pleasanton (BART)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
Livermore (Downtown)			0-H, 0-M, 4-L	0-H, 0-M, 0-L	0 – L
Livermore (I-580)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L

Corridor	Possible Alignments	Alignment Alternative	Section 4(f) Parks/ Recreational Resources (H,M,L)	Section 6(f) Water Conservation Fund Properties	Known Historical Resources Within 500 Feet of Centerline and Overall Ranking of Alignment Alternative (H,M,L)
Livermore (Greenville Road/UPRR)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
Livermore (Greenville Road/I-580)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
Tracy (Downtown)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
Tracy (ACE)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
San Francisco Bay Crossings	1 of 2	Trans Bay Crossing – Transbay Transit Center	1-H, 0-M, 0-L	0-H, 0-M, 0-L	3 – L
		Trans Bay Crossing – 4th & King	0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
	1 of 6	Dumbarton (High Bridge)	4-H, 1-M, 3-L	0-H, 0-M, 0-L	0 – L
		Dumbarton (Low Bridge)	4-H, 1-M, 3-L	0-H, 0-M, 0-L	0 – L
		Dumbarton (Tube)	4-H, 1-M, 3-L	0-H, 0-M, 0-L	0 – L
		Fremont Central Park (High Bridge)	5-H, 1-M, 0-L	0-H, 0-M, 0-L	0 – L
		Fremont Central Park (Low Bridge)	5-H, 1-M, 0-L	0-H, 0-M, 0-L	0 – L
		Fremont Central Park (Tube)	5-H, 1-M, 0-L	0-H, 0-M, 0-L	0 – L
Station Location Options					
Union City (Shinn)			0-H, 1-M, 0-L	0-H, 0-M, 1-L	0 – L
Central Valley	1 of 6	BNSF – UPRR	3-H, 7-M, 2-L	0-H, 0-M, 0-L	28 – L
		BNSF	3-H, 7-M, 2-L	0-H, 0-M, 0-L	17 – L
		UPRR N/S	5-H, 5-M, 2-L	1-H, 0-M, 0-L	67 – M
		BNSF Castle	3-H, 7-M, 2-L	0-H, 0-M, 0-L	21 – L
		UPRR – BNSF Castle	5-H, 5-M, 2-L	1-H, 0-M, 0-L	24 – M
		UPRR – BNSF	5-H, 5-M, 2-L	1-H, 0-M, 0-L	31 – M
Station Location Options					
Modesto (Downtown)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – M
Briggsmore (Amtrak)			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L
Merced (Downtown)			0-H, 0-M, 1-L	0-H, 0-M, 0-L	0 – M
Castle AFB			0-H, 0-M, 0-L	0-H, 0-M, 0-L	0 – L

D. SAN FRANCISCO TO SAN JOSE CORRIDOR

Parkland and Wildlife Refuges

San Francisco to Dumbarton Alignment Alternative

This alignment alternative contains a variety of Section 4(f) and 6(f) resources, including approximately 17 local parks within 900 ft (274 m) that could be affected. This alignment alternative could directly impact up to five Section 4(f) and 6(f) resources within 150 ft (46 m).

Dumbarton to San Jose Alignment Alternative

Within the Dumbarton to San Jose alignment alternative, there are a variety of Section 4(f) and 6(f) resources, including approximately 13 regional and local parks within 900 ft (274 m) of the HST alignment. Approximately three 4(f) resources adjacent to the corridor could be directly affected by the Dumbarton to San Jose alignment alternative.

This alignment alternative would be in the existing railroad corridor as it passes most of these resources between the cities of San Francisco and San Jose, and it is not likely to have a significant impact on 4(f) or 6(f) resources.

Cultural Resources

San Francisco to Dumbarton Alignment Alternative

This alignment alternative has a high density of cultural resources within the city of San Francisco. In total, there are 16 archaeological resources and 35 recorded architectural resources. The area has been developed since the 1850s and therefore is rich in historical architecture as well as archaeological sites. The majority of prehistoric sites are shell middens, and many of the historical sites are deposits from various activities dating from the late 1800s as well as the earthquake in 1906. The alignment alternative in San Francisco goes through numerous historic districts, including the 2nd Street District, the Aronson District, and the Rincon Point/South Beach District. This portion of the alignment alternative includes the 1925 Army-Navy YMCA building, the 1950 Sailors Union of the Pacific building, the 1910 Commercial Block Building, the 1937 Metropolitan Electric building, the World War II era 3rd Street Retail Office Building, the China Basin Warehouse (ca. 1892), the Coal Gasification Facility (ca. 1900), and the Burlingame Commercial Building (ca. 1920s). This portion also contains the 1939 Transbay Terminal. The historic Transbay Terminal will be replaced with a new structure as part of the new Transbay Transit Center sometime between 2008 and 2014. This alignment alternative has a high sensitivity for prehistoric, historical, and architectural resources. No traditional cultural properties were identified within the APE.

Dumbarton to San Jose Alignment Alternative

This alignment alternative has a low density of previously recorded cultural resources until it reaches San Jose, where it has a high density of cultural resources. A total of 10 archaeological resources and 24 architectural resources are located within the APE. These include a 1927 commercial building, the 1941 Silver Springs Underpass, the 1898 Sunol Aqueduct, the 1861 Sanborn/Bunting House, segments of the San Francisco and San Jose Railroad (ca.1860s), and recorded residential properties from the 1890s to the 1940s. The alignment alternative also contains additional historic structures including the city of Mountain View adobe (ca. 1933), the FMC complex in San Jose (ca. 1948), the Union Pacific Rail yard Complex (ca. 1925), and recorded residential buildings dated from the 1880s to the 1940s. One archaeological site in San Jose, the Santa Clara de Asis Mission, includes both prehistoric and historic resources. The Mission was built by the Spanish in the late eighteenth century in order to convert local Native Americans to Christianity. Many of the neophyte converts lived in villages on the perimeter of the mission complex resulting in a mix of historical and prehistoric archaeological deposits, including burials. The portion of the Dumbarton to San Jose alignment alternative that traverses San Jose has a high sensitivity for prehistoric, historical, and architectural resources. No traditional cultural properties were identified within the APE.

San Francisco to San Jose Corridor Station Location Options

Two of the station location options have recorded cultural resources that are within the APE. Millbrae Train Station was built in 1907 after a fire that destroyed the original station built in 1864. It is now a railroad museum located approximately 200 ft from the modern train station. The Palo Alto train station was built in 1941 and included on the NRHP in 1996. The station location options within San Francisco do not have recorded cultural resources within the APE but have a large number of unrecorded architectural resources adjacent to them, including the 1939 Transbay Terminal, as discussed above.

E. OAKLAND TO SAN JOSE CORRIDOR

Parkland and Wildlife Refuges

West Oakland to Niles Junction Alignment Alternative

Within the West Oakland to Niles Junction alignment alternative, there are a variety of Section 4(f) and 6(f) resources, including approximately 17 regional and local parks within 900 ft (274 m) of HST alignments. Approximately five 4(f) and 6(f) resources adjacent to the corridor could be directly affected by this alignment alternative. Nine 4(f) and 6(f) resources could also be indirectly affected by the West Oakland to Niles Junction Alignment Alternative because they are between 150 ft (46 m) and 450 ft (137 m) from the proposed alignment.

12th Street/City Center to Niles Junction Alignment Alternative

Approximately 19 local and regional parks are within 900 ft (274 m) of the 12th Street/City Center to Niles Junction alignment alternative. Six of the 4(f) and 6(f) resources are adjacent to the corridor and could be directly affected by the HST Alignment Alternative. Eight 4(f) and 6(f) resources could also be indirectly affected by the alignment alternative because they are between 150 ft (46 m) and 450 ft (137 m) from the proposed alignment.

Niles Junction to San Jose via Trimble Alignment Alternative.

Within the Niles Junction to San Jose via Trimble alignment alternative, there are a variety of Section 4(f) and 6(f) resources, including approximately eight regional and local parks within 900 ft (274 m) of HST alignments. Two facilities, Fremont Central Park and Grimmer Park, are adjacent to the alignment alternative and could be directly affected by the project. One 4(f) and 6(f) resource, Pinewood Park, could also be indirectly affected by the Niles Junction to San Jose via Trimble alignment alternative because it is between 150 ft (46 m) and 450 ft (137 m) from the proposed alignment.

Niles Junction to San Jose via I-880 Alignment Alternative

There are a variety of Section 4(f) and 6(f) resources within the Niles Junction to San Jose via I-880 alignment alternative, including approximately seven regional and local parks within 900 ft (274 m) of the alignment alternative. There are five adjacent facilities that could be directly affected by the Niles Junction to San Jose via I-880 alignment alternative. One 4(f) and 6(f) resource, Pinewood Park, could also be indirectly affected by this alignment alternative because it is between 150 ft (46 m) and 450 ft (137 m) from the proposed alignment.

Because the majority of these alignment alternatives would be within existing transportation right-of-way, impacts to parks and wildlife resources are not anticipated.

Cultural Resources

West Oakland to Niles Junction Alignment Alternative

In total, there are six recorded archaeological sites and 18 recorded architectural resources within the APE of this alignment alternative. The majority of resources are located within the city of Oakland. These include the 1924 Clorox Chemical Building, the 1926 PG&E Gas Compressor House, industrial complexes dating from the 1920s and 1940s, and 12 recorded residential properties dating from the

1880s to the 1940s. Prehistoric sites in this area tend to be shell middens and occupation sites. Historical sites as well as architectural resources are typically associated with the late 1800s to early 1900s. The alignment alternative also traverses the Old Oakland Historic District. Portions of the alignment alternative outside Oakland have a medium to low sensitivity. This alignment alternative has a high density of cultural resources and has a high sensitivity for prehistoric, historic, and architectural resources. No traditional cultural properties were identified within the APE.

12th Street/City Center to Niles Junction Alignment Alternative

This alignment alternative has the highest density of cultural resources within this corridor. In total, there are 11 recorded archaeological sites and 21 recorded architectural resources within the APE. As in the West Oakland to Niles Junction alignment alternative, the majority of resources are located within the city of Oakland. These include the White Brothers' Hardwood Store (ca. 1927), the Weld-Rite Company Building (ca. 1925), the Art Moderne Sales office building (ca. 1938), and 18 recorded residential properties dating from the 1880s to the 1920s. This alignment alternative has a high sensitivity for prehistoric, historical, and architectural resources. No traditional cultural properties were identified within the APE.

Niles Junction to San Jose via Trimble Alignment Alternative

This alignment alternative has the second highest density of cultural resources within this corridor. In total, there are three recorded archaeological sites and eight recorded architectural resources within the APE. As in the Dumbarton to San Jose alignment alternative, the majority of resources are located within the San Jose, which includes the Santa Clara de Asis Mission. This portion of the project includes the Kraft Foods plant (ca.1950), the Moderne Factory building (ca. 1940), and 18 recorded residential properties. The portion of this alignment alternative that traverses San Jose is sensitive for prehistoric, historical, and architectural resources.

Niles Junction to San Jose via I-880 Alignment Alternative

This alignment alternative has two archaeological resources and two recorded architectural resources dating from 1928 and 1945. It has a medium sensitivity for archaeological and architectural resources.

Oakland to San Jose Corridor Station Location Options

None of the station location options have recorded cultural resources that are within the APE or directly adjacent to the APE, though the station location options within Oakland have a large number of unrecorded architectural resources adjacent to them.

F. SAN JOSE TO CENTRAL VALLEY CORRIDOR

Parkland and Wildlife Refuges

Pacheco Alignment Alternative

This alignment alternative, which runs between the cities of San Jose and Gilroy, is within 900 ft (274 m) of approximately seven Section 4(f) and 6(f) resources. Three of the resources (Edenvale Garden and Coyote Creek parks north of Gilroy and the Upper Cottonwood Wildlife Area west of Interstate 5) could be directly affected by the HST because they are within 150 ft (46 m). There would be no impacts to nearby Henry Coe State Park because it is not within 900 ft (274 m) of the alignment alternative, with State Route 152 acting as a barrier between the HST alignment and the park.

Henry Miller (UPRR) and Henry Miller (BNSF) Alignment Alternatives

East of the San Luis Reservoir, there are two Section 4(f) resources (San Luis Wildlife Refuge and Los Banos Wildlife Area) along the Henry Miller alignment alternative that begins just north of the San Luis Reservoir and traverses east to the City of Merced. The proposed alignment alternative would pass north of the O'Neil Forebay Wildlife Area and continue north and parallel of Henry Miller Road, north of the City of Los Banos. There would be no impacts to Pacheco State Park, the San Luis

Reservoir Wildlife Area, O'Neil Forebay Wildlife Area, the San Luis State Recreation Area, or the Lower Cottonwood Wildlife Area surrounding the San Luis Reservoir. The Volta Wildlife Area near Los Banos would also not be impacted because the alignment alternative would be beyond 900 ft (274 m) of the wildlife area's southern boundary.

GEA North Alignment Alternative

East of the San Luis Reservoir, there are three Section 4(f) resources (San Luis Wildlife Refuge, North Grasslands Wildlife Area, and Great Valley Grasslands State Park) along the GEA North alignment alternative that begins just north of the San Luis Reservoir and traverses east to the City of Merced north of Los Banos. The proposed alignment alternative would pass through and directly affect the San Luis National Wildlife Refuge, north of the City of Los Banos. The alignment alternative would come within 150 ft (46 m), but not encroach into, the boundaries of the North Grasslands Wildlife Area and the Great Valley Grasslands State Park; therefore, these resources could only be indirectly affected by this alternative.

Cultural Resources

Pacheco Alignment Alternative

This alignment alternative roughly follows SR 152 through the Pacheco Pass. Little development has taken place in this area. In total, four recorded architectural resources were found to be located within the project APE. Of these, two are historic canals and one is a bridge. There are also likely historic resources in the Santa Clara Valley, including Morgan Hill and Gilroy. A total of seven previously recorded archaeological resources are located within the APE. Three of them are small prehistoric sites that typically include midden and lithic debitage. Though little archaeological work has been conducted in this area, it is known to be highly sensitive for prehistoric archaeological resources. Overall, this alignment has medium sensitivity for cultural resources.

Henry Miller (UPRR Connection) Alignment Alternative

The majority of this alignment alternative is in Merced County in the Central Valley. Much of the area has seen little development historically. Previously recorded resources present include one archaeological site and four architectural resources. Overall, this alignment alternative has a medium sensitivity for cultural resources.

Henry Miller (BNSF Connection) Alignment Alternative

This alignment alternative would have the same known resources as identified for the Henry Miller (UPRR Connection) alignment alternative.

GEA North Alignment Alternative

This alignment alternative is in Merced County in the Central Valley. Much of the area has seen little development historically. Previously recorded resources present include four archaeological sites and five architectural resources. All four of the archaeological resources are prehistoric sites including a habitation site and human burials just west of the city of Merced. Overall, this alignment alternative has medium sensitivity for cultural resources.

San Jose to Central Valley Corridor Station Location Options

Only the San Jose Diridon station location option within this corridor has a recorded architectural resource that is within the APE or directly adjacent to the APE.

G. EAST BAY TO CENTRAL VALLEY CORRIDOR

Parkland and Wildlife Refuges

I-680/580/UPRR Alignment Alternative

The I-680/580/UPRR alignment alternative is within 900 ft (274 m) of approximately 12 Section 4(f) and 6(f) resources. Seven of the resources, including the Augustin-Bernal and Muirwood parks in

Pleasanton, the Dublin Sports Grounds Complex, Vargas Plateau, and three trails operated by the EBRPD are within 150 ft (46 m) of the proposed alignment alternative and could be directly affected by the HST. Three additional parks are within 450 ft (137 m) of the alignment alternative; Meadowlark and Val Vista parks in Pleasanton and the Las Positas Golf Course in Livermore and could be indirectly affected.

I-580/UPRR Alignment Alternative

There are 10 Section 4(f) and 6(f) resources within 900 ft (274 m) of the I-580/UPRR alignment alternative. One park, the Augustin-Bernal Park in Pleasanton, the Vargas Plateau and three trails operated by the EBRPD could be directly affected by this alignment alternative. Three additional Section 4(f) and 6(f) resources—the Fairways Golf Course in Pleasanton, the Shadow Cliffs Regional Recreation Area, and Las Positas Golf Course in Livermore—are within 450 ft (137 m) of the alignment alternative and could be indirectly affected.

Patterson Pass/UPRR

The Patterson Pass/UPRR alignment alternative is within 900 ft (274 m) of approximately 12 Section 4(f) and 6(f) resources. The Augustin-Bernal Park, Vargas Plateau, and three trails operated by the EBRPD are Section 4(f) or 6(f) resources within 150 ft (46 m) of the proposed alignment alternative and could be directly affected by the project. The alignment alternative could have an indirect impact on an additional five 4(f) or 6(f) resources (Fairways Golf Course, Shadow Cliffs Regional Recreation Area, Oak Knoll Pioneer Memorial Park, Doolan Park, and Madiera Park) that are within 450 ft (137 m).

UPRR

Within 900 ft (274 m) of the UPRR alignment alternative, there are approximately 12 Section 4(f) and 6(f) resources that could be affected. The Augustin-Bernal Park, Vargas Plateau, and three trails operated by the EBRPD are Section 4(f) or 6(f) resources within 150 ft (46 m) of the proposed alignment alternative and could be directly affected by the project. Indirect impacts to five Section 4(f) and 6(f) resources within 450 ft (137 m) could occur at the Fairways Golf Course and Shadow Cliffs Regional Recreational Area in Pleasanton and Oak Knoll Pioneer Memorial, Doolan, and Madiera Parks in Livermore.

Tracy Downtown (BNSF and UPRR Connections)

The Tracy Downtown alignment alternatives are within 900 ft (274 m) of approximately seven Section 4(f) resources and no Section 6(f) resources. There are no Section 4(f) resources that would be directly affected by these alignment alternatives. Two parks, Quail Ridge Park and Cotta Park, are within 450 ft (137 m) of the alignment alternatives and could have the potential for indirect impacts.

Tracy ACE Station (BNSF and UPRR Connections)

Both Tracy ACE Station alignment alternatives are within 900 ft (274 m) of two Section 4(f) resources and no Section 6(f) resources within the study area. There are no Section 4(f) resources that would be directly affected by these alignment alternatives. Two parks are within 450 ft (137 m) of the alignment alternatives and could have the potential to be indirectly affected by the proposed project.

<u>Cultural Resources</u>

I-680/580/UPRR Alignment Alternative

This alignment alternative spans from the eastern Bay Area to the Livermore Valley and has the highest density of cultural resources within this corridor. Much of the area has seen recent development. Along this alignment alternative there are eight previously recorded archaeological sites. There are 12 recorded architectural resources including the Western Pacific Railroad Buildings (ca. 1909), the Kennedy Ranch (ca. 1890), and 10 residential (mainly craftsman) properties dating from 1910 to 1940. The archaeological resources are prehistoric sites. Overall, this alignment alternative has medium sensitivity for cultural resources.

I-580/UPRR Alignment Alternative

The Livermore Valley has seen little archaeological work until recently, though it is known to be rich in prehistoric resources, including large habitation sites and burials. Several unrecorded burials are located immediately adjacent to the APE of this alignment alternative just west of the City of Livermore. Previously recorded resources present include six archaeological sites and 11 architectural resources. Recorded resources include a 1947 industrial warehouse, the Quonset Warehouse (ca. 1950s), the West Altamont Underpass (ca. 1909), and 8 recorded residential properties dating between 1890 and the 1930s. The archaeological resources are prehistoric sites. Overall, this alignment alternative has medium sensitivity for cultural resources.

Patterson Pass/UPRR Alignment Alternative

This alignment alternative includes three previously recorded archaeological resources and three architectural resources. Overall, this alignment alternative has low sensitivity for cultural resources.

UPRR Alignment Alternative

This alignment alternative includes five previously recorded archaeological resources and one architectural resource. Overall, this alignment alternative has low sensitivity for cultural resources.

Tracy Downtown (BNSF Connection) Alignment Alternative

This alignment alternative includes eight previously recorded archaeological resources and 10 architectural resources. Some of the archaeological sites are prehistoric and include midden sites with few to no artifacts or related materials. Overall, this alignment alternative has low sensitivity for cultural resources. The majority of the architectural resources are located south of Tracy.

Tracy ACE Station (BNSF Connection) Alignment Alternative

This alignment alternative includes two previously recorded archaeological resources and 13 architectural resources. Recorded resources include eight World War II era warehouses, a 1952 U.S. Army Depot Flag Pole, and four U.S. Army Depot buildings from the 1950s. Some of the archaeological sites are prehistoric and include midden sites with few to no artifacts or related materials. The majority of the architectural resources are located south of Lathrop. Overall, this alignment alternative has low sensitivity for cultural resources.

Tracy ACE Station (UPRR Connection) Alignment Alternative

This alignment segment includes two previously recorded archaeological resources and 10 architectural resources. Similar to the other Tracy alignment alternatives, the archaeological resources include midden sites and the majority of the architectural resources are located south of Lathrop. Overall, this alignment alternative has low sensitivity for cultural resources.

Tracy Downtown (UPRR Connection) Alignment Alternative

This alignment alternative includes eight previously recorded archaeological resources and seven recorded architectural resources. These include an undated wooden Western Pacific Railroad trestle, two industrial warehouses from the 1950s, residential properties from the 1940s, and an undated farmstead property. Similar to the Tracy Downtown (BNSF Connection) alignment alternative, the archaeological resources include midden sites and the majority of the architectural resources are located south of Tracy. Overall, this alignment alternative has low sensitivity for cultural resources.

The west end of this alignment alternative extends through approximately 2 mi of Miocene sedimentary deposits similar to the Tracy Downtown (BNSF Connection) alignment alternative. Overall, this alignment alternative was identified to have a medium sensitivity for paleontological resources.

East Bay Connections Alignment Alternative

The East Bay Connections alignment alternative is not known to have cultural resources that are within the APE or directly adjacent to the APE.

East Bay to Central Valley Corridor Station Location Options

Based on the archival records search, none of the station location options have cultural resources that are within the APE or directly adjacent to the APE. The station location options were found to have a low sensitivity for cultural resources.

H. SAN FRANCISCO BAY CROSSINGS

Parkland and Wildlife Refuges

Transbay

There is one Section 4(f) resource and no Section 6(f) resources near both Transbay alignment alternatives. South Park in San Francisco is approximately 150 ft (46 m) from the Transbay Transit Center alignment alternative, but because the proposed alignment would be in a tunnel, there is no anticipated impact on the park. The same park is over 1,000 ft (305 m) from the 4th and King alignment alternative, and therefore, there is a limited potential for indirect effect to the park.

Dumbarton

There are approximately eight Section 4(f) resources and no 6(f) resources near the Dumbarton alignment alternatives. Three Section 4(f) resources—the Don Edwards San Francisco Bay National Wildlife Refuge, Kelly Park in Menlo Park, and the Newark Civic Center Park—would be adjacent to the proposed alignment alternatives and could be directly affected by the proposed project. The 28,000-acre Don Edwards San Francisco Bay National Wildlife Refuge, which is located in the region on the southeast side of the San Francisco Bay, is the largest urban wildlife refuge in the nation. It is home to millions of shorebirds and waterfowl, with a total of 250 bird species, including the endangered California clapper rail (*Rallus longirostris obsoletus)*. Another special-status species in the refuge is the salt marsh harvest mouse (*Reithrodontomys raviventris)*. The Ash Street Park in Newark is further away from the proposed alignment alternatives and could potentially be indirectly impacted.

Fremont Central Park

There are six Section 4(f) resources near the Fremont Central Park alignment alternatives. Five resources (Don Edwards San Francisco Bay National Wildlife Refuge, Blacow Park, Fremont Central Park, Gomes Park, and Vallejo Mill Park) are adjacent to the proposed alignment alternatives and have a high potential to be directly affected by the project. The 28,000-acre Don Edwards San Francisco Bay National Wildlife Refuge, which is located in the region on the southeast side of the San Francisco Bay, is the largest urban wildlife refuge in the nation. It is home to millions of shorebirds and waterfowl, with a total of 250 bird species, including the endangered California clapper rail (*Rallus longirostris obsoletus)*. Another special-status species in the refuge is the salt marsh harvest mouse (*Reithrodontomys raviventris)*. Marshall Park in Fremont is within 450 ft (137 m) of the proposed alignment alternatives and has the potential to be indirectly affected by the project.

Cultural Resources

Trans Bay Crossing – Transbay Transit Center Alignment Alternative

Most of this alignment alternative is below the San Francisco Bay and therefore has very low sensitivity for archaeological resources, though the terrestrial portions are highly sensitive for both historical archaeological deposits and architectural resources. One resource, the Transbay Terminal, was built in 1939 as a California Toll Bridge Authority facility in order to facilitate commuter rail travel across the lower portion of the San Francisco-Oakland Bay Bridge. The historic Transbay Terminal will be replaced with a new structure as part of the new Transbay Transit Center sometime between 2008 and 2014. Another resource within the APE is the Historic Ferry Building. Originally constructed in 1903, it was the second busiest transportation terminal in the world during the 1930s. Past subsurface archaeological testing has revealed that much of the area is fill rich with historic artifacts from the Gold Rush period through the 1906 earthquake and resulting fire. This alignment also traverses the Embarcadero Piers Historic District.

Trans Bay Crossing – 4th and King Alignment Alternative
Like the Trans Bay Crossing – Transbay Transit Center alignment alternative, this alignment alternative is below the San Francisco Bay and therefore has very low sensitivity for archaeological resources, though the terrestrial portions are highly sensitive for both historical archaeological deposits and architectural resources. Past subsurface archaeological testing has revealed that much of the area is fill rich with historic artifacts from the Gold Rush period through the 1906 earthquake and resulting fire.

Dumbarton Alignment Alternatives (High Bridge, Low Bridge, Tube)
Four recorded archaeological resources were identified along these alignment alternatives. The prehistoric sites include a habitation site associated with burials while others are historic sites resulting from early 1900s industrial activities. No recorded architectural resources were identified in the records search for these alignment alternatives.

Freemont Central Park Alignment Alternatives (High Bridge, Low Bridge, Tube)
No recorded archaeological or architectural resources were identified in the records search for these alignment alternatives.

I. CENTRAL VALLEY CORRIDOR

Parkland and Wildlife Refuges

UPRR
There are approximately 12 Section 4(f) and 6(f) resources within 900 ft (274 m) of the UPRR alignment. The alignment has the potential to directly affect four Section 4(f) and one Section 6(f) resources, including the Tuolumne Regional Park, County Park in Salida, the Stanislaus County Fairgrounds, and Broadway and Central Parks in Turlock. Five additional resources have the potential to be indirectly affected by the alignment alternative.

BNSF
Along the BNSF alignment, approximately 12 Section 4(f) and 6(f) resources are within 900 ft (274 m). Main Street Park in Escalon, Zerillo Park in Riverbank, and the Jacob Meyer Regional Park in an unincorporated portion of San Joaquin County are within 150 ft (46 m) of this alignment and could be potentially impacted directly. There are seven other resources that are within 450 ft (137 m) of the alignment and could have the potential to be indirectly affected by the project.

Cultural Resources

BNSF/UPRR Alignment Alternative
This alignment alternative, and all alignment alternatives within this corridor, trends north-south through the Central Valley beginning south of Stockton to just south of Chowchilla. This alignment alternative generally follows existing railroad lines. In total, there is one previously recorded archaeological resource and 27 architectural resources. These include a 1947 railroad trestle, a 1950 flatcar railroad bridge, Robertson Boulevard (ca. 1913), Redrock Winery (ca. 1920), Le Grand Canal (ca. 1910), and 22 recorded residential properties dating between 1920 and the 1940s. Most of the architectural resources are within the cities of Escalon and Chowchilla. While some of the architectural resources are single-family residences built in the early 1900s, others are features associated with the railroad. Overall, this alignment alternative has low sensitivity for cultural resources.

U.S. Department of Transportation Federal Railroad Administration

BNSF Alignment Alternative

Similar to the BNSF-UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. In total there is one previously recorded archaeological resource and 16 recorded architectural resources. These include the 1912 Escalon Water and Auxiliary Water Systems; the 1935 Escalon Sanitary Sewer System; portions of the 1895 Atchison, Topeka, and Santa Fe Railroad; Bud's Frosties (ca. 1946); Farmer Bill's Produce (ca. 1940); and 11 recorded residential properties dating between 1910 and the 1940s. Most of the architectural resources are within or around the City of Escalon. Overall, this alignment alternative has low sensitivity for cultural resources.

UPRR N/S Alignment Alternative

Similar to the BNSF-UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. In total, there are four previously recorded archaeological resources and 63 architectural resources. Some of the archaeological resources are prehistoric sites, including a habitation site associated with burials, while others are historic sites resulting from early 1900s industrial activities. Most of the architectural resources are around the communities of Delhi, Livingston, Atwater, and Chowchilla. There are a series of historic canals recorded in this portion of the alignment alternative including the Ashe Lateral (ca. 1890s), the Fairfield Canal (ca. 1910), the 1920 Arena Canal, and seven other unnamed canals dating to ca. 1900. There are also four freeway bridges dating from the 1940s. This portion includes la Fuentes Market (ca.1940) and A.V. Produce (ca. 1925), as well as 43 recorded residential properties dating from the 1890s to the 1950s. Overall, this alignment alternative has medium sensitivity for cultural resources.

BNSF Castle Alignment Alternative

Similar to the BNSF-UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. In total, there is one previously recorded archaeological resource and 20 architectural resources. Most of the architectural resources are within the cities of Escalon and Chowchilla, such as the Escalon Motel (ca. 1940s), a 1926 Texaco Station, and Wright's Petroleum (ca. 1918). Some of the architectural resources are single-family residences (11 recorded) built in the early 1900s. There are also several features associated with the railroad such as a 1909 wooden railroad trestle and portions of the Tidewater Southern Railroad dating from 1912. Overall, this alignment alternative has low sensitivity for cultural resources.

UPRR-BNSF Castle Alignment Alternative

Similar to the BNSF-UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. In total, there are four previously recorded archaeological resources and 20 architectural resources. The recorded architectural resources include the Riverbank Library (ca. 1899), irrigation canals (ca. 1900), a 1904 railroad bridge, a 1910 farmstead, and numerous (13 recorded) residential properties dating between 1900 and 1950. This portion also contains segments of the 1895 Atchison, Topeka, and Santa Fe Railroads. Some of the archaeological resources are prehistoric sites, including a habitation site associated with burials, while others are historic sites resulting from early 1900s industrial activities. Most of the architectural resources are around the cities of Modesto and Merced. Overall, this alignment alternative has medium sensitivity for cultural resources.

UPRR-BNSF Alignment Alternative

Similar to the BNSF-UPRR alignment alternative, this alignment alternative generally follows existing railroad lines. There are four previously recorded archaeological resources within this alignment alternative. There are 27 recorded architectural resources, including three ca. 1940 highway bridges, abandoned segments of State Route 99 that are potentially historic, 1940s farms and associated structures, and numerous (19 recorded) residential properties dating between ca. 1900 and 1950. Some of the archaeological resources are prehistoric sites, including a habitation site associated with burials, while others are historic sites resulting from early 1900s industrial activities. Most of the architectural resources are around Chowchilla. Overall, this alignment alternative has medium sensitivity for cultural resources.

Central Valley Corridor Station Location Options

Based on the archival records search, none of the station location options have known cultural resources that are within the APE or directly adjacent to the APE. Only the Modesto (Downtown) and Merced (Downtown) station location options were found to have a medium sensitivity for cultural resources.

3.16.4 Impact Avoidance Strategies, Including Alternatives Screened from Further Consideration

Throughout the environmental review process, and particularly in the identification of potential HST alignment alternatives and station location options, the Authority has emphasized avoidance of and minimizing harm to the environment. One of the Authority's policies, as stated in Chapter 1, is "to maximize the use of existing transportation corridors and right-of-way to the extent feasible." This policy is one of the primary impact avoidance strategies for the proposed HST system and was applied during preparation of the statewide HST Program EIR/EIS. This policy was carried forward and used in the scoping process and successive screening stages of this program environmental process (see Chapter 2, "Alternatives"). The screening evaluation considered the potential impacts of the various alignments and all the environmental parameters, including impacts on Section 4(f) and 6(f) resources. Based on the overall screening evaluation, in the Bay Area, different alignment alternatives were developed that avoid 4(f) and 6(f) resources, including Henry W. Coe State Park, to a great extent. At the end of this process, prudent and feasible general alignment alternatives were identified for each corridor of the entire Bay Area to Central Valley study region.

3.16.5 Avoidance Alternatives or Reasons for No Prudent or Feasible Alternative for Use of Section 4(f) or 6(f) Resource

Design studies and project-level environmental review for a proposed HST system would evaluate specific alignment alternatives selected for further study, identify potential uses of Section 4(f) and 6(f) resources, and seek additional opportunities to avoid or substantially reduce potential adverse impacts of these alternatives on Section 4(f) and 6(f) resources.

Potential direct impacts on many Section 4(f) and 6(f) resources could be avoided by remaining within existing railroad right-of-way, or moving horizontally within the right-of-way, where feasible. Avoidance of Section 4(f) and 6(f) resources would be further explored during project-level design and environmental evaluation. Project-level evaluations of Section 4(f) and 6(f) resource use would include evaluating the avoidance alternatives and making determinations regarding prudent or feasible alternatives for uses of Section 4(f) and 6(f) resources.

There are several potential Section 4(f) and 6(f) recreation resources and cultural resources within or immediately adjacent to the HST Alignment Alternatives. Avoidance of these resources would be possible in many cases by redesigning or narrowing the disturbance limits, in combination with noise walls and/or visual screening. However, there may be locations where avoidance could not be achieved, possibly for one of more of the following reasons.

- The HST Alignment Alternatives cannot be shifted easily because of the large turning radii required for HST operations and other design considerations. A minor shift in one location on the HST alignment could result in a substantial shift elsewhere on the alignment, potentially resulting in impacts on other Section 4(f) and 6(f) resources.
- Measures to reduce potential proximity impacts, such as noise walls, could result in potential adverse visual impacts on Section 4(f) and 6(f) resources. During project-level review, potential measures to minimize harm at each potentially affected resource would need to be analyzed in consultation with the owners of the resources to ensure that measures to minimize harm would not adversely affect the values of the Section 4(f) and 6(f) resources.

3.16.6 Mitigation Strategies and CEQA Significance Conclusions

The HST system could result in direct impacts to lands containing publicly owned parks and recreational resources by placing HST facilities on them. It could result in indirect impacts to these resources due to construction activities or HST system operations that adversely affect the use of publicly owned parks and recreational resources. The use of existing transportation corridors for HST facilities and the design direction that HST stations should serve as multi-modal transportation hubs has minimized the potential for the HST system impacts and constructive use of parks and recreational resources. In addition to addressing noise, biology, and air quality impacts in other sections, the section identifies the park, open space, wildlife preserves, and recreational resources located within the following categories: 0 to 150 ft (0 to 46 m), 150 to 450 ft (46 to 137 m), and 450 to 900 ft (137 to 274 m) from the centerline of HST alignment alternatives or station location options. Section 4(f) and 6(f) resources within the 0 to 150-foot distance are deemed as a direct and potentially significant impact under CEQA and as a potential constructive use of cultural resources under Section 4(f). This analysis identified a total of 40 4(f) and 6(f) resources within 150 ft of the centerlines for all of the alignment alternatives. The total number actually affected would be less than 40, depending on the Network Alternative selected (See Chapter 7). Resources in the 150 to 450-foot distance could also be significantly affected. Additionally, certain local, regional, or federal recreational resources could be affected. At the program level, it is not possible to know precisely the location, extent, and particular characteristics of impacts to park resources. Due to this uncertainty, as it was for the purposes of system-wide review at the programmatic level, this impact is considered significant for this programmatic review of the Bay Area to Central Valley study region.

The following mitigation strategies can be refined and applied at the project-specific level and would reduce this impact:

1. Continue to apply design practices to avoid impacts to park resources, and when avoidance cannot be accommodated, minimize the scale of the impact.
2. Apply measures at the project level to reduce and minimize indirect/proximity impacts as appropriate for the particular sites affected, while avoiding other adverse impacts (e.g., visual), such as noise barriers, visual buffers, and landscaping.
3. Apply measures to modify access to/egress from the recreational resource to reduce impacts to these resources.
4. Design and construct cuts, fill, and aerial structures to avoid and minimize visual impacts to units of the state park system.
5. Incorporate wildlife under or over crossings at appropriate intervals as necessary.
6. Where public parklands acquired with public funds would be acquired for nonpark use as part of the HST system, commit as required by law to providing funds for the acquisition of substantially equivalent substitute parkland or to acquiring/providing substitute parkland of comparable characteristics.
7. Restore affected parklands to natural state and replace or restore affected park facilities.
8. If park facilities must be relocated, provide planning studies as well as appropriate design and replacement with minimal impact on park use.
9. Use local native plants for revegetation.
10. Develop and implement construction practices, including scheduling, to limit impacts to wildlife, wildlife corridors, and visitor use areas within public parks.
11. For temporary unavoidable loss of park and recreation facility uses, consider providing compensation.

The mitigation strategies described above would substantially lessen or avoid this impact; however, sufficient information is not available at the program level to conclude with certainty that mitigation would reduce this impact to a less-than-significant level in all circumstances. Therefore, at the programmatic level, the potential for impacts to parks and recreational facilities is considered significant.

Planning efforts would be undertaken as a part of the project-level documentation phase to minimize harm to the Section 4(f) and 6(f) resources. This is anticipated to include measures that may be taken to mitigate potential adverse environmental impacts, such as beautification measures, replacement of land or structures or their equivalents on or near their existing site(s), tunneling, cut and cover, cut and fill, treatment of embankments, planting, screening, creating wildlife corridors, acquisition of land for preservation, installation of noise barriers, and establishment of pedestrian or bicycle paths. Other potential mitigation strategies could be identified during the project-level public review process.

3.16.7 Subsequent Analysis

The Section 4(f) and 6(f) evaluation process would be more focused at the project-level. Given the broad focus of analysis for this Program EIR/EIS, the primary goal for project-level analysis would be to identify Section 4(f) and 6(f) resources and potential adverse effects in greater detail, any uses that may occur, the existence of potential prudent and feasible alternatives, and potential mitigation measures.

The following items would be included in the Section 4(f) and 6(f) evaluations at the project level.

- Detailed physical descriptions of a specific portion of the proposed HST system (including plans and profiles).
- Updated list of all Section 4(f) and 6(f) recreation resources (including publicly owned conservation easements) in proximity to the proposed alignment alternative centerlines and project components, using the most recent mapping available, such as annually updated Thomas Bros. maps, general plans, state Web sites, and local jurisdiction web sites.
- Updated list of NRHP-listed and NRHP-eligible cultural resources. As part of detailed cultural resources studies required for project-level environmental review (see Section 3.12.7), all previously identified potentially eligible resources would be further evaluated to determine NRHP eligibility. NRHP-eligible resources would be carried forward to the project-level Section 4(f) and 6(f) evaluation. Field reconnaissance would be needed to complete the required Section 4(f) inventory sheets.
- List of the CRHR-listed and eligible resources and field reconnaissance to provide a complete inventory and description of these resources.
- Descriptions of uses and functions of each Section 4(f) and 6(f) resource, including location map; size; services and facilities; annual patronage; unique qualities; relationship to other lands in the project vicinity; owner/operator; other relevant information regarding the resource; and explanation of the significance of the properties as determined by federal, state, regional, or local officials with jurisdiction over the resource.
- Detailed descriptions of the proposed uses of and potential adverse effects on Section 4(f) and 6(f) resources and of the methods used to identify them. Specific potential impacts on each resource would be identified, including proximity impacts as a result of impacts on ambient noise, air quality, transportation, and visual resources.
- Identification and refinement of strategies to avoid or minimize use of and adverse effects on Section 4(f) and 6(f) resources by narrowing rights-of-way/disturbance limits, realigning/relocating project features, and developing other alignment adjustments. These strategies would analyze, as appropriate, the technical feasibility of possible mitigation, including cost estimates with figures showing percentage differences in total project costs, possibility of community or ecosystem

disruption, and other potential significant adverse environmental impacts of each alternative. These cost estimates should also show the financial, social, or ecological costs or potential adverse environmental impacts of each alternative, as well as any unique problems and extraordinary magnitudes of impacts.

- Documentation of consultation with the affected local jurisdictions and owners/operators of the identified Section 4(f) and 6(f) resources. This would include documentation of concurrence or efforts to obtain concurrence from the public official or officials having jurisdiction over the Section 4(f) and 6(f) resources and documentation of the planning to minimize harm to the affected resources. (Refer to Chapter 11, "Organization, Agency, and Business Outreach before Draft Program EIR/EIS Release," for additional discussion of these consultations.) In addition to the mitigation proposed, the Section 4(f) and 6(f) evaluation should document the National Park Service's tentative position relative to any proposed Section 6(f) conversion and should address the need for replacement lands under federal and California law (Federal Highway Administration 1987).

3.17 Cumulative Analysis

3.17.1 Purpose and Content of This Section

The purpose of this section is to summarize the potential cumulative physical and growth-related environmental consequences associated with the HST Network Alternatives.[1] The analysis focuses on regional scenarios and programmatic estimates of potential impacts; therefore, the magnitude of impacts reported in this document is likely to be considerably larger than the actual impacts that would be expected from the HST system in the study area.

Refer to Chapter 3, "Affected Environment, Environmental Consequences, and Mitigation Strategies," and Chapter 7, "High-Speed Train Network and Alignment Alternatives Comparisons," for a presentation of potential environmental consequences in each environmental resource area.

This section is organized into the following sections:

- Regulatory requirements and methods of evaluation.
- Cumulative projects and growth projections.
- Analysis of cumulative impacts by environmental resource area.

3.17.2 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

National Environmental Policy Act (NEPA)

Under NEPA, a cumulative impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7).

A cumulative impact includes the total effect on a natural resource, ecosystem, or human community attributable to past, present, or reasonably foreseeable future activities or actions of federal, nonfederal, public, and private entities. Cumulative impacts also may include the effects of natural processes and events, depending on the specific resource in question. Cumulative impacts include the total of all impacts on a particular resource that have occurred, are occurring, and will likely occur as a result of any action or influence, including the direct and indirect impacts of a federal activity. Accordingly, there may be different levels of cumulative impacts on different environmental resources.

California Environmental Quality Act (CEQA)

Under CEQA, cumulative impacts are defined as two or more individual effects that, when considered together, are considerable or compound or increase other environmental impacts. The cumulative impact from several projects is the change in the environment that results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time (State CEQA Guidelines Section 15355).

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[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

A project's contribution to a cumulative impact may be considered less than significant if it is implementing a plan or program designed to avoid the cumulative impact (State CEQA Guidelines Section 15064[h]) or if it will implement or fund its fair share of a mitigation measure designed to alleviate the cumulative impact (State CEQA Guidelines Section 15130[a]).

Under CEQA, the discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion may be less detailed than the analysis of the project's individual effects. The discussion should be guided by the standards of practicality and reasonableness and should focus on the cumulative impact to which the identified other projects contribute, rather than the attributes of the other projects that do not contribute to the cumulative impact (State CEQA Guidelines Section 15130[b]).

As further defined under State CEQA Guidelines Section 15130(b), the following elements are necessary in an adequate discussion of significant cumulative impacts:

(1) Either:

(A) A list of past, present, future, and probably future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency, or

(B) A summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or areawide conditions contributing to the cumulative impact. Any such planning document shall be referenced and made available to the public at a location specified by the lead agency.

(2) When utilizing a list, factors to consider when determining whether to include a related project should include the nature of each environmental resource being examined, the location of the project and its type.

(3) Lead agencies should define a geographic scope of the area affected by the cumulative effect and provide a reasonable explanation for the geographic limitation used.

(4) A summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available; and

(5) A reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

Both CEQA and NEPA allow the scope of a cumulative impact analysis to be limited through the use of tiering (40 CFR 1508.28, State CEQA Guidelines 15130). Tiering can be used when cumulative impacts have been addressed adequately in a previous document certified for a programmatic plan and the current project is consistent with the plan. The statewide program EIS/EIR evaluated cumulative impacts using a list of major projects for consideration in the cumulative impact analysis. Although the statewide program EIS/EIR analysis helped identify cumulative projects for this project, the cumulative analysis contained herein is not tiered off the previous statewide document because it is also programmatic and relates just to the Bay Area to Central Valley study area. This section includes an analysis of cumulative impacts resulting from transportation, land use, redevelopment, and other projects that have the potential to affect similar resources in the vicinity of the proposed project.

B. METHODS OF EVALUATION OF IMPACTS

Because of the broad regional nature of the proposed HST project and the programmatic nature of this document, the cumulative impact analysis uses both the list and projections approach to evaluate potential cumulative impacts of the project. The discussion below identifies the methods employed to identify the cumulative scenario.

The cumulative projects list incorporates reasonably foreseeable, relevant projects and focuses on those that, when combined with the proposed HST Network Alternatives, could contribute to cumulative impacts. Projects considered in the cumulative impacts analysis were identified through (1) telephone conversations with respective city planners and engineers and (2) review of projects identified under applicable Bay Area and Central Valley regional transportation improvement plans (RTIP) as part of the State Transportation Improvement Plan (STIP). Based on information provided by the local jurisdictions and the STIP, the cumulative projects list was prepared; the list identifies projects in the same geographic area as the proposed HST project, including projects for which development is underway, for which applications have been filed, or that have recently been approved but not yet constructed. The following criteria were used to narrow the list of projects considered in the analysis:

- Projects that are under active consideration.
- Projects that have recently completed or are in some active stage of completing project-level environmental documentation.
- Projects that would be completed or operational within the timeframe being considered for the HST project and in the same vicinity.
- Projects in proximity and of a size/scale that, in combination with the HST Network Alternatives, have the potential to affect the same resources.

To consider the cumulative scenario relative to planned development not identified under the cumulative projects list, projections for population, employment, and urbanization were used.

In accordance with State CEQA Guidelines (Section 15130[b]), the analysis of cumulative effects is qualitative. Both cumulative impacts associated with future projects and future regional growth are identified. The cumulative projects are discussed in detail in Appendix 3.17-A, and growth inducement and indirect effects from growth are described in Chapter 5, “Economic Growth and Related Impacts.”

3.17.3 Cumulative Projects and Growth Forecasts

A. CUMULATIVE PROJECTS LIST

The HST Network Alternatives represent different ways to implement the HST system between the Bay Area and Central Valley along combinations of HST Alignment Alternatives and station location options (refer to Chapter 7, “High-Speed Train Network and Alignment Alternatives Comparisons”). The HST system would continue outside the study area to the major metropolitan areas in the state, as described in the statewide program EIR/EIS (Authority and FRA November 2005). The network alternatives are grouped into three route options: Altamont Pass, Pacheco Pass, and Pacheco Pass with Altamont Pass (local service). The following route options contain 21 network alternatives:

Altamont Pass Network Alternatives	Pacheco Pass Network Alternatives	Pacheco Pass with Altamont Pass (local service) Network Alternatives
• San Francisco & San Jose Termini	• San Francisco & San Jose Termini	• San Francisco & San Jose Termini
• Oakland & San Jose Termini	• Oakland & San Jose Termini	• Oakland & San Jose Termini
• San Francisco, Oakland & San Jose Termini	• San Francisco, Oakland, & San Jose Termini	• San Francisco, Oakland, & San Jose Termini (without Dumbarton Bridge)
• San Jose Terminus	• San Jose Terminus	• San Jose Terminus
• San Francisco Terminus	• San Jose, San Francisco & Oakland—via Transbay Tube	
• Oakland Terminus	• San Jose, Oakland & San Francisco—via Transbay Tube	
• Union City Terminus		
• San Francisco & San Jose—via San Francisco Peninsula		
• San Francisco, San Jose, Oakland—no Bay Crossing		
• Oakland & San Francisco—via Transbay Tube		
• San Jose, Oakland, & San Francisco—via Transbay Tube		

The cumulative projects included in this analysis are those that are either close to the HST Network Alternatives or of a size/scale that could affect regional resources. One of the major projects currently underway is the San Francisco Bay Area Regional Rail Plan (Plan) being prepared by the MTC, BART, Caltrain, and the Authority. The Regional Rail Plan will look at improvements and extensions of railroad, rapid transit, and high-speed rail services for the near term (5–10 years), intermediate term (10–25 years), and long term (beyond 25 years). Given the close coordination between the two projects, their similar nature, and in some cases the same rights-of-way and stations, the Plan is discussed below. Other cumulative projects are discussed in detail in Appendix 3.17-A. This information represents the most up-to-date and accurate information available as of the date of publication of this document.

Table 3.17-1 summarizes the locations of the cumulative projects relative to the HST Network Alternatives. The locations of the cumulative projects in relation to the HST Network Alternatives are also illustrated in Figure 3.17-1.

Regional Rail Plan for the San Francisco Bay Area

The MTC, BART, Caltrain, and the Authority, along with a coalition of rail passenger and freight operators, prepared the Regional Rail Plan for the San Francisco Bay Area per the specifications of Regional Measure 2 (RM2), approved in 2004. RM2 specified and provided funding for the preparation of a comprehensive master plan for Bay Area rail (MTC 2007). The Plan completed the unfinished work of the 1957 Rail Plan and addressed new opportunities. The Plan also established a long-range vision to create a Bay Area rail network that addresses the anticipated growth in transportation demand and meets that demand. The Plan examined ways to incorporate expanded passenger train services into existing rail systems, improve connections to other trains and transit, expand the regional rapid transit network, increase rail capacity, coordinate rail investment around

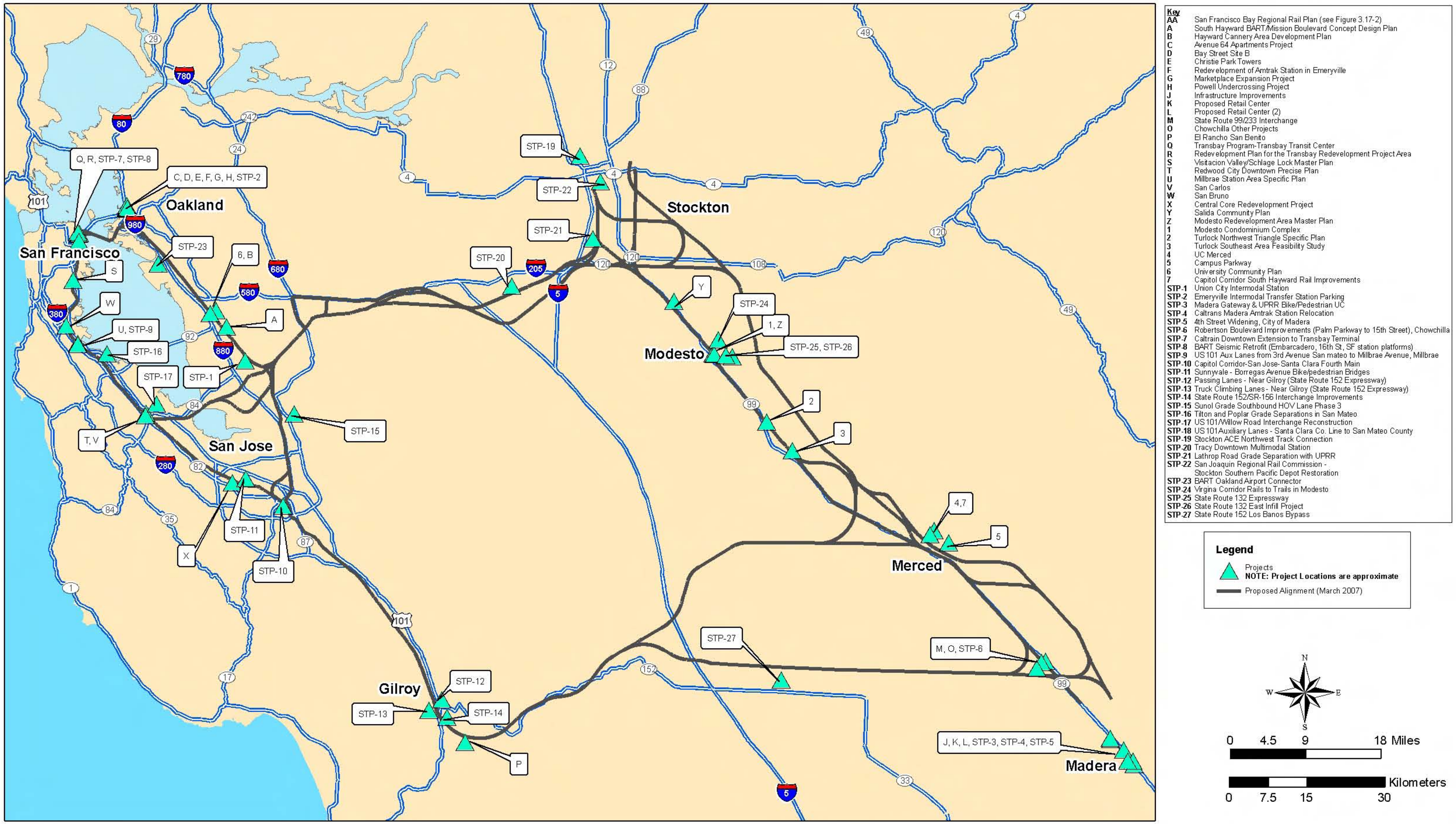
San Francisco
Oakland
San Jose
Gilroy
Stockton
Modesto
Merced
Madera
Key
AA San Francisco Bay Regional Rail Plan (see Figure 3.17-2)
A South Hayward BART/Mission Boulevard Concept Design Plan
B Hayward Cannery Area Development Plan
C Avenue 64 Apartments Project
D Bay Street Site B
E Christie Park Towers
F Redevelopment of Amtrak Station in Emeryville
G Marketplace Expansion Project
H Powell Undercrossing Project
J Infrastructure Improvements
K Proposed Retail Center
L Proposed Retail Center (2)
M State Route 99/233 Interchange
O Chowchilla Other Projects
P El Rancho San Benito
Q Transbay Program-Transbay Transit Center
R Redevelopment Plan for the Transbay Redevelopment Project Area
S Visitacion Valley/Schlage Lock Master Plan
T Redwood City Downtown Precise Plan
U Millbrae Station Area Specific Plan
V San Carlos
W San Bruno
X Central Core Redevelopment Project
Y Salida Community Plan
Z Modesto Redevelopment Area Master Plan
1 Modesto Condominium Complex
2 Turlock Northwest Triangle Specific Plan
3 Turlock Southeast Area Feasibility Study
4 UC Merced
5 Campus Parkway
6 University Community Plan
7 Capitol Corridor South Hayward Rail Improvements
STP-1 Union City Intermodal Station
STP-2 Emeryville Intermodal Transfer Station Parking
STP-3 Madera Gateway & UPRR Bike/Pedestrian UC
STP-4 Caltrans Madera Amtrak Station Relocation
STP-5 4th Street Widening, City of Madera
STP-6 Robertson Boulevard Improvements (Palm Parkway to 15th Street), Chowchilla
STP-7 Caltrain Downtown Extension to Transbay Terminal
STP-8 BART Seismic Retrofit (Embarcadero, 16th St, SF station platforms)
STP-9 US 101 Aux Lanes from 3rd Avenue San mateo to Millbrae Avenue, Millbrae
STP-10 Capitol Corridor-San Jose-Santa Clara Fourth Main
STP-11 Sunnyvale - Borregas Avenue Bike/pedestrian Bridges
STP-12 Passing Lanes - Near Gilroy (State Route 152 Expressway)
STP-13 Truck Climbing Lanes - Near Gilroy (State Route 152 Expressway)
STP-14 State Route 152/SR-156 Interchange Improvements
STP-15 Sunol Grade Southbound HOV Lane Phase 3
STP-16 Tilton and Poplar Grade Separations in San Mateo
STP-17 US 101/Willow Road Interchange Reconstruction
STP-18 US 101 Auxiliary Lanes - Santa Clara Co. Line to San Mateo County
STP-19 Stockton ACE Northwest Track Connection
STP-20 Tracy Downtown Multimodal Station
STP-21 Lathrop Road Grade Separation with UPRR
STP-22 San Joaquin Regional Rail Commission - Stockton Southern Pacific Depot Restoration
STP-23 BART Oakland Airport Connector
STP-24 Virgina Corridor Rails to Trails in Modesto
STP-25 State Route 132 Expressway
STP-26 State Route 132 East Infill Project
STP-27 State Route 152 Los Banos Bypass
Legend
Projects
NOTE: Project Locations are approximate
Proposed Alignment (March 2007)
0 4.5 9 18 Miles
0 7.5 15 30 Kilometers

Table 3.17-1. Cumulative Projects Associated with HST Network Alternatives

Cumulative Project Code	Cumulative Project	Altamont Pass Network Alternatives											Pacheco Pass Network Alternatives						Pacheco Pass with Altamont Pass (local service)			
		San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland & San Jose Termini	San Jose Terminus	San Francisco Terminus	Oakland Terminus	Union City Terminus	San Francisco & San Jose - via SF Peninsula	San Francisco, San Jose, Oakland – no Bay Crossing	Oakland & San Francisco – via Transbay Tube	San Jose, Oakland, & San Francisco via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland, & San Jose Termini	San Jose Terminus	San Jose, San Francisco & Oakland-via Transbay Tube	San Jose, Oakland & San Francisco-via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	SF, Oak, & SJ Termini (without Dumbarton Bridge)	San Jose Terminus
AA	San Francisco Bay Area Regional Rail Plan	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A	South Hayward BART/Mission Blvd. Concept Design Plan		X	X			X			X	X	X		X	X			X		X	X	
B	Hayward Cannery Area Development Plan		X	X			X			X	X	X		X	X			X		X	X	
C	Avenue 64 Apartments Project		X	X			X			X	X	X		X	X			X		X	X	
D	Bay Street Site B		X	X			X			X	X	X		X	X			X		X	X	
E	Christie Park Towers		X	X			X			X	X	X		X	X			X		X	X	
F	Redevelopment of Amtrak Station in Emeryville		X	X			X			X	X	X		X	X			X		X	X	
G	Marketplace Expansion Project		X	X			X			X	X	X		X	X			X		X	X	
H	Powell Undercrossing Project		X	X			X			X	X	X		X	X			X		X	X	
I	Inter-Modal Station Passenger Rail Project		X	X			X	X		X	X	X		X	X			X		X	X	
J	UPRR Infrastructure Improvements - Madera	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
K	Proposed Retail Center	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L	Proposed Retail Center (2)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M	State Route 99/233 Interchange	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
O	Chowchilla Other Projects	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
P	El Rancho San Benito												X	X	X	X	X	X	X	X	X	X
Q	Transbay Program-Transbay Transit Center	X		X		X			X	X	X	X	X		X		X	X	X		X	
R	Redevelopment Plan for the Transbay Redevelopment Project Area	X		X		X			X	X	X	X	X		X		X	X	X		X	
S	Visitacion Valley/Schlage Lock Master Plan	X		X		X			X	X			X		X		X		X		X	
T	Redwood City Downtown Precise Plan	X	X	X	X	X	X	X	X	X	X	X	X		X		X		X		X	
U	Millbrae Station Area Specific Plan	X	X	X	X	X	X	X	X	X	X	X	X		X		X				X	
V	San Carlos	X	X	X	X	X	X	X	X	X	X	X	X		X		X		X		X	
W	San Bruno	X	X	X	X	X	X	X	X	X	X	X	X		X		X		X		X	
X	Central Core Redevelopment Project	X	X	X	X	X	X	X	X	X	X	X	X				X		X		X	
Y	Salida Community Plan	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
Z	Modesto Redevelopment Area Master Plan	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
1	Modesto Condominium Complex	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
2	Turlock Northwest Triangle Specific Plan	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
3	Turlock Southeast Area Feasibility Study	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X
4	UC Merced	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	Campus Expressway	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	Capitol Corridor South Hayward Rail Improvements		X	X			X			X	X	X		X	X			X		X	X	
7	Merced County University Community Plan	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 3.17-1. Continued

Cumulative Project Code	Cumulative Project	Altamont Pass Network Alternatives											Pacheco Pass Network Alternatives						Pacheco Pass with Altamont Pass (local service)			
		San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland & San Jose Termini	San Jose Terminus	San Francisco Terminus	Oakland Terminus	Union City Terminus	San Francisco & San Jose - via SF Peninsula	San Francisco, San Jose, Oakland – no Bay Crossing	Oakland & San Francisco – via Transbay Tube	San Jose, Oakland, & San Francisco via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	San Francisco, Oakland, & San Jose Termini	San Jose Terminus	San Jose, San Francisco & Oakland-via Transbay Tube	San Jose, Oakland & San Francisco-via Transbay Tube	San Francisco & San Jose Termini	Oakland & San Jose Termini	SF, Oak, & SJ Termini (without Dumbarton Bridge)	San Jose Terminus
STP-1	Union City Intermodal Station		X	X			X	X		X	X	X		X	X			X		X	X	
STP-2	Emeryville Intermodal Transfer Station Parking		X	X			X			X	X	X		X	X			X		X	X	
STP-3	Madera Gateway & UPRR Bike/Pedestrian UC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-4	Caltrans Madera Amtrak Station Relocation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-5	4th Street Widening, City of Madera	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-6	Robertson Boulevard Improvements (Palm Parkway to 15th Street), Chowchilla	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-7	Caltrain Downtown Extension to Transbay Transit Center	X		X		X		X	X			X										
STP-8	BART Seismic Retrofit (Embarcadero, 16th St, SF station platforms)	X		X		X		X	X			X										
STP-9	US 101 Aux Lanes from 3rd Avenue San mateo to Millbrae Avenue, Millbrae	X		X		X		X	X			X										
STP-10	Capitol Corridor-San Jose-Santa Clara Fourth Main	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X	X
STP-11	Sunnyvale - Borregas Avenue Bike/pedestrian Bridges								X	X			X		X		X		X		X	
STP-12	Passing Lanes - Near Gilroy (State Route 152 Expressway)												X	X	X	X	X	X	X	X	X	X
STP-13	Truck Climbing Lanes - Near Gilroy (State Route 152 Expressway)												X	X	X	X	X	X	X	X	X	X
STP-14	State Route 152/SR-156 Interchange Improvements												X	X	X	X	X	X	X	X	X	X
STP-15	Sunol Grade Southbound HOV Lane Phase 3	X	X	X	X					X		X		X	X			X		X	X	X
STP-16	Tilton and Poplar Grade Separations in San Mateo	X		X		X			X	X			X		X		X		X		X	
STP-17	US 101/Willow Road Interchange Reconstruction	X		X		X			X	X			X		X		X		X		X	
STP-18	US 101 Auxiliary Lanes – Santa Clara Co. Line to San Mateo County								X	X			X		X		X		X		X	
STP-19	Stockton ACE Northwest Track Connection	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-20	Tracy Downtown Multimodal Station	X																				
STP-21	Lathrop Road Grade Separation with UPRR	X																				
STP-22	San Joaquin Regional Rail Commission – Stockton Southern Pacific Depot Restoration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-23	BART Oakland Airport Connector		X	X			X			X	X	X		X	X			X		X	X	
STP-24	Virginia Corridor Rails to Trails in Modesto	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-25	State Route 132 Expressway	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-26	State Route 132 East Infill Project	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STP-27	State Route 152 Los Banos Bypass Project												X	X	X	X	X	X	X	X	X	X

transit-friendly communities and businesses, and identify functional and institutional consolidation opportunities. The plan also included a detailed analysis of potential high-speed rail routes between the Bay Area and the Central Valley that are consistent with the HST Network Alternatives in this environmental document. As noted above, the Plan looked at improvements for the near term, intermediate term, and long term. The Plan's network and services are intended to:

- Address the combined challenges of moving people and goods.
- Link people with commercial, employment, and residential centers.
- Expand capacity for goods movements to support the regional economy.
- Serve as the backbone of an integrated regional transit network with seamless connections at key transit hubs to local transit services.
- Accommodate development of statewide high-speed rail and enable operation of regional services along high-speed lines, and vice-versa.
- Include policies and incentives to encourage local governments to create well-designed, walkable communities with a mix of services near transit.
- Explore a governance structure that can develop regional system improvements and deliver coordinated, customer-oriented services.

Core Elements

There are five core elements of the Plan:

- BART.
- Railroad-based regional passenger services, e.g., Capitol Corridor, Caltrain, ACE, etc.
- High-Speed Rail.
- Accommodation of increased rail freight movements attributable to economic growth.
- Long-term land use, including the impact of “smart growth” policies.

Following full technical analysis of alternatives, the study will designate the most promising systemwide alternatives, both for scenarios without high-speed rail and for scenarios that include high-speed rail from either the east (Altamont Pass) or south (Pacheco Pass).

Evaluation of systemwide alternatives will consider travel performance, cost, and impacts for two horizon years (2030 and 2040/50). Corridor-level evaluation and phasing considerations will distinguish the Year 2030 plan from the Year 2050 plan; the Year 2030 plan would be developed from the Resolution 3434 network.[2] The Plan base case or No Project Alternative includes the existing financially constrained MTC RTP and the ten rail extensions (as well as service improvements to ACE, Caltrain, and the Capitol Corridor) identified in MTC Resolution 3434. The ten rail extensions identified in MTC’s Resolution 3434 are:

1. BART/East Contra Costa Rail (eBART)
2. ACE Increased Services
3. BART/I-580 Rail Right-of-Way Preservation
4. Dumbarton Bridge Rail Service
5. BART/Fremont–Warm Springs to San Jose Extension

[2] For more information please see the MTC website at: www.mtc.ca.gov

6. Caltrain/Rapid Rail/Electrification & Extension to Downtown San Francisco/Transbay Transit Center
7. Caltrain Express Service
8. SMART (Sonoma-Marin Rail)
9. Capitol Corridor/Increased Services
10. BART/Oakland Airport Connector

Themes and Alternatives

Different themes for each of the five major Plan elements are explored in the Plan and systemwide alternatives:

High-Speed Rail—Regional Rail Overlay

The study of high-speed rail in the Plan is consistent with the HST Network Alternatives described in this Draft Program EIR/EIS. As the HST system involves major infrastructure investment, the Plan identified and evaluated options for providing overlay services (use of the HST infrastructure for regional rail service with additional investments in facilities and compatible rolling stock).

Regional overlay operations on HST lines could provide service to additional local stations along the HST lines. Such local stops typically would be developed as four-track sections with a pair of outside platforms for regional trains and two express tracks (no platforms) in the center. The extent of the four-track sections would depend on the prevailing speed of the line for statewide service as well as the spacing and location of the local stops. The regional overlay services would be operated with compatible equipment, but the average speeds and overall travel times would be greater than the HST because of the additional stops. As additional investment would be necessary to provide the infrastructure for such regional overlay services, these additional regional services need to be evaluated for cost-effectiveness.

BART

The following three themes are considered for expansion of BART:

1. BART is extended and expanded beyond the Resolution 3434 base case to become a system providing regional service throughout the Bay Area counties similar to the original BART plan.
2. BART is not extended, but infill stations are constructed and service is concentrated to provide mass transit service in dense areas with express service and/or skip-stop service being used to provide adequate travel times for longer length trips.
3. The BART system remains largely as is with improvements focused on core capacity needs; alternative technologies are used to extend coverage except where short extensions of the BART technology would provide the most beneficial solution.

Railroad-Based Passenger Services

Different levels of improvement to passenger rail services along existing conventional rail lines are explored. At the highest level of improvement, infrastructure would be similar to the HST infrastructure. With HST implementation, overlay service in the HST corridors would substitute for the railroad-based passenger service. High, low, and hybrid themes are explored for passenger rail services:

1. High: existing conventional rail lines are upgraded ultimately to provide 115 mph (185 kph) service operating throughout the region on separate electrified grade-separated trackage along principal line segments; passenger service is withdrawn from existing freight tracks along principal lines, thereby improving capacity for goods movement.

2. Low: appropriate capacity and operational improvements, including signaling, passing tracks and/or multi-tracking and route alignments, are constructed along shared lines to accommodate the projected increases in combined passenger and freight demand in shared freight/passenger corridors using FRA-compliant equipment with higher speeds. With HST implementation, the HST would be on separate trackage without an overlay service.
3. Hybrid: a combined strategy is pursued in which an appropriate vehicle technology and infrastructure solution is selected on a corridor-by-corridor basis, considering adjacent corridors and other systems (e.g., BART and the HST) so that a consistent, workable systemwide plan results.

Freight

Different scenarios for freight movements are considered including maintaining existing practices with some improvements to accommodate traffic growth. A second scenario considers a coordinated and optimized operation of freight and passenger trains with infrastructure improvements. A third scenario considers consolidating portions of the regional rail network under public ownership and controlling from a consolidated passenger–freight dispatch center with major infrastructure improvements and rerouting of freight traffic.

Land Use

The Plan considers the linkage between land use and transportation in a framework for Plan implementation and explores three significantly different development patterns:

1. Urban Infill "Core" Development—Concentration of growth in existing urban areas by focusing growth on vacant or underutilized lands.
2. Urban-Suburban "Hub and Spoke" Development—Combination of urban infill and continued suburbanization along spokes of residential-intensive communities surrounding the inner Bay Area.
3. Regional "Web" Development—Growth of outlying areas serving clusters of employment and housing tied to local industry geography.

Principal Corridors

The Plan study area was divided into geographically distinct corridors connecting major population centers that also reflect the logic of rail infrastructure. Within the overall Plan study area bounded by Cloverdale and Auburn to the northwest and northeast and by Monterey and Merced to the southwest and southeast are 12 distinct transportation corridors (Figure 3.17-2):

1. BART System (all lines)
2. US 101 North Corridor (Marin – Sonoma)
3. North Bay Corridor (Marin – Sonoma)
4. I-80 Corridor (Auburn – Oakland)
5. East Bay Corridor (Oakland – San Jose)
6. Transbay Corridor (San Francisco – Oakland)
7. Peninsula Corridor (San Francisco – San Jose)
8. South Counties Corridor (Santa Cruz , Monterey, San Benito)
9. Dumbarton Corridor (Redwood City – Union City)
10. I-680 & Tri-Valley Corridor (Contra Costa & Southern Alameda)
11. Central Valley Corridor (Sacramento – Merced)

12. Grade Crossings and Grade Separations (all lines)

San Francisco Bay Area Regional Rail Plan Conclusions

This Regional Rail Plan Revised Draft Report was prepared in response to input received from the public. In August 2007, a series of regional rail workshops were held to solicit input on a Draft Summary Report of the Regional Rail Plan, which was first presented and reviewed by a steering committee in July 2007. A final report of the Regional Rail Plan for the San Francisco Bay Area was prepared and was adopted by MTC in September 2007. The final report includes a "Regional Rail Vision" and has three scenario outcomes: 1) without High-Speed Rail; 2) with High-Speed Rail via Altamont Pass; and 3) with High-Speed Rail via Pacheco Pass. For each of these three outcomes, improvements were recommended for the 12 corridors.

Regional Rail Vision

The executive summary of the final Regional Rail Plan presents the Regional Rail Vision as follows (pg ES-3):

- Ring the Bay with Rail: A long-term vision of many in the region is to ring the Bay, connecting the three major Bay Area cities (San Francisco, Oakland, and San Jose), with fast, frequent and integrated passenger rail network.
- The Right Technology Should Be Used With the Right Corridor: A broad range of rail technologies, including BART and conventional passenger trains like Amtrak, are considered in this plan. Emerging technologies such as non-Federal Railroad Administration compliant Electric Multiple Unit (EMU) trains are also explored.
- The BART & Caltrain Systems Are the Backbone: The BART and Caltrain systems serve as the backbone of the regional rail network and it is clear there will be capacity constraints and renovation needs for the existing systems. This reinvestment should be a top regional priority over the next few decades.
- The BART System's Outward Expansion Is Nearly Complete: While BART will always remain at the core of the region's rail system, its outward expansion potential is limited. Once the extension to San Jose is completed, and the existing lines are brought to logical terminals in Livermore, Santa Clara, and East Contra Costa County, no additional outward extensions of the BART technology are contemplated. Higher-speed express trains would better serve outlying suburban markets. Instead, BART will evolve toward a higher-frequency, highly productive metro system.
- The Bay Area Needs a Regional Rail Network: As the BART system becomes more of a high-frequency, close stop spacing urban subway system, it needs to be complemented with a larger regional express network serving longer-distance trips. These trains would run largely on existing tracks, some shared with freight and others in their own rights-of-way with specialized signaling and dispatch systems.
- Rail Infrastructure Must Be Expanded to Accommodate Growth in Passenger and Freight Traffic: To allow the region's economy to continue growing while meeting increased passenger needs, the freight and passenger rail systems must be increasingly accommodated. Certain freight corridors require additional mainline tracks to support high-frequency freight and passenger services.
- High-Speed Rail Provides Opportunities to Enhance and Accelerate Regional Rail Improvements: High-speed rail complements and supports the development of regional rail—a statewide high-speed train network would enable the operation of fast, frequent regional services along the high-speed lines and should provide additional and accelerated funding where high-speed and regional lines are present in the same corridor.

Study Corridors

LEGEND:

1 US 101 North Corridor (Marin ↔ Sonoma)
2 I-80 Corridor (Auburn ↔ Oakland)
3 North Bay Corridor (Marin ↔ Solano)
4 Peninsula Corridor (San Francisco ↔ San Jose)
5 South Counties Corridor (Santa Cruz, Monterey, San Benito)
6 East Bay Corridor (Oakland ↔ San Jose)
7 Transbay Corridor (San Francisco ↔ Oakland)
8 Dumbarton Corridor (Redwood City ↔ Union City)
9 Central Valley Corridor (Sacramento ↔ Merced)
10 I-680 and Tri-Valley Corridor (Contra Costa & Southern Alameda)

Not Shown:

BART System (all lines)

Grade Crossings and Grade Separations (all lines)

Source: Regional Rail Plan for the San Francisco Bay Area, September 2007.

Figure 3.17-2
Regional Rail Plan Corridors Map

Regional Rail without High-Speed Rail

The Plan for Regional Rail without High-Speed Rail includes:

- BART: Improve core capacity, implement Resolution 3434 extensions; extend BART to Livermore; construct fourth track through Oakland; develop infill stations; increase capacity; and in the longer term pursue a second Bay crossing (between San Francisco and Oakland).
- US 101 North: Implement non-electric SMART project (in the early years with 30-minute headways).
- North Bay: Corridor preservation and consideration of standard non-electric rail services.
- I-80 & East Bay: Expand East Bay non-electric standard rail network from San Jose to Sacramento to three tracks with some four-track sections.
- Transbay: Provide near-term investments in BART Core Capacity (higher-capacity cars, improved signaling, etc.); in the long term, provide new transbay tube and San Francisco BART Line paired with rail tunnel.
- South Counties: Extend non-electric conventional rail service to Salinas, with further expansion to provide rail connections to Monterey and Santa Cruz.
- Peninsula: Expand Caltrain to three or four tracks and operate with lightweight electric multiple-unit equipment.
- Dumbarton: In the near term, implement service between Union City and Redwood City with standard railroad equipment; in the long term, develop separate passenger-only trackage from Redwood City to Union City to support lightweight equipment compatible with Caltrain Peninsula operations.
- Tri-Valley/I680: Add trackage to support improved non-electric conventional passenger service along the ACE rail corridor and to accommodate regional freight trains for approximate 100-minute operating time between Stockton and San Jose. Develop regional bus options in the I-680 corridor.
- Central Valley: Provide a non-electric conventional regional corridor service between Sacramento and Merced over the long term, interlined with ACE services and complimenting the San Joaquin long haul trains.

The estimated total capital cost of the Regional Rail Plan is about $45 billion (2006 dollars). Funding for Regional Rail investments beyond current Resolution 3434 commitments will likely come from multiple sources, including federal, state, regional, local, and public/private partnerships, and other sources.

Regional Rail with High-Speed Rail

The Plan analysis identified numerous opportunities to operate regional “overlay” services across high-speed lines within northern California. Implementation of these services would require provision of four tracks at the regional stations as well as approaching and departing the regional stations. Regardless of which Altamont or Pacheco alignment alternatives would be developed, an initial phase of investment would be on the San Francisco Peninsula between San Jose and San Francisco to make the Caltrain corridor “high-speed rail ready” for operation as a grade-separated, higher speed alignment suitable for use of electric, multiple-unit equipment. The Plan with HST is very similar to the Plan without HST, except that HST would provide a higher level of service and additional and accelerated funding where HST and regional rail lines are in the same corridor.

The Plan concluded that both the Altamont Pass and Pacheco Pass alignments have similar total costs, and that to accommodate regional services on HST infrastructure would add about $1 billion. The Plan states, “if either Altamont or Pacheco were selected as the sole option, 4-track sections would be needed at regional stations as well as approaching and departing regional stops. These four-track sections would be required along the Altamont route between Fremont and Tracy and along the Pacheco route between San Jose and Gilroy. By contrast, with an Altamont + Pacheco option, two-track section would suffice from San Jose to Gilroy and from Fremont to Tracy." (page ES-17).

The Plan also concluded that Altamont and Pacheco would have similar regional ridership levels of approximately 54 million to 56 million northern California trips in Year 2030 (including both intra-regional trips within northern California as well as inter-regional trips to points south of Merced). The Plan states, "An Altamont alignment would have higher regional ridership (between points located from Merced and north) of 20-million trips in Year 2030 vs. about 16-million trips for a Pacheco alignment – by contrast, a Pacheco alignment would have higher ridership between Northern California and Southern California (between points located from Fresno and south) of 40-million trips in Year 2030 vs. about 34-million trips for an Altamont alignment" (pg ES-17).

The Plan outcome "with High-Speed Rail via Altamont Pass" presents the opportunity for shared infrastructure and shared costs with the statewide HST system in several of the corridors under investigation: the Tri-Valley (Altamont Pass), the East Bay, Peninsula, Transbay, and Central Valley. The potential number of stations in these corridors and the relatively short length suggest that the combined services (HST + Regional Rail Overlay) could require four tracks for passenger services throughout much of the HST alignment for this alternative. Even so, the Plan would also include improvement in the South County corridor (along US 101 from San Jose to Monterey-Salinas).

The Plan outcome "with High-Speed Rail via Pacheco Pass" also would present the opportunity for shared infrastructure and shared costs with the statewide HST system in several of the corridors under investigation: the South County, the East Bay, Peninsula, Transbay, and Central Valley. With this Plan alternative, a considerable level of improvement in the "Tri-Valley" corridor (Altamont Pass) would also occur.

B. CUMULATIVE GROWTH PROJECTIONS

California's population has grown from 20 million to more than 36 million people over the last 30 years. At the same time, more than 10 million additional jobs have been created in California. As of 2005, California was estimated to have about 36.1 million people and 20.9 million jobs. Table 3.17-2 lists Year 2005 population and employment and 2030 projections as well as estimates of 2002 and 2030 urbanization. Data are presented for major regions in California as well as individual counties in the Bay Area to Central Valley region. As expected, the Bay Area counties have a higher total population than those in the Central Valley in 2005 and 2030, but the 64% growth rate for the Central Valley is more than 33% higher and exceeds the 44% growth rate for the 11-county core study area and the state. Employment also is projected to increase substantially by 2030 in both the Bay Area and Central Valley counties, exceeding the growth rate for the state. Urbanization is projected to increase by 392,000 ac (158,700 ha) by 2030 in the 11-county core study area, with 68% of this occurring in the Central Valley counties.

Table 3.17-2
Population, Employment (2005-2030) and Urbanization (2002-2030) Trends

County	Population			Employment			Urbanized Area		
	2005 Conditions	2030 No Project	Growth Rate	2005 Conditions	2030 No Project	Growth Rate	Year 2002 Acres (ha)	2030 No Project Acres (ha)	Growth Rate
Alameda County	1,451,065	2,038,482	40.5%	953,937	1,247,413	30.8%	141,654 (57,327)	186,683 (75,551)	31.8%
Contra Costa County	1,017,644	1,543,053	51.6%	508,854	763,445	50.0%	142,467 (57,656)	183,869 (74,412)	29.1%
San Francisco County	741,025	796,208	7.4%	779,357	975,823	25.2%	23,277 (9,420)	30,013* (12,146)	28.9%
San Mateo County	701,175	814,065	16.1%	522,830	717,526	37.2%	70,869 (28,681)	80,304 (32,499)	13.3%
Santa Clara County	1,705,158	2,152,963	26.3%	1,323,920	1,769,498	33.7%	184,481 (74,659)	207,833 (84,110)	12.7%
Study Area—Bay Area	*5,616,067*	*7,344,771*	*30.8%*	*4,088,898*	*5,473,705*	*33.9%*	*562,748* (227,744)	*688,702* (278,718)	*22.4%*
Fresno County	878,089	1,297,476	47.8%	435,769	589,226	35.2%	96,977 (39,247)	150,223 (60,795)	54.9%
Madera County	142,530	219,832	54.2%	56,892	91,364	60.6%	23,255 (9,411)	36,366 (14,717)	56.4%
Merced County	242,249	437,880	80.8%	87,365	115,054	31.7%	31,712 (12,834)	60,455 (24,466)	90.6%
Sacramento County	1,363,423	2,293,028	68.2%	805,978	1,259,792	56.3%	157,101 (63,579)	237,818 (96,245)	51.4%
San Joaquin County	664,796	1,229,757	85.0%	274,155	368,745	34.5%	74,250 (30,049)	145,776 (58,996)	96.3%
Stanislaus County	505,492	744,599	47.3%	224,491	316,686	41.1%	55,426 (22,431)	74,267 (30,056)	34.0%
Study Area—Central Valley	*3,796,579*	*6,222,572*	*63.9%*	*1,884,650*	*2,740,867*	*45.4%*	*438,721* (177,550)	*704,905* (285,275)	*60.7%*
Core Study Area	*9,412,646*	*13,567,343*	*44.1%*	*5,973,548*	*8,214,572*	*37.4%*	*1,001,469* (405,295)	*1,393,607* (563,993)	*39.2%*
Statewide Total	36,154,147	48,110,671	33.1%	20,903,134	28,617,864	36.9%			

Sources: U.S. Bureau of the Census; MTC/California High-Speed Rail Travel Demand Model; Cambridge Systematics, Inc, 2007

*Note: Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Since "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than increases in urbanized area size implied in this table.

3.17.4 Analysis of Cumulative Impacts

The following analysis describes the potential range of impacts from the HST Network Alternatives to contribute to cumulative impacts related to the environmental topics of Chapter 3 when considering past, present, and reasonably foreseeable future projects. The environmental topics are discussed herein in the same order as they appear in Chapter 3. The impacts of growth potentially induced by the proposed project are addressed in Chapter 5, "Economic Growth and Related Impacts." These potential secondary impacts were considered in the cumulative impacts analysis.

A. TRAFFIC AND CIRCULATION AND TRAVEL CONDITIONS

California's intercity travel network consists of three main components: highways, airports, and rail. As discussed in Section 3.2, "Travel Conditions," automobiles and air transportation carry more than 99% of intercity trips in California. The urban areas of San Francisco and Los Angeles experience some of the most severe highway congestion and travel delays in the country. Between 1990 and 2003, the vehicle miles of travel (VMT) (vehicle kilometers of travel [VKT]) on only the state highway system increased by almost 37 billion mi (60 billion km), a 26% increase (California Department of Transportation 2007). Between 2005 and 2030, the statewide vehicle miles of travel on all roadways is projected to increase by more than 68% to over 550 billion miles (890 billion km) in 2030 (California Department of Transportation 2006). In addition, California airports generally experience the highest average air travel delays in the nation (Hansen et al. 2002). Although the main contributors to congestion are local and commuter highway trips and transcontinental and international flights (such as in San Francisco), intercity trips compete for the limited capacity on overburdened facilities.

The study area for the cumulative analysis of traffic and circulation was identified to be the study region, Bay Area to Central Valley. This included major intercity highways, roadways, passenger transportation services, and intersections around stations within 1 mi (1.6 km) of suburban station options and 0.25 mi (0.40 km) of downtown station options.

No Project Alternative

As described in Chapter 3 (Sections 3.1 and 3.2), the program-level impact analysis of traffic and circulation and travel conditions focused on traffic and LOS analysis of intercity highway segments, primary highway/roadways accessing proposed HST stations, and primary highway/roadways accessing airports and potential impacts on transit, goods movement, and parking at proposed stations. Impacts on travel conditions included analysis of travel time, reliability, safety, connectivity, sustainable capacity, and passenger cost. Intercity travel in California is forecasted to increase up to 63% between 2000 and 2030, from 550 million trips to more than 896 million trips. An estimated 86% of these trips will be made by automobile, as stated in the purpose and need chapter of this Program EIR/EIS (Chapter 1). More than 42% of the intercity travel market forecast for 2030 between the state's major metropolitan areas and more than 62% of the projected intercity ridership of the proposed statewide HST system would have a trip-end (either origin or destination) in the Bay Area to Central Valley study area. More than two-thirds of the 18 highway segments analyzed in this study would operate at unacceptable conditions (LOS F) under the No Project Alternative. The expected increase in the number of autos on the highways by 2030 also would result in significant travel delays and congestion under the No Project Alternative, which would have significant potential impacts on the state's economy and quality of life. Under the No Project Alternative, there would be adverse effects related to traffic and LOS on intercity highway segments, primary highway/roadways accessing proposed HST stations, and primary highway/roadways accessing airports. There would be adverse impacts on transit, goods movement, and parking. Therefore, under the No Project Alternative, the cumulative impact related to traffic and circulation would be significant when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.1).

HST Network Alternatives

Compared to the No Project Alternative in 2030, the proposed statewide HST system would result in a reduction of automobile travel of from 12 to 23 billion miles (19 to 37 billion km) annually, depending on network alternative as discussed in Section 3.2, "Travel Conditions." This outcome would benefit intercity highways within the study region and reduce travel delays on the affected highways and on surface streets leading to and from intercity highways. Therefore, implementation of the HST Network Alternatives would not lead to a considerable contribution to the cumulative impact related to highway and airport use but could be a considerable contribution to the cumulative impact related to surface streets leading to and from proposed stations.

Program mitigation strategies, as discussed in Section 3.1, could be developed in consultation with state, federal, regional, and local governments and affected transit agencies to improve the flow of intercity travel on the primary routes and access to the proposed stations. Regional strategies would include coordination with regional transportation planning and intelligent transportation system strategies. Local improvements could employ TSM/signal optimization; local spot widening of curves; and major intersection improvements.

B. AIR QUALITY

As stated in Section 3.3, "Air Quality," pollution sources in the two air basins directly affected by the proposed project account for about 30% of the total statewide criteria pollutant emissions. Overall, emissions in the San Francisco Bay Area Air Basin and San Joaquin Valley Air Basin have been declining for the past 20 years despite population growth and increases in vehicular travel. This decline is a result of new controls, rules, and more stringent emissions standards. The one exception to improvement has been PM10. PM10 emissions are predicted to increase through 2010 as a result of growth in emissions from areawide sources, primarily fugitive dust sources. An additional growing environmental concern is global climate change, and the transportation sector is responsible for about 40% of California's greenhouse gas emissions, and up to 50% in the Bay Area.

The study area for the cumulative analysis of air quality was identified to be the San Francisco Bay Area Air Basin and San Joaquin Valley Air Basin, as well as the state as a whole. CO_2 emissions are only calculated on a statewide level.

No Project Alternative

The program-level impact analysis of air quality described in Section 3.3, "Air Quality," focused on the potential statewide, regional, and localized impacts related to pollutant burdens occurring from highway vehicle miles traveled, number of plane operations, number of train movements, and power requirements. The analysis of air quality considers emissions of projected regional growth by the CARB for eight criteria pollutants (CO, SO_x, HC, NO_x, O_3, PM10, PM2.5, and Pb) in the two air basins potentially affected, and therefore includes past, present, and reasonably foreseeable projects/actions and population growth as part of the No Project Alternative. CO_2, the primary greenhouse gas, is projected to increase 38% statewide from existing conditions. As noted above, the analysis is structured to estimate the potential impacts on air quality on the local and regional levels in two air basins directly affected by the project alternatives as well as statewide. Under the No Project Alternative, the cumulative impact related to air quality would be significant when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.3).

HST Network Alternatives

It is estimated that the proposed HST Network Alternatives would be able to accommodate between 88 and 117 million people annually for intercity trips, as discussed in Section 3.2, "Travel Conditions." Intercity passengers using the HST system otherwise would use the roadways and airports, and the result is a potential reduction of automobile travel from 22 to 32 billion miles (36 to 52 billion km) annually, and a reduction in emissions because of the reduced number of flights (19.3 to 20.1 million air trips would shift to HST annually, as discussed in Section 3.3). Overall, pollutants would decrease statewide compared to the No Project Alternative: CO 5.2% to 5.3%, PM10 5.4% to 5.5%, PM2.5 5.1% to 5.6%, NO_X 4.2%, and total organic gases 5.2% to 5.3%. Therefore, the HST Network Alternatives would result in an air quality benefit. The benefit could increase if the HST ridership increased beyond the levels assumed in this document. However, as described in Section 3.3, there may be localized air quality impacts from the HST Network Alternatives.

The HST Network Alternatives would also reduce greenhouse gas emissions (CO_2) statewide by 0.9% to 1.4%. The proposed HST system would result in beneficial impacts related to greenhouse gases and global climate change. Any additional carbon entering the atmosphere, whether by emissions from the project itself or removal of carbon sequestering plants (included agricultural crops), would be more than offset by the beneficial reduction of carbon resulting from the project due to a reduction in automobile vehicle miles traveled (mobile sources) and reduction in the number of airplane trips.

The potential local air quality impacts of the HST Network Alternatives, in combination with the air quality impacts of other projects identified for this cumulative impact analysis (Appendix 3.17-A) and those projects considered in the state implementation plan for air quality, could contribute considerably to cumulative air quality impacts in the two air basins in the study area. Local adverse air quality impacts related to traffic could occur near HST stations. Program-level analysis reviews the potential statewide air quality impacts that would support determination of conformity, as discussed in Section 3.3. At the project level, mitigation strategies to address localized impacts could consider increasing emission controls from power plants supplying power for the HST Network Alternatives; designing the system to use energy efficient, state-of-the-art equipment; promoting increased use of public transit, alternative fueled vehicles, and parking for carpools, bicycles, and other alternative transportation methods; alleviating traffic congestion around passenger station areas; and minimizing construction air emissions.

C. NOISE AND VIBRATION

As noted in Section 3.4, "Noise and Vibration," the noise environment in the study area along the proposed HST alignments and stations generally is dominated by transportation-related sources. The ambient noise in the northern portion of the Bay Area to Central Valley region is dominated by motor vehicle traffic in densely populated areas and along freeways. Other major contributors include Caltrain, Amtrak, and freight rail as well as international airports at San Francisco, Oakland, and San Jose. In the more rural areas of the region, the ambient noise is lower because it is more removed from transportation noise sources.

The study area for the cumulative analysis of noise and vibration was identified to be within 1,000 ft (305 m) of the HST Network Alternatives.

No Project Alternative

Noise and vibration impacts, particularly in growing urban areas and along highway corridors, will continue to increase as population grows and use of highways and airports increases. Therefore, under the No Project Alternative the cumulative impact related to noise and vibration would be significant when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.4).

HST Network Alternatives

Implementation of the proposed HST Network Alternatives potentially could result in high noise impacts for up to approximately 20 mi (32.4 km) of alignment, depending on network alternative. These potential impacts, when combined with the potential noise impacts of other highway, roadway, and transit expansion projects in the Bay Area to Central Valley region, could locally contribute potential cumulative noise impacts during construction and operation. The same is true for vibration impacts where the network alternatives would potentially result in high vibration impacts for up to approximately 52 mi (84.3 km) of alignment.

The potential impacts of the HST Network Alternatives could be a considerable contribution to cumulative noise and vibration impacts. Program-level mitigation of noise and vibration impacts, as discussed in Section 3.4, "Noise and Vibration," relates to design practices emphasizing the use of tunnels or trenches; use of electric-powered trains, higher quality track interface, and smaller lighter and more aerodynamic trainsets; and grade separations from roadways. At the project level, mitigation strategies to address localized noise and vibration impacts should include treatments for insulation of buildings affected by noise and vibration; sound barrier walls within the right-of-way; track treatments to minimize train vibrations; and construction mitigation (See Section 3.4).

D. ENERGY

As noted in Section 3.5, "Energy," California is the tenth-largest worldwide energy consumer and is ranked second in consumption in the United States, behind Texas. The study area for the cumulative analysis of energy was identified to be the state of California. Of the overall energy consumed in the state, the transportation sector represents the largest portion at 46%. Between 2005 and 2030, the statewide vehicle miles of travel on all roadways are projected to increase by more than 68%, with fuel consumption increasing by more than 61% (California Department of Transportation 2006).

According to the CEC, total statewide electricity consumption grew from 228,038 GWh in 1990 to 272,000 GWh in 2005, approximately 19%. The upward electricity consumption trend throughout the state is anticipated to continue because of growth (California Energy Commission 2006a).

<u>No Project Alternative</u>

As discussed in Section 3.5, the No Project Alternative assumes continued dependence on automobiles and air travel for intercity trips in the state. Compared to 2000, this increase in travel would result in an increase in annual energy consumption by an estimated 56 to 63 million barrels of oil per year, depending on low-end or high-end ridership forecasts. Therefore, under the No Project Alternative, the cumulative impact related to energy consumption would be significant when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.5).

<u>HST Network Alternatives</u>

The statewide HST system would reduce energy consumption in 2030 by an estimated 22 million barrels of oil annually, depending on HST Network Alterative (a 5% savings compared to the No Project Alternative). This conservative estimate is based on use of average size trains that could be expanded to carry more passengers; the potential energy benefits could be substantially higher if train capacity and ridership were increased. The proposed statewide HST system, regardless of network alternative, would have a beneficial effect on energy consumption in the state and, therefore, would not contribute to cumulative energy impacts.

The statewide HST system would represent a small percentage of generating and transmission capacity required to satisfy projected overall demand in 2030. The electricity requirement of the HST system would be about 794 MW, depending on overall ridership, during peak electricity demand periods in 2030. This represents approximately 0.96% of the projected statewide electricity demand in 2030. The proposed HST system is anticipated to reduce energy consumption overall. Any localized electricity impacts would be avoided through proper planning and design of power distribution systems and their relationship with the overall power grid. Therefore, the statewide HST system's contribution to cumulative electricity demand would be less than significant when considering past, present, and reasonably foreseeable future projects.

Construction-related energy consumption of the statewide HST system would result in a one-time, nonrecoverable energy cost of 22 million barrels of oil spaced over a number of years. Because of the more energy-efficient mode of travel provided by the HST, the energy consumed for construction would be recovered by the energy savings within about one year as noted in Section 3.5, "Energy." Construction of the HST system potentially would represent a significant use of nonrenewable resources. Mitigation strategies to address construction energy use include implementation of a construction energy conservation plan. Therefore, the statewide HST system would result in a considerable contribution to a significant cumulative energy impact when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.5).

E. ELECTROMAGNETIC FIELDS AND ELECTROMAGNETIC INTERFERENCE

As described in Section 3.6, EMFs exist in the environment both naturally and as a result of human activities. The study area for the cumulative analysis of EMF and EMI was identified to be within 1,000 ft (305 m) of the right-of-way of the HST Network Alternatives.

No Project Alternative

By Year 2030, EMFs along existing roadways and railroad rights-of-way probably would be affected by technological developments and by increases in total energy consumption. For example, general EMF levels along highways may be cumulatively increased by advanced automotive technologies such as collision avoidance systems and automatic vehicle guidance systems, if such technologies are implemented by 2030, and increased reliance on electrically powered automobiles. Improvements to airports may also increase environmental EMFs because of increased use of radar, radio communications, and instrument landing systems. Based on available information, these changes are not likely to cause significant changes in EMF levels, increased human exposures to EMFs, or EMI in the environment. Therefore, under the No Project Alternative there would be no cumulative impact related to EMFs or EMIs when considering past, present, and reasonably foreseeable future projects in the study area.

HST Network Alternatives

The HST Network Alternatives would traverse a range of geographic and land use typologies and could result in potential EMF exposure in urban, suburban, rural, agricultural, and industrial areas. The various components of the HST infrastructure and the trains themselves would be sources of EMFs at both ELF and RF. It is likely that some additional potential for human exposure to EMFs and EMI would occur with the HST Network Alternatives in combination with other proposed projects (potential activities include transmission lines and other electric rail systems); however, although the HST Network Alternatives could cause direct and indirect EMF and EMI impacts, there would not be a considerable contribution to EMF and EMI levels because mitigation included in project-level analysis would include design choices (tunnel, elevated track, physical barriers between track and receptor, or facility site selection) and through shielding to avoid or minimize potential EMF and EMI impacts.

F. LAND USE AND PLANNING, COMMUNITIES AND NEIGHBORHOODS, PROPERTY, AND ENVIRONMENTAL JUSTICE

Even though the population in the San Joaquin Valley grew from 200,000 to 3 million in the 20th century, it underwent much less of a transformation than did the Bay Area. Population growth in the northern San Joaquin Valley was 63% between 1980 and 2000. In this same period the urban to rural share went from 78% urban and 22% rural to 89% urban and 11% rural (Teitz et al. 2005). Since 1990 the rate of land conversion has increased by 21% in the northern San Joaquin Valley (Great Valley Center 2006).

With a population of approximately 7 million in the year 2000, the San Francisco Bay Area (nine-county area) is the fifth most populous metropolitan area in the United States. Only about 18% of the region's approximately 4.8 million ac is developed. Residential uses account for 72% of this developed land. From 1960 to 2000, the region's population has grown by 90%, while jobs increased by 200%. The locations of people and jobs have become much more dispersed with both population growth and jobs occurring in new urban centers on the edge of the region. Since the 1990s, the Bay Area has experienced significant growth, with population increasing by 764,000 and employment by 548,000 jobs. Development has continued as well, with a 5% increase in developed acres (Metropolitan Transportation Commission 2004).

The study area for the cumulative analysis of land use and planning, communities and neighborhoods, property, and environmental justice was identified to be at least 0.25 mi (0.40 km) on either side of the HST Network Alternatives.

<u>No Project Alternative</u>

As described in Section 3.7, the land use and local communities are expected to change between 2006 and 2030 as a result of past, present, and reasonably foreseeable future projects, related to population growth and changes in economic activity in the project study area (see also, Chapter 5, "Economic Growth and Related Impacts"). It is expected that some changes related to land use compatibility, communities and neighborhoods, property, and environmental justice will occur, even though it is assumed that reasonably foreseeable future projects would include typical design and construction practices to avoid or minimize potential impacts and would be subject to a project-level environmental review process to identify potentially significant impacts and to include feasible mitigation measures to avoid or substantially reduce potential impacts. Therefore, under the No Project Alternative the cumulative impact related to land-use compatibility, communities and neighborhoods, property, and environmental justice would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

<u>HST Network Alternatives</u>

The HST Network Alternatives potentially could contribute to cumulative impacts associated with community and neighborhood cohesion and property loss, although most alignment options of the HST Network Alternatives would be within existing railroad right-of-way or adjacent to transportation facilities. Combined with other transit (light rail and commuter rail) and roadway projects considered for this cumulative impact analysis, as listed in Appendix 3.17-A, these localized impacts could contribute to cumulative community/neighborhood impacts. At some locations of the HST Network Alternatives, there would be impacts on adjoining land uses, including residential, parks, commercial business areas, and industrial. Environmental Justice impacts also would occur at select locations along alignments and at stations. These impacts, in combination with other transit extension and roadway projects and when considering past, present, and reasonably foreseeable future projects in the study area, could cause a considerable contribution to potential cumulative impacts on various property types, neighborhoods, and communities.

Program-level mitigation of the HST Network Alternatives' contributions to the land-use compatibility, communities and neighborhoods, property, and environmental justice cumulative impacts, as discussed in Section 3.7, includes design practices to maximize use of existing rights-of-way and incorporating strategies for stations to incorporate transit oriented design, and coordination with cities and counties in each region to ensure that project facilities would be consistent with land use planning processes and zoning ordinances.

G. AGRICULTURAL LANDS

As noted in Section 3.8, the most recent statistics (2004) indicate that California has approximately 26.7 million ac (10.8 million ha) of land in farms, has approximately 77,000 farms, and produces more than 350 different crop types. Six of the top ten California agricultural counties in 2001 were located in the Central Valley (California Department of Food and Agriculture 2005). According to an estimate in a May 2001 report by the University of California Agricultural Issues Center, California lost approximately 497,000 ac (201,000 ha) of farmland to urbanization in the decade between 1988 and 1998, a loss rate of approximately 49,700 ac (20,100 ha) per year (Kuminoff et al. 2001).

The study area for the cumulative analysis of agricultural lands was identified to be the 11 counties potentially affected by the project.

<u>No Project Alternative</u>

As noted in Chapter 5, "Economic Growth and Related Impacts," farmland conversion to non-agricultural use in the 11-county regional area, it is anticipated that by 2030 under the No Project Alternative, the region may have lost nearly 236,000 ac (95,510 ha) of farmland to urban development. This amount would represent a reduction of approximately 1% in the state's 26.7 million ac (10.8 million hectares) of farmland. Therefore, under the No Project Alternative, the cumulative impact related to farmland conversion would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

<u>HST Network Alternatives</u>

Potential direct impacts on farmland from the proposed HST Network Alternatives would vary based on the alignment options selected. The ranges of potential impacts would be 420 ac (170 ha) to 765 ac (309 ha) of prime farmland, 75 ac (30 ha) to 174 ac (70 ha) of unique farmland, 209 ac (84 ha) to 397 ac (161 ha) of farmland of statewide importance, and 51 ac (21 ha) to 181 ac (73 ha) of farmlands of local importance, according to the land designations in the FMMP. The total potential impact on agricultural lands throughout the study area would vary between 755 ac (306 ha) and 1,384 ac (560 ha), depending on the network alternative. Of the nearly 236,000 ac (95,510 ha) projected for conversion to nonagricultural use by 2030, the HST Network Alternatives would represent less than 1% of additional farmland conversion. However, the potential reduction of farmland from the HST Network Alternatives nonetheless could be a considerable contribution to the overall potential cumulative impact on agricultural land throughout the study area and the state.

Program-level mitigation for the HST Network Alternative contributions to the agricultural conversion cumulative impacts, as discussed in Section 3.8, includes design practices to avoid agricultural land conversion through maximizing use of existing rights-of-way to minimize encroachment on additional agricultural lands; using aerial structure or tunnel alignments to allow vehicular and pedestrian traffic access across the alignment; and reducing the new right-of-way to 50 ft in constrained areas. Mitigation measures also may be applied through project-level environmental review and could include securing easements, participating in mitigation banks, increasing permanent protection of farmlands at the local planning level, and coordinating with various local, regional, and state agencies to support farmland conservation programs.

H. AESTHETICS AND VISUAL RESOURCES

Aesthetics and visual resources refer to the natural and human-made features of a landscape that characterize its form, line, texture, and color. The character of the existing landscape has changed in the Bay Area to Central Valley region over time as a result of land uses, including the changes from a natural condition to agriculture, development, and urban growth that have occurred in the past.

The study area for the cumulative analysis of aesthetics and visual resources was identified to be up to 0.25 mi (0.40 km) on each side of the HST Network Alternatives.

No Project Alternative

The aesthetic and visual quality analysis focused on potential impacts on visual resources (particularly scenic resources, areas of historical interest, natural open space areas, and significant ecological areas) along the proposed corridors for the HST Network Alternatives including HST alignments and station sites, as described in Section 3.9. Therefore, under the No Project Alternative, the cumulative impact related to aesthetic and visual resources would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

HST Network Alternatives

The proposed HST Network Alternatives could contribute to both short- and long-term potential cumulative impacts on visual resources (particularly scenic resources, areas of historical interest, natural open space areas, and significant ecological areas). Construction of the system would have short-term potential impacts on visual resources. Construction equipment, staging areas with construction materials, signage, and night lighting would be visible from adjacent properties and roadways during the construction period. Such disruptions could continue for a period of years, potentially a few months to 2 years for most local areas.

Long-term visual changes would result from the introduction of 146 mi (237 km) to 366 mi (593 km) of a new transportation system that would be visible along many major highways and rail corridors connecting the Bay Area and Central Valley. The track, catenary, fencing, soundwalls (where included), elevated guideway (where included), and trains themselves would introduce a linear element into the landscape that could contribute to potential cumulative visual impacts when considered with the strong linear element of the existing highway, rail facilities, and transmission lines that the HST Network Alternatives would parallel for much of the system. HST lines in new corridors either through the Altamont Pass or Pacheco Pass could have significant cumulative effects on visual resources. The significance of the visual change would vary by location, depending on the sensitivity of the landscape and the compatibility with existing landscape features. Therefore, the HST Network Alternatives would result in a considerable contribution to a significant cumulative impact on aesthetic and visual resources when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.9).

Program-level mitigation of the HST Network Alternatives' contributions to the cumulative impacts on aesthetic and visual resources, as discussed in Sections 3.9, includes design practices that will incorporate local agency and community input during subsequent project-level environmental review in order to develop context sensitive aesthetic designs and treatments for infrastructure. Mitigation measures also may be applied through project-level environmental review and could include design of facilities that integrate into landscape contexts, reducing potential view blockage, contrast with existing landscape settings, and light and shadow effects.

I. PUBLIC UTILITIES

As discussed in Section 3.10, "Public Utilities," electric transmission lines, telecommunications lines, natural gas pipelines, and wastewater and water pipelines exist in the project study area, as do fixed facilities, such as electrical substations, power stations, and wastewater treatment plants. Service providers include both public and private entities.

The study area for the cumulative analysis of public utilities was identified to be at least 100 ft (30 m) on each side of the HST Network Alternatives.

No Project Alternative

Construction of development projects and linear facilities (e.g., highway expansions, rail extensions, pipelines, transmission lines) and other reasonably foreseeable future projects in the study area would create cumulative impacts on public utilities and future land use opportunities because of right-of-way needs and property restrictions associated with these types of improvements, as discussed in Section 3.10. These projects would constrain future development, including future development of public utilities. Therefore, under the No Project Alternative the cumulative impact related to public utilities would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

HST Network Alternatives

Of the utilities identified at the program level, there is potential for conflicts with 33 to 126 utilities, depending on network alternative. The HST Network Alternatives would use a large amount of existing right-of-way, and extensive utility relocation could cause a considerable contribution to cumulative impacts on public utilities. Program-level mitigation of HST Network Alternatives' contributions to the cumulative impacts on public utilities, as discussed in Section 3.10, includes design practices that will avoid potential conflicts, at the project-level analysis, to the extent feasible and practical. At the project level, coordination with utility representatives during construction in the vicinity of critical infrastructure will occur. Design methods to avoid crossing or using utility rights-of-way include modifying both the horizontal and vertical profiles of proposed transportation improvements. Emphasis would be placed on detailed alignment design to avoid potential contribution to cumulative impacts from linear facilities on land use opportunities and to minimize conflicts with existing major fixed public utilities and supporting infrastructure facilities.

J. HAZARDOUS MATERIALS AND WASTES

Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHA), is responsible for developing and maintaining the Environmental Protection Indicators for California (EPIC). The latest update to the environmental indicators relating to solid and hazardous wastes in 2005 shows that the total amount of hazardous waste shipped for treatment, storage, and disposal has fluctuated over the past decade, with the lowest amounts shipped in 1996 and 1997, and the highest in 2001. The amount of hazardous waste generated per unit of economic activity has continued to decline over the past decade. In addition, more than 75% of hazardous wastes shipped off site were destined for disposal in landfills or recycling in 2003. The amount of hazardous waste disposed in landfills has varied over the past 10 years but has increased overall, as has the amount being recycled. The EPIC Update notes that there has been no clear trend related to hazardous material spills or soil cleanup at hazardous waste sites (Cal/EPA 2005).

No Project Alternative

Evaluation of the No Project Alternative assumed that no additional hazardous materials/waste impacts would occur beyond those addressed in the environmental documents for those projects and that any hazardous material/waste impacts would be mitigated as part of those projects. Therefore, under the No Project Alternative, there would be no cumulative impact related to hazardous materials/waste when considering past, present, and reasonably foreseeable future projects in the study area.

HST Network Alternatives

Although past, present, and reasonably foreseeable future projects in the study area could cause cumulative impacts from hazardous materials and waste, implementation of the proposed HST Network Alternatives would not directly or indirectly generate hazardous materials or wastes. As noted in Section 3.11, "Hazardous Materials and Wastes," construction of the network alternatives could encounter hazardous materials/waste sites through ground-disturbing activities. These sites would be handled and disposed of in accordance with regulatory requirements. Therefore, the HST Network Alternatives would not contribute to a cumulative impact related to hazardous materials/waste when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.11).

K. CULTURAL AND PALEONTOLOGICAL RESOURCES

California's cultural heritage is a result of descendants of more than 300 indigenous tribal groups, European explorers and settlers, miners, and immigrants. Archaeological evidence places prehistoric people in California as early as 8,000 to 12,000 years ago. Each year more archaeological and historic cultural resources are identified and surveyed.

The study area for the cumulative analysis of cultural and paleontological resources was identified to be at least 500 ft (152 m) on each side of the HST Network Alternatives.

No Project Alternative

As described in Section 3.12, "Cultural Resources and Paleontological Resources," it is not realistically feasible to identify or quantify the impacts on cultural and paleontological resources at a program-level analysis. No additional impacts on cultural resources would occur under the No Project Alternative beyond those addressed in environmental documents for those projects. Therefore, under the No Project Alternative, the cumulative impact related to cultural and paleontological resources would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

HST Network Alternatives

As noted in Section 3.12, the HST Network Alternatives have the potential to affect 78 to 222 known archaeological and historic resources, depending on network alternative. Potential impacts likely would occur in areas that cross formations with paleontological sensitivity and in areas where the proposed HST alignments and stations are adjacent to existing rail corridors, because these older corridors tend to be surrounded by historical structures and districts. In addition, the HST Network Alternatives could contribute to potential cumulative impacts on historical districts combined with other projects over time. Therefore, the HST Network Alternatives would contribute to cumulative impacts on archaeological resources, historical structures, and paleontological resources when considering past, present, and reasonably foreseeable future projects in the study area (Section 3.12).

Program-level mitigation for the cumulative impacts on cultural and paleontological resources, as discussed in Section 3.12, relate to avoidance measures through identification of sensitive resources in the project-level analysis and project design refinement, and careful selection of alignments. At a program level, continued consultation with the SHPO would occur to define and describe general procedures to be applied in the future for fieldwork, method of analysis, and development of specific mitigation measures to address effects and impacts on cultural resources, resulting in a programmatic agreement among the Authority, FRA, and the SHPO. In addition, consultation with Native American tribes would occur. Subsequent project-level field studies to verify the location of cultural resources would offer opportunities to avoid or minimize direct impacts on resources, based on the type of project, type of property, and impacts on the resource (see Section 3.12 for more detail on particular mitigation measures that would be applied through project-level environmental analysis).

L. GEOLOGY AND SOILS

The study area for the cumulative analysis of geology and soils was identified to be at least 200 ft (60 m) on each side of the HST Network Alternatives.

No Project Alternative

As described in Section 3.13, "Geology and Soils," although it is expected that planned projects in the study area would incorporate safeguards as part of the development, design, and construction process, it would not be possible to eliminate or mitigate all geologic hazards. Therefore, under the No Project Alternative, the cumulative impact related to geology and soils would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

HST Network Alternatives

The HST Network Alternatives could affect slope stability in various proposed locations of cut and fill. Some construction activities, such as placing a building or fill material on top of a slope or performing additional cuts at the toe of a slope, can decrease the stability of the slope. These activities, when combined with similar activities from other projects in the region, could contribute considerably to the cumulative impact on geology and soils related to slope stability in areas susceptible to slope failure. Pumping or construction dewatering associated with the HST Network Alternatives in segments with tunneling or extensive earthwork potentially would affect the ground surface and could result in subsidence at some locations. This could cause a considerable contribution to cumulative impacts on geology and soils related to subsidence if other projects under construction in the area also needed to dewater from the same drainage basin.

Program-level mitigation of the HST Network Alternatives' contributions to the cumulative impacts on geology and soils, as discussed in Section 3.13, includes design practices to prepare extensive alignment studies to ensure that potential effects related to major geologic hazards such as major fault crossings, oil fields, and landslide areas, will be avoided. Mitigation for potential impacts will be developed on a site-specific basis, based on detailed geotechnical studies to address ground shaking, fault crossings, slope stability/landslides, areas of difficult excavation, hazards related to oil and gas fields, and mineral resources.

M. HYDROLOGY AND WATER RESOURCES

California has dealt with the limitations resulting from its natural hydrology and grown in population by developing a system of reservoirs, canals, and pipelines under federal, state, and local projects. About 30% of California's water supply need is met by groundwater. Groundwater use increases to about 40% statewide and 60% or more in some regions during dry years. Approximately 40% to 50% of the state's population relies on groundwater for part of their water supply. It is estimated that groundwater overdraft[3] in the state is between 1 million and 2 million acre-feet annually. Overdraft can result in increased water production costs, land subsidence, water quality impairment, and environmental degradation. (California Department of Water Resources 2003.)

As noted in Section 3.14, "Hydrology and Water Resources," the study area includes portions of the Central Valley and San Francisco Bay regions of the RWQCBs. The Central Valley Region is the state's largest and includes 11,350 miles (18,400 km) of streams, 579,110 ac (234,354.4 ha) of lakes, and the largest contiguous groundwater basin in California. The San Francisco Region includes San Francisco Bay and estuaries. In the Central Valley and San Francisco Regions, there were 204 (89 in San Francisco Bay Region and 115 in Central Valley Region) Clean Water Act Section 303(d) impaired waters in 2006 (State Water Resources Control Board 2006).

As noted in Section 3.14, "Hydrology and Water Resources," floodplains are important because they provide floodwater storage and attenuate the risk of downstream flooding, typically provide important

[3] Overdraft is the condition of a groundwater basin in which the amount of water withdrawn by pumping over the long term exceeds the amount of water that recharges the basin.

habitat for native species, improve water quality, and may provide locations for groundwater recharge. Historically, people have been attracted to bodies of water as places for living, business, and recreation. This pattern of development has continued throughout California's history. Growth in floodplains alters the floodplain and the dynamics of flooding, and buildings and infrastructure are damaged during flood events. California has built a series of flood control facilities to minimize flooding and contain floodwaters. California's Central Valley flood control facilities are deteriorating, and at the same time the Central Valley's population growth is moving into areas that are vulnerable to flooding (California Department of Water Resources 2005).

The study area for the cumulative analysis of hydrology and water resources was identified to be at least 200 ft (60 m) on each side of the HST Network Alternatives.

<u>No Project Alternative</u>

As described in Section 3.14, "Hydrology and Water Resources," although it is expected that impacts on hydrologic and water resources from planned projects in the study area would be limited through incorporation of typical design and construction practices to meet permit conditions, it would not be possible to eliminate or mitigate all impacts on hydrology and water resources. Therefore, under the No Project Alternative, the cumulative impact related to hydrology and water resources would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

<u>HST Network Alternatives</u>

The proposed HST Network Alternatives would encroach significantly into sensitive hydrologic resources, including approximately 178 ac to 573 ac (72 ha to 232 ha) of floodplains, 14,400 linear ft to 30,300 linear ft (4,389 linear m to 9,235 linear m) of streams, 2 ac to 42 ac (0.8 ha to 17 ha) of lakes and/or San Francisco Bay, and 1,094 ac to 2,900 ac (493 ha to 1,174 ha) of groundwater areas. In addition, the network alternatives potentially would affect between 14 and 40 polluted 303(d) waters. In addition to direct impacts, potential indirect impacts of the proposed project were evaluated as part of the cumulative impact analysis. The HST Network Alternatives could indirectly affect 12.3 miles to 26.1 miles (20 km to 42.3 km) of streams, canals, and channels. The amount of impervious surface associated with the HST Network Alternatives would be minimized because much of the HST facilities would consist of permeable fill, elevated structures, and/or tunnels. Design characteristics such as a relatively narrow alignment width and columns required to support HST structures also would minimize hydrologic impacts. Indirect floodplains impacts associated with the HST Network Alternatives range from 561 ac to 3,411 ac, while indirect impacts to water bodies, including lakes and San Francisco Bay, range from 7.6 ac to 253 ac. Through avoidance and design, the HST Network Alternatives would minimize impacts on floodplain and surface water resources; however, implementation of the HST Network Alternatives could cause a considerable contribution to potential cumulative impacts on hydrologic resources when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.14).

Program-level mitigation of the HST Network Alternatives' contributions to the cumulative impacts on hydrology and water resources, as discussed in Section 3.14, includes design practices to maximize use of existing rights-of-way to minimize potential impacts on water resources. Avoidance and minimization measures would be incorporated into the development, design, and implementation phases at project-level environmental analysis. In addition, close coordination will occur with the regulatory agencies to develop specific design and construction standards for stream crossings, infrastructure setbacks, erosion control measures, sediment-controlling excavation/fill practices, and other BMPs. In addition, mitigation strategies specific to reconstruction, restoration, or replacement of the resource will occur, in close coordination with state and federal resource agencies, related to floodplains; surface waters, runoff, and erosion; and groundwater.

N. BIOLOGICAL RESOURCES AND WETLANDS

The analysis of potential impacts on biological resources and wetlands includes special-status plant and wildlife species, marine and anadromous fish habitat, riparian corridors, wildlife movement corridors, jurisdictional wetlands, and waters of the U.S. that would require a permit under Section 404 of the Clean Water Act (and also would require documentation of compliance with EPA's Section 404b(1) Guidelines).

California has about 10% to 15% of the wetlands that existed before settlement by Europeans (California Resources Agency, Wetlands Information System 1998a). Estimates of wetlands that existed historically in California range from 3 to 5 million ac (1.2 to 2.0 million ha). The current estimate of wetland acreage in California is approximately 450,000 ac (182,115 ha); this represents an 85 to 90% reduction (California Resources Agency, Wetlands Information System 1998b). The Central Valley region of the state contains the highest amount of wetlands. The region of the study area once had wetlands extending over approximately 4 million ac that have diminished over the years to around 300,000 ac (121,410 ha). Only 5% of the state's coastal wetlands remain intact (California Resources Agency, Wetlands Information System 1998a). Also in the study area is San Francisco Bay, which has undergone rapid, large-scale, permanent changes driven by population migration attracted to the region's natural setting and economic opportunities. This growth and urbanization have resulted in the loss of wetlands and impacts on biological resources (U.S. Geological Survey 2006).

Wildlife movement corridors and habitat linkages in the study area primarily would be in three of nine regions identified in the California Wildlife Action Plan (California Department of Fish and Game 2006) and Missing Linkages: Restoring Connectivity to the California Landscape (Penrod et al. 2001). The effects would occur primarily in the central portion of the Central Valley and Bay Delta regions and the northern tier of the Central Coast region. Natural habitats in these regions have been converted to a variety of different land uses, including weedy pastureland, dryland farming, irrigated cropland, relatively permanent orchards and vineyards, large dairies, rural residential, and high-density urban. CDFG estimates that the overall Central Valley region has lost 99% of its historical native grasslands and valley oak savanna; 95% of its wetlands, and 89% of its riparian woodlands (California Department of Fish and Game 2006). In the Bay area, it is estimated that 88% of the original moist grasslands, 84% of the riparian forest, and 80% of the tidal marshes have been converted or substantially altered. In addition to removing and fragmenting habitats, the land uses in the regions also have introduced structures that impede or prevent wildlife movement within and between the remaining natural habitats. These structures include roads, canals, and powerlines that affect a wide variety of animals as well as dams, dikes, and levees that block fish migration. In the central portion of the Central Valley and Bay Delta regions and the northern tier of the Central Coastal region, many of the remaining wildlife movement corridors follow the riparian corridors along major creeks and rivers.

The study area for the cumulative analysis of biological resources and wetlands was identified to be at least 0.25 mi (0.40 km) from the HST Network Alternatives. The direct and indirect impacts of the proposed project were evaluated as part of the cumulative impact analysis. Direct impacts for aquatic and biological resources were identified to be within the HST right-of-way footprint. Direct impacts for aquatic and biological resources can be either permanent or temporary. Examples of permanent impacts include removal or altering of a resource either during the construction phase (temporary) or by permanent project features. Indirect impacts, also referred to as secondary impacts, are those caused by the project that may occur either later in time or some distance from the project site, but are still reasonably foreseeable. Examples include downstream effects, implementation of mitigation measures for other resources that may result in secondary impacts, and/or the growth that would be caused or accelerated by the project. The quantities identified in this analysis should be viewed as areas where direct or indirect impacts could potentially occur and not as a specific or worst-case impact amount. Indirect impacts as a result of construction of the

HST system and other projects may also occur. This includes air quality (dust can affect certain species), lighting (especially for nearby nocturnal species), and runoff from activities involving soil disturbance (downstream water quality, erosion, sedimentation, and water temperature that could affect wetland or aquatic species). Construction can also set up conditions that favor the introduction or spread of invasive species.

No Project Alternative

As described in Section 3.15, "Biological Resources and Wetlands," although it is expected that impacts on biological resources and wetlands from planned projects in the study area would be limited through incorporation of typical design and construction practices to meet permit conditions, it would not be possible to eliminate or mitigate all impacts on biological resources and wetlands. This would be in addition to existing biological habitat losses that have occurred as well as the estimated 90% of wetlands already lost in California because of past development as noted above. Therefore, under the No Project Alternative, the cumulative impact related to biological resources and wetlands would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

HST Network Alternatives

The additional land required and the linear features added under HST Network Alternatives could cause a considerable contribution to the potential for cumulative impacts on biological resources and wetlands throughout the study area (1,000 ft [305 m] on either side of alignment centerlines and around stations in urbanized areas, 0.25 mi [0.40 km] on either side of alignment centerlines and around stations in undeveloped areas, and 0.50 mi [0.81 km] on either side of alignment centerlines and around stations in sensitive areas).

The HST Network Alternatives potentially would have impacts on sensitive biological resources and wetlands when combined with other foreseeable projects (Appendix 3.17-A) in the study area. Portions of the HST Network Alternatives would use existing transportation right-of-way and therefore would minimize direct disturbance of sensitive habitats. The potential for indirect noise effects on biological resources is addressed in Section 3.4, "Noise and Vibration." Although there is a potential for cumulative impacts on biological resources from increased noise from projects in specific areas, the information for assessing this potential additive effect cannot be considered at this program level of analysis and would be addressed when site-specific analysis is completed in a subsequent phase of evaluation.

The additional embankments and bridges associated with the proposed HST Network Alternatives potentially would result in direct impacts on approximately 10.7 ac to 56.1 ac (4.3 ha to 22.7 ha) of wetlands and 74 to 129 special-status species throughout the study area. Indirect impacts on wetlands could be between 499 ac and 3,499 ac (202 ha and 1,416 ha). Wildlife movement corridors may be affected where the HST Network Alternatives would not be in an existing rail or highway corridor and would traverse a natural area (e.g., Pacheco Pass for the Pacheco Pass Network Alternatives) or where there is habitat use in existing rights-of-way (where wildlife movement occurs across roads and rail lines where fences are not obstructing movement). Therefore, the HST Network Alternatives would result in a considerable contribution to a significant cumulative impact on biological resources and wetlands when considering past, present, and reasonably foreseeable future projects in the study area (See Section 3.15).

Program-level mitigation of the HST Network Alternatives' contributions to the cumulative impacts on biological resources and wetlands, as discussed in Section 3.15, includes design practices to maximize use of existing rights-of-way to minimize potential impacts on biological resources and wetlands. Avoidance and minimization measures would be incorporated into the development, design, and implementation phases at project-level environmental analysis. In addition, close coordination will occur with the regulatory agencies to develop specific design and construction standards for stream crossings, infrastructure setbacks, monitoring during construction, and other BMPs. In addition, mitigation strategies specific to reconstruction, restoration, or replacement of the resource will occur, in close coordination with state and federal resource agencies, related to wetlands. The HST Network Alternatives generally would be located within or adjacent to existing transportation corridors or would be in tunnel or elevated through mountain passes and sensitive habitat areas. During project-level environmental review, field studies would be conducted to verify the location, in relation to the HST alignments, of sensitive habitat, wildlife movement corridors, and wetlands. These studies would provide further opportunities to minimize and avoid potential impacts on biological resources through changes to the alignment plan and profile in sensitive areas. For example, the inclusion of design features such as elevated track structures over drainages and wetland areas and wildlife movement corridors would minimize potential impacts on wildlife and sensitive species.

O. SECTION 4(f) AND 6(f) RESOURCES (PUBLIC PARKS AND RECREATIONAL RESOURCES)

The study area for the cumulative analysis of Section 4(f)/6(f) resources was identified to be at least 900 ft (274 m) on each side of the HST Network Alternatives.

No Project Alternative

As discussed in Section 3.16, Section 4(f) and 6(f) resources include publicly owned parklands, recreation lands, wildlife and waterfowl refuges, and historic sites that are covered by Section 4(f) of the DOT Act of 1966 and Section 6(f) of the Land and Water Conservation Fund Act of 1965. Although it is expected that impacts on 4(f) and 6(f) resources from planned projects in the study area would be limited through incorporation of typical design and construction practices to avoid these resources, it would not be possible to eliminate or mitigate all impacts. Therefore, under the No Project Alternative, the cumulative impact related to Sections 4(f) and 6(f) resources would be significant when considering past, present, and reasonably foreseeable future projects in the study area.

HST Network Alternatives

The proposed HST Network Alternatives could contribute to the cumulative impact on parkland resources. The impacts on parkland resources from the HST Network Alternatives would be minimized, because it is possible to plan the HST alignment, stations, and other facilities with the intent to avoid or minimize potential effects by routing the train around, above, or below an identified resource. Depending on the network alternative selected, the HST Network Alternatives could result in impacts on 8 to 46 parkland resources. This includes potential impacts on the Don Edwards San Francisco Bay National Wildlife Refuge for network alternatives that extend across the Bay at Dumbarton Bridge and the Upper Cottonwood Creek Wildlife Area for the Pacheco Pass Network Alternatives (GEA North Alignment Alternative would directly impact the San Luis National Wildlife Refuge and the Great Valley Grasslands State Park). When combined with the impacts of other highway and transit expansion projects in the region, the potential impacts of the HST Network Alternatives could cause a considerable contribution to potential cumulative impacts on parklands and recreational resources throughout the study area.

Program-level mitigation of the HST Network Alternatives' contributions to the cumulative impacts on 4(f) and 6(f) resources, as discussed in Section 3.16, includes design practices to maximize use of existing rights-of-way to minimize potential impacts on 4(f) and 6(f) resources. Avoidance and minimization measures would be incorporated into the development, design, and implementation phases at project-level environmental analysis. In addition, close coordination will occur with the agency having jurisdiction over the resource and the regulatory agencies to develop specific design and construction standards for stream/Bay crossings, infrastructure setbacks, monitoring during construction, and other BMPs. In addition, mitigation strategies specific to reconstruction, restoration, or replacement of the resource will occur, in close coordination with state and federal resource agencies, related to wetlands. During project-level environmental review, field studies would offer the opportunity to avoid or minimize direct or indirect impacts on parklands by making adjustments in the alignment plan or profile. In the event that, during project-level environmental analysis, it is determined that the alternative cannot avoid being located near 4(f) and 6(f) lands, mitigation related to natural, cultural, aesthetic, and recreational impacts would be incorporated, including compensation for temporary and permanent loss of park and recreation uses; inventory and recordation of historic features removed; provision of alternative shuttle access for park visitors; and restoration of park features post construction.

3.17.5 Mitigation Strategies

The mitigation strategies described below are further discussed in Chapter 3 of this program EIR/EIS for each topic area. These mitigation strategies were identified for the program-level analysis to avoid, minimize, or reduce potentially significant environmental impacts, including cumulative impacts. Further environmental analyses tiering from this EIS/EIR will be conducted for the project-level document, as required by NEPA and CEQA. At the Tier 2 project level, mitigation strategies identified in the program document will be used as starting points to determine their applicability to a specific project and to develop refined and/or additional mitigation measures for significant adverse impacts identified in the project-specific analysis. Because all the potential actions and impacts and their significance for tiered projects cannot be anticipated at a programmatic level, future project-level documents will need to select those strategies applicable to the impacts associated with the specific location and type of action. For purposes of CEQA, the mitigation strategies in this final program EIS/EIR also serve as mitigation measures at a programmatic level. In addition, the Authority has committed to design practices and policies that will be used to develop alignment alternatives at the project-level to avoid impacts and to help shape specific mitigation measures.

Resource Area	Impact Area	Mitigation Measure
Traffic and circulation	Traffic and circulation	Require that HST system stations serve as multi-modal transportation hubs providing easy connection to local/regional bus, rail, and transit services, as well as providing bicycle and pedestrian access.
		Require the HST system to be grade-separated from all roadways to allow vehicular traffic to flow without impediment from the HST system.
		Work with local and regional agencies to develop and implement transit-oriented development strategies, as described in Chapter 6, around HST stations.
		Work with local and regional agencies to identify, plan, coordinate, and implement traffic flow improvements around HST station locations during project-level planning. Such improvements may include: a. a construction phasing and traffic management plan for construction periods; b. improving capacity of local streets with upgrades in geometrics such as providing standards roadway lane widths, traffic controls, bicycle lanes, shoulders, and sidewalks; c. modifications at intersections, such as signalization and/or capacity improvements (widening for additional left-turn and/or through lanes), and turn prohibitions; d. signal coordination and optimization (including retiming and rephasing); e. designation of one-way street patterns near some station locations; f. truck route designations; and g. coordination with Caltrans regarding nearby highway facilities.
		Work with public transportation providers to coordinate services and to increase service and/or add routes, as necessary, to serve the HST station areas.
		Avoid parking impacts by developing and coordinating implementation at the project-level of parking improvement strategies consistent with local policies, including shared parking, offsite parking with shuttles, parking and curbside use restrictions, parking permit plans for neighborhoods near HST stations, and other parking management strategies.
Air quality	Localized air quality impacts due to congestion/traffic near HST stations	Assure that HST stations are multi-modal hubs and include appropriate parking.
		Coordinate with local and regional public transportation providers to increase opportunities for connection between the HST system and other public transportation services.
		Work with local and regional agencies to implement local street and roadway improvements, including various traffic flow improvements and congestion management techniques, and parking management strategies to reduce localized pollution from traffic related to the HST system.
	Short-term air quality impacts due to construction	Water all active construction areas at least twice daily.
		Require that all trucks hauling soil, sand, and other loose materials be covered or maintain at least 2 feet of freeboard.
		Pave, apply water three times daily, or apply nontoxic soil stabilizers on all unpaved access roads, parking areas, and staging areas at active construction sites.
		Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas at active construction sites.
		Sweep nearby streets daily (with water sweepers) if visible soil materials from HST system construction are carried onto adjacent public streets.
		Hydroseed or apply nontoxic soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more).
		Enclose, cover, water twice daily, or apply nontoxic soil binders to exposed stockpiles of dirt, sand, etc.
		Limit traffic speeds on unpaved roads to 15 mph.

Resource Area	Impact Area	Mitigation Measure
		Install sand bags or other erosion control measures to prevent silt runoff to public roads.
		Replant vegetation in disturbed areas as quickly as possible.
		Use alternative fuels for construction equipment when feasible.
		Minimize equipment idling time.
		Maintain properly tuned equipment.
Noise	Increased noise from train operations and construction	Grade separations to eliminate grade crossing related noise.
		Noise barriers, such as sound walls, where there are severe noise impacts.
		Require noise reduction in HST equipment design and track structures design.
		Use of enclosures or walls to surround noisy equipment, and installation of mufflers on engines; substituting quieter equipment or construction methods, minimizing time of operation, and locating equipment farther from sensitive receptors.
		Where not already included, consider placing alignment sections in tunnel or trenches or behind berms where possible and where other measures are not available to reduce significant noise impacts.
		Suspend construction between 7:00 pm and 7:00 am and/or on weekends or holidays in residential areas where there are severe noise impacts.
		In managing construction noise, take into account local sound control and noise level rules, regulations, and ordinances.
		Ensure that each internal combustion engine is equipped with a muffler of a type recommended by the manufacturer.
		Specify the use of the quietest available construction equipment where appropriate and feasible.
		Turn off construction equipment during prolonged periods of nonuse.
		Require contractors to maintain all equipment and to train their equipment operators.
		Locate noisy stationary equipment away from noise sensitive receptors.
	Exposure to ground-borne vibration	Specify the use of train and track technologies that minimize ground vibration such as state of the art suspensions, resilient track pads, tie pads, ballast mats, or floating slabs.
		Phase construction activity, use low impact construction techniques, and avoid use of vibrating construction equipment where possible to avoid vibration construction impacts.
Energy	Increased energy use and electricity demand with the HST system	HST stations will be multi-modal hubs providing linkage for various transportation modes, which will contribute to increased efficiency of energy use for intercity trips and by commuters, and the stations will be required to be constructed to meet Title 24 California Code of Regulations energy efficiency standards.
		Design practices will require that the electrically powered HST technology be energy efficient, include regenerative braking to reduce energy consumption, and minimize grade changes in steep terrain to reduce energy consumption.
		Design practices will require that localized impacts be avoided through planning and design of the power distribution system for the HST system.
		Locate HST maintenance and storage facilities within proximity to major stations/termini.
	Energy use during construction of the HST system	Develop and implement a construction energy conservation plan.
		Use energy efficient construction equipment and vehicles.
		Locate construction material production facilities on site or in proximity to project construction sites.

Resource Area	Impact Area	Mitigation Measure
		Develop and implement a program encouraging construction workers to carpool or use public transportation for travel to and from construction sites.
Electromagnetic fields and electromagnetic interference	Exposure of electromagnetic fields to HST system workers, passengers, and nearby residents, schools and other facilities	Use standard design practices for overhead catenary power supply systems and vehicles, including appropriate materials, location and spacing of facilities, and power supply systems to minimize exposure to receptors over distance, and shielding with vegetation and other screening materials.
		Design overhead catenary system, substations, and transmission lines to reduce the electromagnetic fields to a practical minimum.
	Electromagnetic interference with electronic and electrical devices	Design the overhead catenary system, substations, and transmission lines to reduce the electromagnetic fields to a practical minimum.
		Design the project component to minimize arcing and radiation of radiofrequency energy.
		Choose devices generating radio frequency with a high degree of electromagnetic compatibility.
		Where appropriate, add electronic filters to attenuate radio frequency interference.
		Relocate receiving antennas and use antenna models with greater directional gain where appropriate, particularly for sensitive receptors near the HST system.
		Comply with the FCC regulations for intentional radiators, such as the proposed HST wireless systems.
		Establish safety criteria and procedures and personnel practices to avoid exposing employees with implantable medical devices to EMF levels that may cause interference with such implanted biomedical devices.
Land use	Incompatibility with land uses and disruption to communities	Continue to apply design practices to minimize property needed for the HST system and to stay within or adjacent to existing transportation corridors to the extent feasible.
		Work with local governments to consider local plans and local access needs, and to apply design practices to limit disruption to communities.
		Work with local governments to establish requirements for station area plans and opportunities for transit-oriented development.
		Work with local governments to enhance multi-modal connections for HST stations.
		Coordinate with cities and counties to ensure that HST facilities will be consistent with land use planning processes and zoning ordinances.
		Provide opportunities for community involvement early in project-level studies.
		Hold design workshops in affected neighborhoods to develop understanding of vehicle, bicycle, and pedestrian linkages in order to preserve those linkages through use of grade-separated crossings and other measures.
		Ensure that connectivity is maintained across the rail corridor (pedestrian/bicycle and vehicular crossings) where necessary to maintain neighborhood integrity.
		Develop facility, landscape, and public art design standards for HST corridors that reflect the character of adjacent affected neighborhoods.
		Maintain high level of visual quality of HST facilities in neighborhood areas by implementing such measures as visual buffers, trees and other landscaping, architectural design, and public artwork.
	Impacts to neighborhoods during construction	Develop a traffic management plan to reduce barrier effects during construction.
		To the extent feasible, maintain connectivity during construction.
Agricultural	Conversion of	Avoid farmland whenever feasible during the conceptual design stage of the project.

Resource Area	Impact Area	Mitigation Measure
lands	prime, statewide important, and unique farmlands, and farmlands of local importance, to project uses	Reduce the potential for impacts by sharing existing rail rights-of-way where feasible or by aligning HST features immediately adjacent to existing rail rights-of-way.
		Reduce the potential for impacts by reducing the HST right-of-way width to 50 feet in constrained areas.
		Increase protection of existing important farmlands by securing easements or participating in mitigation banks.
		Coordinate with and support the California Farmland Conservancy Program to secure conservation easements on farmland in geographic areas where the HST project creates impacts.
		Coordinate with private agricultural land trusts, local programs, mitigation banks, and Resource Conservation Districts to identify additional measures to limit important farmland conversion or provide further protection to existing important farmland.
	Severance of prime, statewide important, and unique farmlands, and farmlands of local importance, to project uses	Avoid farmland whenever feasible during the conceptual design stage of the project.
		Minimize severance of agricultural land by constructing underpasses and overpasses at reasonable intervals to provide property access.
		Work with landowners during final design of the system to enable adequate property access.
		Provide appropriate severance payments to landowners.
Aesthetics and visual resources		At the project-level, design proposed facilities that are attractive in their own right and that will integrate well into landscape contexts, so as to reduce potential view blockage, contrast with existing landscape settings, light and shadow effects, and other potential visual impacts.
		Design bridges and elevated guideways with graceful lines and minimal apparent bulk and shading effects.
		Design elevated guideways, stations, and parking structures with sensitivity to the context, using exterior materials, colors, textures, and design details that are compatible with patterns in the surrounding natural and built environment, and that minimize the contrast of the structures with their surroundings.
		Use neutral colors and dulled finishes that minimize reflectivity for catenary support structures, and design them to fit the context of the specific locale.
		Use aesthetically appropriate fencing along rights-of-way, including decorative fencing, where appropriate, and use dark and non-reflective colors for fencing to reduce visual contrast.
		Where at-grade or depressed route segments pass through or along the edge of residential areas or heavily traveled roadways, install landscape treatments along the edge of the right-of-way to provide partial screening and to visually integrate the right-of-way into the residential context.
		Use the minimum amount of night lighting consistent with that necessary for operations and safety.
		Use shielded and hooded outdoor lighting directed to the area where the lighting is required, and use sensors and timers for lights not required to be on all the time.
		Design stations to minimize potential shadow impacts on adjacent pedestrian areas, parks, and residential areas, and site all structures in a way that minimizes shadow effects on sensitive portions of the surrounding area.
		Seed and plant areas outside the operating rail trackbed that are disturbed by cut, fill, or grading to blend with surrounding vegetated areas, where the land will support plants. Use native vegetation in appropriate locations and densities.

Resource Area	Impact Area	Mitigation Measure
		Use strategic plantings of fast-growing trees to provide partial or full screening of elevated guideways where they are close to residential areas, parks, and public open spaces.
		Where elevated guideways are located down the median strips or along the edge of freeways or major roadways, use appropriate landscaping of the area under the guideway to provide a high level of visual interest. Landscaping in these areas should use attractive shrubs and groundcovers and should emphasize the use of low-growing species to minimize any additional shadow effects or blockage of views.
		Plan hours of construction operations and locate staging sites to minimize impacts to adjacent residents and businesses.
Public utilities		Make adjustments to the HST alignments and vertical profiles to avoid crossing or using major utility right-of-way or fixed facilities during engineering design.
		If avoidance is not feasible, in consultation and coordination with the utility owner, relocate or protect in-place transmission lines, substations, and any other affected facilities.
		For acquisition projects which result in utility relocation, follow the uniformity and equitable treatment policies, and comply with the requirements, of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 for all property necessary for the proposed HST system.
Hazardous materials and wastes		Investigate soils and groundwater for contamination and prepare environmental site assessments when necessary.
		Design realignment of the HST corridors to avoid identified sites.
		Relocate HST associated facilities such as stations to avoid identified sites.
		Remediate identified hazardous materials and hazardous waste contamination.
		Prior to demolition of buildings for project construction, survey for lead-based paint and asbestos-containing materials.
		Follow BMPs for testing, treating, and disposing of water, and acquire necessary permits from the regional water quality control board, if ground dewatering is required.
		When indicated by project-level environmental site assessments, perform Phase II environmental site assessments in conformance with the ASTM Standards related to the Phase II Environmental Site Assessment Process to identify specific mitigation measures.
		Prepare a Site Management Program/Contingency Plan prior to construction to address known and potential hazardous material issues, including: a. measures to address management of contaminated soil and groundwater; b. a site-specific Health and Safety Plan (HASP), including measures to protect construction workers and general public; and c. procedures to protect workers and the general public in the event that unknown contamination or buried hazards are encountered.
		As part of the second-tier environmental review, consider impacts to the environment on sites identified on the Cortese list (Government Code Section 65962.4) at that time.
Cultural and paleon-tological resources	Impacts to archaeological resources and traditional cultural properties	Avoid the impact, or when avoidance cannot be accommodated, minimize the scale of the impact.
		Incorporate the site into parks or open space.
		Provide data recovery for archaeological resources, which may include excavation of an adequate sample of the site contents so that research questions applicable to the site can be addressed.

Resource Area	Impact Area	Mitigation Measure
		Develop procedures for fieldwork, identification, evaluation, and determination of potential effects to archaeological resources in consultation with SHPO and Native American tribes. Procedures may include onsite monitoring when sites are known or suspected of containing Native American human remains and be reflected in Memoranda of Agreement with appropriate bodies.
		Coordinate and consult with tribal representatives.
	Impacts to historic properties/ resources	Avoid the impact through project design. Prepare and utilize a treatment plan for protection of historic properties/resources that will describe methods to preserve, stabilize, shore/underpin, and monitor buildings, structures, and objects.
		Avoid high vibration construction techniques in sensitive areas.
		Record and document cultural resources that would be adversely affected by the project to the standards of the Historic American Building Survey or Historic American Engineering Record.
		Develop design guidelines to ensure sympathetic, compatible, and appropriate designs for new construction.
		Consult with architectural historians or historical architects to advise on appropriate architectural treatment of the structural design of proposed new structures. Prepare interpretive and/or educational materials and programs regarding the affected historic properties/resources. Materials may include: a popular report, documentary videos, booklets, and interpretive signage.
		Make interpretive information available to state and local agencies, such as salvage items, historic drawings, interpretive drawings, current and historic photographs, models, and oral histories. Also assist with archiving and digitizing the documentation of the cultural resources affected and disseminating material to the appropriate repositories.
		Relocate and rehabilitate historic properties/resources that would otherwise be demolished because of the project.
		Monitor project construction to ensure it conforms to design guidelines and any other treatment procedures agreed to by the parties consulting pursuant to Section 106 of the National Historic Preservation Act. Repair inadvertent damage to historic properties/resources in accordance with the Secretary of the Interior's Standards for Treatment of Historic Properties.
		Salvage selected decorative or architectural elements of the adversely affected historic properties/resources, and retain and incorporate salvaged items into new construction where possible. If reuse is not possible, make salvaged items available for use in interpretive displays near the affected resources or in an appropriate museum.
		Implement an agreement with appropriate bodies specifying procedures for addressing historic resources which may be affected by the HST system.
	Impacts to paleontological resources	Educate workers.
		Recover fossils identified during the field reconnaissance.
		Monitor construction.
		Develop protocols for handling fossils discovered during construction, such as temporary diversion of construction equipment so that the fossils could be recovered, identified, and prepared for dating, interpreting, and preserving at an established, permanent, accredited research facility.
Geology and soils	Seismic hazards	Design structures to withstand anticipated ground motion, using design options such as redundancy and ductility.
		Prevent liquefaction and resulting structural damage and traffic hazards using: 1. ground modification techniques such as soil densification; and 2. structural design, such as deep foundations.

Resource Area	Impact Area	Mitigation Measure
		Utilize motion sensing instruments to provide ground motion data and a control system to temporarily shut down HST operations during or after an earthquake to reduce risks.
		Design and engineer all structures for earthquake activity using Caltrans Seismic Design Criteria.
		Design and install foundations resistant to soil liquefaction and settlement.
		Identify potential serpentinite bedrock disturbance areas and implement a safety plan.
		Apply Section 19 requirements from the most current Caltrans Standard Specifications to ensure geotechnically stable slopes are planned and created.
		Install passive or active gas venting systems and gas collection systems in areas where subsurface gases are identified.
		Remove corrosive soil and use corrosion protected materials in infrastructure.
		Address erosive soils through soil removal and replacement, geosynthetics, vegetation, and/or riprap, where warranted.
		Remove or moisture condition shrink/swell soils.
		Utilize stone columns, grouting, and deep dynamic compaction in areas of potential liquefaction.
		Utilize buttress berms, flattened slopes, drains, and/or tie-backs in areas of slope instability.
		Avoid settlement through preloading, use of stone columns, deep dynamic compaction, grouting, and/or special foundation designs.
	Surface rupture hazards	Install early warning systems triggered by strong ground motion associated with ground rupture, such as linear monitoring systems (i.e., time domain reflectometers) along major highways and rail lines within the zone of potential rupture to provide early warnings and allow for temporary control of rail and automobile traffic to avoid and reduce risks.
		Continue to modify alignments to avoid crossing known or mapped active faults within tunnels.
		Avoid active faults to the extent possible. Where avoidance is not possible, cross active faults at grade and perpendicular to the fault line.
	Slope instability	Install temporary and permanent slope reinforcement and protection, based on geotechnical investigations, and review of proposed earthwork and foundation excavation plans.
		Conduct geotechnical inspections during construction to verify that no new unanticipated conditions are encountered.
		Incorporate slope monitoring in final design.
	Difficulty in excavation	Identify areas of potentially difficult excavation to ensure safe practices.
		Focus future geotechnical engineering and geologic investigations in areas of potentially difficult excavation.
		Monitor conditions during and after construction.
		Employ tunnel excavation and lining techniques to ensure safety.
	Hazards related to oil and gas fields	Follow federal and state Occupational Safety and Health Administration regulatory requirements for excavations.
		Consult with other agencies such as the Department of Conservation's Division of Oil and Gas, or the Department of Toxic Substances Control regarding known areas of concern.
		Use safe and explosion-proof equipment during construction.

Resource Area	Impact Area	Mitigation Measure
		Test for gases regularly.
		Install monitoring systems and alarms in underground construction areas and facilities where subsurface gases are present.
		Install gas barrier systems.
Hydrology and water resources	Impacts on floodplains	Avoid or minimize construction of facilities within floodplains where feasible.
		Minimize the footprint of facilities within the floodplain through design changes or the use of aerial structures and tunnels.
		Restore the floodplain to its prior operation in instances where the floodplain is affected by construction.
	Impacts on surface waters	Use construction methods and facility designs to minimize the potential encroachments onto surface water resources.
		Minimize sediment transport caused by construction by following BMPs as part of NPDES and SWPPP requirements that will be included in construction permits. BMPs may include measures such as: a. providing permeable surfaces where feasible; b. retaining and treating stormwater on site using catch basins and filtering wet basins; c. minimizing the contact of construction materials, equipment, and maintenance supplies with stormwater; d. reducing erosion through soil stabilization, watering for dust control, installing perimeter silt fences, placing rice straw bales, and installing sediment basins; e. maintaining water quality by using infiltration systems, detention systems, retention systems, constructed wetland systems, filtration systems, biofiltration/bioretention systems, grass buffer strips, ponding areas, organic mulch layers, planting soil beds, sand beds, and vegetated systems such as swales and grass filter strips that are designed to convey and treat either fallow flow (swales) or sheetflow (filter strips) runoff.
		Use methods such as habitat restoration, reconstruction of habitat on site, and habitat replacement off site to minimize surface water quality impacts.
		Comply with mitigation measures included in permits issued under Sections 404 and 401 of the federal Clean Water Act.
		Comply with requirements in the SWPPP to reduce pollutants in storm water discharges and the potential for erosion and sedimentation.
		Comply with requirements of Section 10 of the federal Rivers and Harbors Act for work required around a water body designated as navigable and applicable permit requirements.
		Comply with the requirements of a state Streambed Alteration Agreement for work along the banks of various surface water bodies.
		Implement a spill prevention and emergency response plan to handle potential fuel or other spills.
		Where feasible, avoid significant development of facilities in areas that may have substantial erosion risk, including areas with erosive soils or steep slopes.
	Impacts on groundwater	Minimize development of facilities in areas that may have substantial groundwater discharge or affect recharge.
		Apply for, obtain, and comply with conditions of applicable waste discharge requirements as part of project-level review.
		Develop facility designs that are elevated, or at a minimum are permeable, and will not affect recharge potential where construction is required in areas of potentially substantial groundwater discharge or recharge.

Resource Area	Impact Area	Mitigation Measure
		Apply for and obtain a SWPPP for grading, with BMPs that will control release of contaminants near areas of surface water or groundwater recharge. BMPs may include constraining fueling and other sensitive activities to alternative locations, providing drip plans under some equipment, and providing daily checks of vehicle condition.
		Use and retain native materials with high infiltration potential at the ground surface in areas that are critical to infiltration for groundwater recharge.
Biological resources and wetlands	Impacts to sensitive vegetation communities (as defined at the project level)	Utilize existing transportation corridors and rail lines to minimize potential impacts.
		Use large diameter tunnels as part of the design to limit surface access needs in tunnels for ventilation or evacuation, as a method to avoid or limit impacts to vegetation and habitat above tunnels.
		Use in-line construction (i.e., use new rail infrastructure as it is built) to transport equipment to/from the construction site and to transport excavated material away from the construction to appropriate re-use or disposal sites to minimize impacts from construction access roads on vegetation/habitat.
		Accomplish necessary geologic exploration in sensitive areas by using helicopters to transport drilling equipment and for site restoration to minimize surface disruption.
		Use and reuse excavated materials within the confines of the project.
		Participate in or contribute to existing or proposed conservation banks or natural management areas, including possible acquisition, preservation, or restoration of habitats.
		Revegetate/restore impacted areas, with a preference for onsite mitigation over offsite, and with a preference for offsite mitigation within the same watershed or in close proximity to the impact where feasible.
		Comply with the Biological Resources Management Plan(s) developed or identified during project-level studies, as reviewed by the USFWS, CDFG, and USACE.
		Conduct preconstruction focused biological surveys.
		Conduct biological construction monitoring.
		Undertake plant relocation, seed collection, plant propagation, and outplanting at suitable mitigation sites.
		Prevent the spread of weeds during construction and operation by identifying areas with existing weed problems and measures to control traffic moving out of those areas such as cleaning construction vehicles or limiting the movement of fill.
	Impacts to wildlife movement corridors	Construct wildlife underpasses, bridges, and/or large culverts to facilitate known wildlife movement corridors.
		Ensure that wildlife crossings are of a design, shape, and size to be sufficiently attractive to encourage wildlife use.
		Provide appropriate vegetation to wildlife overcrossings and undercrossings to afford cover and other species requirements.
		Establish functional corridors to provide connectivity to protected land zoned for uses that provide wildlife permeability.

Resource Area	Impact Area	Mitigation Measure
		Design protective measures for wildlife movement corridors using the following process in consultation with resource agencies: a. identify the habitat areas the corridor is designed to connect; b. select several species of interest from the species present in the area; c. evaluate the relevant needs of each selected species; d. for each potential corridor, evaluate how the area will accommodate movement by each species of interest; e. draw the corridors on a map; and f. design a monitoring program.
		Utilize existing transportation corridors and rail lines to minimize potential impacts.
		Use aerial structures or tunnels to allow for unhindered crossing by wildlife.
	Impacts to nonwetland jurisdictional waters	Utilize existing transportation corridors and rail lines to minimize potential impacts.
		Return degraded habitat to pre-existing conditions.
		Create new habitat by converting nonwetland habitats into wetland or other aquatic habitat.
		Enhance existing habitats by increasing one or more functions through activities such as plantings or nonnative vegetation eradication.
		Provide for passive revegetation by allowing a disturbed area to revegetate naturally.
		Purchase credits in an existing wetlands or aquatic habitat mitigation bank.
		Provide in-lieu fee payments to an agency or other entity who will provide aquatic habitat conservation or restoration.
		Prefer onsite mitigation over offsite mitigation, and for offsite mitigation, prefer that it be located within the same watershed or as close in proximity to the area of impact as possible.
	Impacts to wetlands	Utilize existing transportation corridors and rail lines to minimize potential impacts.
		Return degraded habitat to pre-existing conditions.
		Create new habitat by converting nonwetland habitats into wetland or other aquatic habitat.
		Enhance existing habitats by increasing one or more functions through activities such as plantings or nonnative vegetation eradication.
		Provide for passive revegetation by allowing a disturbed area to revegetate naturally.
		Purchase credits in an existing wetlands or aquatic habitat mitigation bank.
		Provide in-lieu fee payments to an agency or other entity who will provide aquatic habitat conservation or restoration.
		Develop and implement measures to address the “no net loss” policy for wetlands.
		Prefer onsite mitigation over offsite mitigation, and for offsite mitigation, prefer that it be located within the same watershed or as close in proximity to the area of impact as possible.
	Impacts to marine and anadromous fishery resources	Utilize existing transportation corridors and rail lines to minimize potential impacts.
		Comply with the terms of a Streambed Alteration Agreement for work along banks of surface water bodies.
		Implement a spill prevention and emergency response plan to handle potential fuel or other spills.
		Incorporate biofiltration swales to intercept runoff.

Resource Area	Impact Area	Mitigation Measure
		Where feasible, avoid significant development of facilities in areas that may have substantial erosion risk, including areas with erosive soils and steep slopes.
	Impacts to special status species	Utilize existing transportation corridors and rail lines to minimize potential impacts.
		Relocate sensitive species.
		Conduct preconstruction focused surveys.
		Conduct biological construction monitoring.
		Restore suitable breeding and foraging habitat.
		Purchase credits from an existing mitigation bank.
		Participate in an existing Habitat Conservation Plan.
		Phase construction around the breeding season.
Public parks and recreation resources	Impacts to parks and recreational resources	Continue to apply design practices to avoid impacts to park resources, and when avoidance cannot be accommodated, minimize the scale of the impact.
		Apply measures at the project level to reduce and minimize indirect/proximity impacts as appropriate for the particular sites affected, while avoiding other adverse impacts (e.g., visual), such as noise barriers, visual buffers, and landscaping.
		Apply measures to modify access to/egress from the recreational resource to reduce impacts to these resources.
		Design and construct cuts, fill, and aerial structures to avoid and minimize visual impacts to units of the state park system.
		Incorporate wildlife under- or overcrossings at appropriate intervals as necessary.
		Where public parklands acquired with public funds will be acquired for nonpark use as part of the HST system, commit as required by law to providing funds for the acquisition of substantially equivalent substitute parkland or to acquiring/providing substitute parkland of comparable characteristics for construction impacts.
		Restore affected parklands to natural state and replace or restore affected park facilities.
		If park facilities must be relocated, provide planning studies as well as appropriate design and replacement with minimal impact on park use.
		Use local native plants for revegetation.
		Develop and implement construction practices, including scheduling, to limit impacts to wildlife, wildlife corridors, and visitor use areas within public parks.
		For temporary unavoidable loss of park and recreation facility uses, consider providing compensation.
Cumulative	Impacts on traffic and circulation and travel conditions	The following program-level mitigation strategies can be developed, in consultation with state, federal, regional, and local governments and affected transit agencies, to improve the flow of intercity travel on the primary routes and access to the proposed stations or airports and would reduce this impact: 1. Regional strategies will include coordination with Regional Transportation planning and Intelligent Transportation System Strategies. 2. Local improvements could employ TSM/Signal Optimization; local spot widening of curves; and major intersection improvements.
		The following program-level mitigation strategies can be developed, in consultation with state, federal, regional, and local governments and affected transit agencies, to improve the flow of intercity travel on the primary routes and access to the proposed stations or airports and would reduce this impact: 1. Regional strategies would include coordination with Regional Transportation planning and Intelligent Transportation System Strategies. 2. Local improvements could employ TSM/Signal Optimization; local spot widening of curves; and major intersection improvements.

Resource Area	Impact Area	Mitigation Measure
	Impacts on air quality	The project-level mitigation strategies to address localized impacts can include the following and would reduce this impact: 1. Increase emission controls from power plants supplying power for the HST alignment. 2. Design the system to utilize energy efficient, state-of-the-art equipment. 3. Promote increased use of public transit, alternative fueled vehicles, and parking for carpools, bicycles, and other alternative transportation methods. 4. Alleviate traffic congestion around passenger station areas. 5. Minimize construction air emissions.
	Impacts on noise and vibration	The program-level mitigation strategies include the following and would reduce this impact: 1. Design practices emphasizing the use of tunnels or trenches. 2. Use of electric powered trains, higher quality track interface, and smaller, lighter, and more aerodynamic trainsets. 3. Full grade separations from all roadways.
		The project-level mitigation strategies include the following and would reduce this impact: 1. Treatments for insulation of buildings affected by noise and vibration. 2. Sound barrier walls within the right-of-way. 3. Track treatments to minimize train vibrations. 4. Construction mitigation.
	Impacts on land use and planning, communities and neighborhoods, property, and environmental justice	The program-level mitigation strategies for HST alignment contributions to the land use impacts include the following and would reduce this impact: 1. Design practices to maximize use of existing rights-of-way and incorporating strategies for stations to incorporate transit-oriented design. 2. Coordination with cities and counties in each region to ensure that project facilities will be consistent with land use planning processes and zoning ordinances.
	Impacts on agricultural lands	The program-level mitigation strategies include the following and would reduce this impact: 1. Design practices to avoid agricultural land conversion through maximizing use of existing rights-of-way to minimize encroachment on additional agricultural lands. 2. Utilizing aerial structure or tunnel alignments to allow for vehicular and pedestrian traffic access across the alignment. 3. Reducing the new right-of-way to 50 feet in constrained areas.
		The project-level mitigation strategies include the following and would reduce this impact: 1. Securing easements. 2. Participating in mitigation banks. 3. Increasing permanent protection of farmlands at the local planning level. 4. Coordinating with various local, regional, and state agencies support farmland conservation programs.
	Impacts on aesthetics and visual resources	The program-level mitigation strategies include the following and would reduce this impact: 1. Design practices that will incorporate local agency and community input during subsequent project-level environmental review in order to develop context sensitive aesthetic designs and treatments for infrastructure.

Resource Area	Impact Area	Mitigation Measure
		The project-level mitigation strategies include the following and would reduce this impact: 1. Design of facilities that integrate into landscape contexts, which will reduce potential view blockage, contrast with existing landscape settings, and light and shadow effects.
	Impacts on public utilities	The program-level mitigation strategies include the following and would reduce this impact: 1. Design practices that will avoid potential conflicts, at the project-level analysis, to the extent feasible and practical. These practices include design methods to avoid crossing or using utility rights-of-way by modifying both the horizontal and vertical profiles of proposed transportation improvements. Emphasis will be placed on detailed alignment design to avoid potential contribution to cumulative impacts from linear facilities on land use opportunities and to minimize conflicts with existing major fixed public utilities and supporting infrastructure facilities.
		The project-level mitigation strategies include the following and would reduce this impact: 1. Coordination with utility representatives during construction in the vicinity of critical infrastructure will occur.
	Impacts on cultural and paleontological resources	The program-level mitigation strategies include the following and would reduce this impact: 1. Continued consultation with SHPO will occur to define and describe general procedures to be applied in the future for fieldwork, method of analysis, and the development of specific mitigation measures to address effects and impacts to cultural resources, resulting in a programmatic agreement between the Authority, FRA, and SHPO. 2. Consultation with Native American tribes will occur.
		The project-level mitigation strategies include the following and would reduce this impact: 1. Avoidance measures through identification of sensitive resources within the project-level analysis, project design refinement, and careful selection of alignments. 2. Subsequent project-level field studies to verify the location of cultural resources will offer opportunities to avoid or minimize direct impacts on resources, based on the type of project, type of property, and impacts to the resource.
	Impacts on geology and soils	The program-level mitigation strategies include the following and would reduce this impact: 1. Design practices will be used while preparing extensive alignment studies to ensure that potential effects related to major geologic hazards such as major fault crossings, oil fields, and landslide areas will be avoided. 2. Mitigation for potential impacts will be developed on a site-specific basis, based on detailed geotechnical studies to address ground shaking, fault crossings, slope stability/landslides, areas of difficult excavation, hazards related to oil and gas fields, and mineral resources.
	Impacts on hydrology and water resources	The program-level mitigation strategies include the following and would reduce this impact: 1. Design practices to maximize use of existing rights-of-way to minimize potential impacts on water resources.

Resource Area	Impact Area	Mitigation Measure
		The project-level mitigation strategies include the following and would reduce this impact: 1. Avoidance and minimization measures will be incorporated into the development, design, and implementation phases. 2. Close coordination will occur with the regulatory agencies to develop specific design and construction standards for stream crossings, infrastructure setbacks, erosion control measures, sediment controlling excavation/fill practices, and other best management practices. 3. Mitigation strategies specific to reconstruction, restoration, or replacement of the resource will occur, in close coordination with state and federal resource agencies, related to flood plains; surface waters, runoff, and erosion; and groundwater.
	Impacts on biological resources and wetlands	The program-level mitigation strategies include the following and would reduce this impact: 1. Design practices to maximize use of existing rights-of-way to minimize potential impacts on biological resources and wetlands.
		The project-level mitigation strategies include the following and would reduce this impact: 1. Avoidance and minimization measures will be incorporated into the development, design, and implementation phases. 2. Close coordination will occur with the regulatory agencies to develop specific design and construction standards for stream crossings, infrastructure setbacks, monitoring during construction, and other best management practices. 3. Mitigation strategies specific to reconstruction, restoration, or replacement of the resource will occur, in close coordination with state and federal resource agencies, related to wetlands. 4. Field studies will be conducted to verify the location, in relation to the HST alignments, of sensitive habitat, wildlife movement corridors, and wetlands. These studies will provide further opportunities to minimize and avoid potential impacts on biological resources through changes to the alignment plan and profile in sensitive areas. For example, the inclusion of design features such as elevated track structures over drainages and wetland areas and wildlife movement corridors will minimize potential impacts to wildlife and sensitive species.
	Impacts on Section 4(f) and 6(f) resources (public parks and recreational resources)	The program-level mitigation strategies include the following and would reduce this impact: 1. Incorporation of sound barriers (e.g., walls, berms, or trenches), visual buffers/landscaping, and modification of transportation access to/egress from the public lands and recreational resource. 2. Incorporation of design modifications or controls on construction schedules, phasing, and activities.

Resource Area	Impact Area	Mitigation Measure
		The project-level mitigation strategies include the following and would reduce this impact: 1. Beautification measures. 2. Replacement of land or structures or their equivalents on or near their existing site(s). 3. Tunneling, cut and cover, and cut and fill of right-of-ways. 4. Treatment of embankments. 5. Planting, screening, creating wildlife corridors, acquisition of land for preservation, and installation of noise barriers. 6. Establishment of pedestrian or bicycle paths. 7. Other potential mitigation strategies identified during the public input process.
		In the event that HST alignments or facilities are located within or in close proximity to public parks, the following mitigations for natural, cultural, aesthetic, and recreational impacts may be considered to offset the contribution to the cumulative impact, including but not limited to: 1. Compensation for temporary and loss of park and recreation use. 2. Recordation of any historic features removed. 3. If necessary, provide alternative shuttle access service to park visitors. 4. Restore directly impacted park lands to a natural state. 5. If any facilities must be relocated, provide planning studies as well as design and appropriate replacement with minimal impact on park use. 6. Inventory and record affected historic structures. Provide appropriate mitigation for adverse effects to historic structures. 7. Require appropriate vehicle cleaning for all construction equipment used near units of the California State Park System to protect against spreading exotic plants or disease. 8. Use local native plants for revegetation. 9. Design and construct cuts, fills, and aerial structures to avoid and minimize visual impact to units of the State Park System. 10. In addressing impacts to wildlife movement corridors and habitat directly related to California State Park System units, consult with the California Department of Parks and Recreation. 11. Incorporate wildlife under- or overcrossings as necessary. 12. Adopt construction practices to protect critical wildlife corridors and visitor use areas within public parks.

3.18 Construction Methods and Impacts

This section describes the construction methods and related types of impacts considered for the No Project and HST Alignment Alternatives[1]. Construction methods are the basis for assessing and qualifying the potential environmental impact from construction activities. These construction methods would be used to prepare, construct, and implement the typical highway, airport, and HST alignment improvements that make up the alternatives.

3.18.1 Construction Method Approach

This section identifies the types of construction (highway and rail alignment) associated with the alternatives, describes the typical sequence and methods for each type of construction, and discusses potential construction-related impacts. The construction of highway improvements is a common element of both the No Project and the HST Alignment Alternatives. Improvements that make up the alternatives are grouped by type of construction and their relationship to the system alternatives, as indicated in Table 3.18-1.

Table 3.18-1
System Alternative Construction Types

Improvement Type	System Alternative	
	No Project	HST Alignment
Expanded Highway	X	X
HST Alignment		X
HST Station/Facility		X
X = Common construction type.		

3.18.2 Planned Highway Improvements

Improvements to existing highways that are planned and programmed are included in the No Project and HST Alignment Alternatives. The improvements to existing highways include:

- Safety improvements.
- Straightening the alignment.
- Interchange improvements.
- Access and terminal/station road improvements.
- Limiting access.
- Adding ramp meters.
- Adding a truck climbing lane.
- Adding new auxiliary lanes.
- Adding new HOV lanes.
- Adding new general use lanes.

[1] See Section 3.0, Introduction, for an explanation of how this section fits together with the HST Network Alternatives presented in Chapter 7, as well as for an overview of the information presented in the other chapters.

3.18.3 Highway Improvement Process

A. CONSTRUCTION WORKSITE CHARACTERISTICS

The worksite for a highway capacity improvement project is the existing highway right-of-way and additional right-of-way (including any temporary construction easements) that has been acquired for the project. The defining characteristic of this worksite is the need to maintain traffic on the existing highway during construction of the improvement.

During construction, traffic is first shifted to one side of the existing roadway while the opposite side is improved (e.g., new retaining walls and pavement installed to widen the roadway, barriers installed or replaced), then traffic is shifted back onto the newly improved portion while the other side is improved. Operational issues associated with construction are complicated and require significant coordination with the contractors and responsible agencies.

B. TYPICAL CONSTRUCTION SEQUENCE (CONSTRUCTION METHOD)

The typical construction sequence would be:

- Mobilization and site preparation—Clear any remaining buildings or other improvements from any new right-of-way.
- Initial traffic control phase—Implement a plan for the temporary protection and direction of traffic. The initial traffic control plan phase would probably include construction of new sound walls along the new edge of the right-of-way.
- Repeat for each traffic control phase—Remove the portions of existing structures; construct the portions of new structures and bridges, existing structure widening, and existing embankment widening or excavations; and widen pavement and install temporary pavement markings. Repeat for the next phase of the traffic control plan.
- Final traffic control plan phase—Construct new wearing surface across entire width of each direction of roadway and install final pavement markings.
- Finishes—Construct elements such as signage and landscaping (this phase may start prior to the final traffic control phase).

<u>Mobilization and Site Preparation</u>

The key mobilization activity would be to develop a traffic control plan for the temporary protection and direction of traffic. If the capacity improvement project is expanding the highway right-of-way, site preparation would include clearing the new right-of-way of conflicting structures, obstructions, and utilities. If the project does not include new right-of-way, little site preparation work can be started until a plan for the traffic plan is implemented.

Minor capacity improvement projects generally do not require sufficient excavation or embankment to justify developing new material sources or waste sites. Major highway widening may justify opening (or more likely re-opening) a quarry or other aggregate source and setting up a rock crusher. A project that includes replacing the existing structures or pavement may well include an aggregate (pavement) crushing plant to recycle used pavement into new aggregate. The crushing plant would not be mobilized until sufficient material has been removed to allow several months of continuous operation. (If the project does not require recycling, the contractor would dispose of the waste material, either as embankment material or at a disposal site.)

Initial Traffic Control Phase

Each traffic control phase would shift traffic away from that phase's work zone and would install temporary barriers to protect workers in the work zone from traffic. The shift can use some combination of closed lanes, narrowed lanes, and the pavement shoulder for through traffic.

Earthwork

The contractor would construct the required retaining walls, embankments, and excavations. The design would attempt to balance cut and fill requirements, but severe terrain or urban conditions may require imported fill or exported cut material. If the overall schedule permits, the embankments would be allowed to consolidate for a year or two before pavement is placed on them. The contractor would route any existing drainage that crosses the alignment through new and extended pipes or box culverts. The contractor would install inlets and pipes, detention basins, and outfalls for roadway drainage.

Structures

The contractor would construct grade separation, drainage, and other bridges or concrete boxes as required.

Pavement

The contractor would finish grading the new roadbed, install subbase, base rock, and bridge approach slabs, and may pave the new roadway. The new pavement would drain to the inlets previously constructed. The contractor would construct any transition sections required. The contractor would install pavement markings on the completed roadway.

Repeat For Each Traffic Control Phase

Subsequent traffic control phases would shift traffic onto the completed portion of the work to create a new work zone. The contractor would construct/reconstruct the portion of the pavement and structures in the new work zone, then shift the traffic to a new traffic control phase until all new pavement and structures are complete.

Final Traffic Control Plan Phase

For some roadway widening, when the temporary barrier is removed, the contractor would overlay a new pavement wearing surface across the entire roadway width. This paving could be done at night, when traffic volumes are reduced, and may take several nights. The contractor would install temporary pavement markings as the new top lift is installed. The contractor would install permanent markings after the new wearing course has aged for a week.

Finishes

Construction of the new pavement wearing course and markings may complete the project, or construction may continue with shoulder barriers, signage, and landscaping.

C. TYPICAL CONSTRUCTION IMPACTS

The impacts of any single capacity improvement project would be localized. The impacts of a program of capacity improvements underway at more or less the same time would be increased, not only because of the longer work zones but also because a multitude of projects too small individually to develop their own sources may overtax commercial suppliers of aggregate and paving materials. Other typical impacts may include:

- Traffic plan lane closures and lane narrowing would divert more traffic demand than would be added as a result of construction traffic.
- The existing roadway drainage would be disrupted during construction. The construction contractor would use silt fences, hay bales, and other measures to control runoff and erosion.
- Roadway widening would generate waste pavement and waste structural concrete that would either be placed in landfills or recycled.
- Most roadway widening activities would not increase the ambient highway noise level. Demolition and pile driving are inherently noisy and would be audible at nearby land uses, but these activities and their associated noise would also be of comparatively short duration compared to the paving activities.
- Much of the work involved in setting up the traffic control phases, demolishing existing structures, and final paving would take place at night, when traffic volumes are less. The night worksites would be illuminated, and the illumination may have an impact on adjacent land uses.
- Roadway projects would generate short-term pollutant noise increases and air emissions (fugitive dust emissions, mobile source emissions and asbestos) from the following construction activities:
  - Demolition of existing structures and roadways.
  - Excavation related to activities such as preparation of track beds, installation of rail, roadway modifications, and facilities construction.
  - Welding related to continuously welded rail (CWR) operations.
  - Mobile emissions related to construction worker travel to and from project sites.
  - Mobile emissions related to the delivery and hauling of construction supplies and debris to and from project sites.
  - Stationary emissions related to fuel consumption by onsite construction equipment.

3.18.4 High-Speed Train Alignment Alternatives

This section applies to the HST Alignment Alternatives and the new construction associated with track alignment and system elements. The alignment would include at-grade, aerial, bridge, and tunnel components.

A. CONSTRUCTION WORKSITE CHARACTERISTICS

In most locations, particularly in urban areas, the worksite (new HST alignment) would be close to existing railroad tracks or highway facilities. However, in some locations, the worksite would follow a new alignment independent of existing railroad or highway infrastructure through undeveloped areas.

The new trackway and worksite would have three primary characteristics in high-speed segments—long tangent sections connected by very large-radius horizontal curves, long sections of constant grade connected by long vertical curves, and underpasses or overpasses wherever the trackway crosses another surface transportation alignment (e.g., street, highway, railroad track). In urban areas, the curve radii are generally reduced because of development constraints, but the curves generally are still greater than the existing highway alignments.

In some locations, such as the Central Valley, the topography simplifies construction of an HST trackway. The major construction effort would be to clear obstructions from an appropriately straight alignment and to construct grade separation structures to carry crossing roads and other railroads over or under that alignment.

In other locations, especially where the HST system crosses mountain ranges, the topography would challenge the construction of an HST trackway. In challenging terrain, the major construction effort would consist of reshaping the earth (earthwork or cut and fill) and constructing bridges and tunnels to cross over or under the existing ground surface where it is impractical to achieve the alignment geometry through reshaping.

There would be additional infrequent, but important, worksites along the alignment. These additional worksites include:

- Traction power substations and signal/communications bungalows.
- Tunnel ancillary structures (e.g., tunnel emergency egress/access points, tunnel ventilation buildings, tunnel drainage pumping plants).

In addition, there would be temporary (construction-related) sites, such as:

- Access roads and yards.
- Embankment material and aggregate source sites.
- Tunnel spoil and other excavation material disposal sites.
- Rail welding, aggregate crushing, Portland cement concrete, and asphaltic concrete plant sites.

B. TYPICAL CONSTRUCTION SEQUENCE (CONSTRUCTION METHOD)

The typical construction sequence would be:

- Mobilization and site preparation—Clear the alignment of conflicting improvements, including buildings and utilities not already removed, and mobilize for construction, including establishing construction yards, building site access roads if necessary, developing aggregate sources and embankment material borrow pits, and preparing excavation material and tunnel spoil waste sites.
- Heavy civil construction—Construct the trackbed, including embankments, cuts, bridges, or tunnels; construct crossing highway or railroad grade separation structures if not already in place; and construct supporting facilities, including central control building, vehicle maintenance buildings and storage yards, and passenger stations.
- Railroad systems construction—Construct trackwork and special trackwork, traction electrification, and railroad signaling and communications on the trackbed and at the supporting facilities.
- Finishes—Construct elements such as signage and landscaping (this phase would overlap with railroad systems installation and system testing).
- System testing—equipment and system testing would culminate with a period of simulated full revenue service.

Mobilization and Site Preparation

Construction of the HST system would require a large workforce, a large fleet of construction equipment, large quantities of aggregate and embankment materials, and a large number of manufactured products. This initial phase would develop the construction yards and other temporary infrastructure required to assemble and organize these construction resources. The Authority's right-of-way acquisition program may have cleared the right-of-way of existing improvements (primarily buildings and utilities). If those improvements have not already been removed, the contractor would remove them during this phase.

During the construction mobilization phase, the contractor would set up construction yards to receive equipment and products, prepare sources (i.e. quarries and borrow pits) for aggregate and embankment materials, and cut pioneer roads as necessary to reach remote work sites (e.g., tunnel portals and shafts, bridge piers). The contractor would also remove or relocate any conflicting improvements (buildings, utilities, roads, track) that remain on the right-of-way.

Heavy Civil Construction

Construction of the high speed rail system would reshape a strip of land 40 to 100 ft wide to create a trackbed meeting the system's horizontal and vertical alignment requirements. (The width of the strip of land would be greater at special locations such as passenger stations or vehicle maintenance facilities.) The trackbed would be grade separated—meaning that other facilities, such as existing or future roads, tracks, or cattle paths, would cross the alignment above or below the high speed rail tracks. Where the terrain is too severe, or the crossing roadways and other tracks too numerous, bridges or tunnels would carry the trackbed over or under the terrain.

Reshape the earth means that the contractor would remove the existing vegetation and topsoil, excavate farther down (below the topsoil), or bring in embankment material and construct engineered fill as necessary to reach the design subgrade elevation, and cap the subgrade with compacted crushed aggregate subballast. The contractor would construct drainage ditches or subdrains on either side of the alignment. The contractor would also construct discharges from the ditches and subdrains at appropriate points.

In any of these grade separation cases, the contractor would build grade separation structures and roadwork or trackwork on or though the structures during the heavy civil construction phase. If the structure carries the high speed rail alignment over the crossing road or track, the structure would be constructed prior to the trackbed. If the structure carries the crossing road or track over the high speed rail alignment, the structure could be constructed either before or after the trackbed. Grade separation construction would sometimes include the modification of existing or construction of new traffic signal systems.

To construct a grade separation bridge, the contractor would remove the existing vegetation and topsoil under the future structure, construct foundations under piers and bridge abutments, construct piers and abutments, construct the bridge superstructure (girders and deck), and install finish elements such as approach slabs, metal railings, or solid concrete parapets. The foundations and superstructure types for any bridge would be selected in the design phase based on site-specific conditions from menus of likely foundations and superstructures. The foundation menu includes:

- Spread footings.
- Driven or drilled piling covered with a pile cap.
- Cast-in-drilled-hole (CIDH) piers.

The superstructure menu includes:

- Steel or precast concrete girders supporting a deck slab.
- A cast-in-place or precast concrete box with a deck slab integrated into the main girder.

Precast concrete girders would also be prestressed; cast-in-place concrete boxes may be prestressed or reinforced without prestress.

To construct a grade separation cut-and-cover concrete box, the contractor would excavate to a depth below the future box, then construct the box bottom slab, walls, and roof; backfill the sides and over the top of the completed box; and install finish elements such as lighting.

Construction of any of these structures would require heavy equipment access to the site and maneuvering room for the equipment. In addition, the cast-in-place concrete box option would require falsework to support the formwork that shapes the structure.

Bridges over severe terrain could be similar to grade separation bridges; however, because of the difficulty in locating intermediate piers, severe terrain bridges could require more elaborate long span or precast segmental superstructures. While special superstructures could reduce the access requirements for intermediate piers, they would still require access to both abutments and possible larger abutment work areas to prepare girders to be launched across the ravine being bridged.

Tunnels through severe terrain must be excavated from headings. If the tunnel is short (up to 6 miles long), it might be reasonable to construct it from a single heading. The selected HST system has no tunnels longer than 6 miles.

At each tunnel heading access site, there must be sufficient work area to accommodate:

- Worker and equipment staging.
- Tunnel utility infrastructure (fresh air supply, compressed air, water, electric power, and tunnel drainage).
- Tunnel spoil surge piles.
- Storage of excavation support materials (e.g., steel ribs, rock bolts and shotcrete, precast liner panels).

There must be room to transfer materials going into the tunnel from trucks to tunnel railcars, and to transfer spoil coming out of the tunnel from tunnel railcars or conveyor belts to trucks. These heading access site requirements are generally independent of the excavation method (tunnel boring machine, drill and blast, or road-header) or number of tunnel bores (two single-track tunnels or one double-track tunnel).

After the tunnel is excavated, many of the tunnel construction access sites would become permanent tunnel support sites, such as ventilation plants, pump stations, traction power substations, emergency access points.

To avoid or limit potential impacts along the surface above the tunnels, the selected HST system has limited surface access for ventilation and/or evacuation through tunnel design. The potential impacts associated with construction access roads would be greatly limited, and avoided altogether in some sensitive segments (as defined at the project level), by using in-line construction, i.e., by using the new rail infrastructure as it is built to transport equipment to and from the construction site and to transport excavated materials away from the construction area and to appropriate re-use or disposal sites. To avoid the creation of access roads in sensitive areas (as defined at the project level), it may be necessary to conduct geologic exploration using helicopter transport for drilling equipment and restoring sites after use, which would result in minimal surface disruption. Small pilot tunnels would be used where more extensive subsurface geology information is needed.

The heavy civil construction phase may also include construction of alignment elements to support the subsequent railroad systems phase:

- Cable trough or duct banks.

- Foundations for poles supporting the overhead contact system.
- Site work for traction power substations.

Railroad Systems Construction

The railroad systems include trackwork, traction electrification, signaling, and communications. (The rail vehicles are another key system but are not discussed in this section.)

Trackwork includes both the typical track structure and special trackwork. Special trackwork is the track switches, frogs, crossing diamonds, etc., that make up turnouts and crossovers. Trackwork is the first rail system to be constructed, and it must be in place at least locally to start traction electrification and railroad signaling installation. Trackwork construction generally requires the welding of transportable lengths of steel running rail (traditionally 78 ft in length) onto longer lengths (approximately ¼ mile), which are placed in position on crossties or track slabs and field-welded into continuous lengths from special trackwork to special trackwork.

Tie and ballast track construction typically requires that crossties and ballasts be distributed along the trackbed by truck or tractor. In sensitive areas, this operation can be accomplished by using the established right-of-way corridor with delivery of the material via the constructed rail line because in-line construction techniques are proposed. The top 4 inches or so of ballast can be delivered by railcar over the assembled track.

The traction electrification equipment to be installed includes traction power substations and the overhead contact system. The running rails, which serve as the power return current conductor, are also part of the electrical circuit. Traction power substations are typically fabricated and tested in a factory, then delivered by tractor-trailer to a prepared site adjacent to the alignment. Substation spacing depends on the power supply technology selected, but this document assumes one substation every 30 miles per the Engineering Criteria Report, January 2004.

The overhead contact system is assembled in place over each track from components (poles, brackets, insulators, conductors, and various hardware). The overhead contact system is connected by field-wiring to adjacent substations.

The signaling equipment to be installed includes wayside cabinets and bungalows (within established rights of way), wayside signals (at interlockings), switch machines, insulated joints, impedance bonds, and connecting cabling. The equipment supports several technologies—Automatic Train Protection, Automatic Train Control, and Positive Train Control—to control train separation, train routing at interlockings, and train speed.

The communications equipment to be installed includes System Control and Data Acquisition (SCADA), telephone, radio, closed-circuit television, and visual messaging. The equipment is located in the system central control facility, wayside communications bungalows, passenger stations, tunnel equipment rooms, traction power substations, signal bungalows, and other locations. Communications data likely would be carried on a fiber optic backbone running the length of the alignment.

Finishes

Landscaping, signage, architectural finishes, and similar items involve construction trades different from those required for heavy civil or railroad systems. The distinction between finishes and earlier phases of work is important for labor and material scheduling but not for the identification of work sites or overall construction methods. Finishes would be installed at the same construction worksites as the earlier phases of construction and would probably overlap the completion of the heavy civil and railroad systems work.

Testing and Start-Up

All work would be inspected and tested as stand-alone items as part of its construction. During system testing and start up, the work would be checked again to confirm that it functions as an integrated system. For example, integrated testing would confirm that the SCADA tunnel ventilation system status display at central control truly reflects the status of the ventilation systems, and that the ventilation equipment correctly responds to commands initiated at central control.

C. TYPICAL CONSTRUCTION IMPACTS

Overall, the HST Alignment Alternative construction sites would have numerous site-specific impacts on adjacent land uses. However, some construction impacts would be more universal in nature. Typical impacts may include:

- The worksite would generate traffic on public roads leading to the site and on private haul routes running along the alignment or between the alignment and construction yards. The traffic would include construction worker commuting, delivering construction supplies (e.g., bulk cement, asphalt, steel, fuel, manufactured products), and moving construction materials (primarily dirt from excavations to embankments, and aggregate). In sensitive areas, these operations can be accomplished using the established right-of-way corridor with delivery of the material via the constructed rail line because in-line construction techniques are proposed.
- The worksite would be cleared of ground cover for construction. As a result, rainstorms would produce greater runoff and erosion than would otherwise be the case. The high speed rail construction contractor would use silt fences, hay bales, and other measures to control runoff and erosion.
- The construction project has the potential to generate large quantities of material—from pavement demolition, clearing and grubbing, and soil/rock—that is anticipated to be suitable for reuse in the construction of the proposed HST facilities. Potential uses include aggregate for concrete and fill material for other portions of the line. The project itself would generate a much smaller volume of waste—product packaging, broken equipment, and site litter. The project may experience minor hydraulic fluid, motor oil, and fuel spills that would result in the disposal of contaminated soil. The project may generate a comparatively tiny volume of hazardous waste from building demolition. The high speed rail construction contractor would collect and dispose of solid waste appropriately.
- Some heavy civil construction activities, notably pile driving and rock excavation with explosives, would be inherently noisy. Most construction activities would use large pieces of construction equipment, and the equipment would generate noise. Most of the construction worksite would be sufficiently remote so that construction noise would not cause adverse impacts on adjacent land uses. However, the portions of the worksite in urban areas may experience sufficient construction noise to have an impact on adjacent properties.
- Tunnel excavation would likely take place 24 hours per day. As a result, tunnel heading access sites would also be occupied 24 hours per day and would be illuminated at night. The nighttime illumination may have an impact on adjacent land uses.
- Roadway grade separations would connect to active roads at both ends of the grade separation worksite. Particularly in urban areas where the surrounding areas are not sensitive to noise impacts, roadway traffic may be such that the connection work must be performed overnight, when traffic volumes are less. The night connection work, if required, would be illuminated, and the illumination may have an impact on adjacent land uses.
- The following construction activities would generate short-term pollutant noise increases and air emissions (fugitive dust emissions, mobile source emissions, and asbestos):

- Demolition of existing structures.
- Excavation related to preparation of track beds and installation of rail.
- Welding related to CWR operations.
- Mobile emissions related to construction worker travel to and from project sites.
- Mobile emissions related to the delivery and hauling of construction supplies and debris to and from project sites.
- Stationary emissions related to fuel consumption by onsite construction equipment.

3.18.5 High-Speed Train Stations/Facilities

This section applies to the HST Alignment Alternatives and the new construction associated with stations and maintenance facilities. These facilities would include urban and rural locations, potentially joint-operated and joint-developed locations, and at-grade, aerial, and underground locations. Passenger stations include improvements to existing railroad stations and newly constructed stations. Substations and maintenance facilities would be newly constructed structures.

A. CONSTRUCTION WORKSITE CHARACTERISTICS

In urban areas, most worksites would include an expansion of or improvements to existing train stations. In rural areas, most worksites would include new construction along a new alignment independent of existing railroads.

A unique characteristic of construction on existing railroad stations is the need to maintain capacity and passenger levels of service during the construction activities. Unlike highways, where traffic can be diverted to other facilities during construction, railroad stations must be able to accommodate demand and operations because passengers cannot typically be diverted to other facilities. As a result, railroad station improvements require significant coordination and planning to accommodate safe and convenient access for passengers and no disruptions to operations.

The worksite for a new railroad station or maintenance facility most likely would be a constrained parcel of land. The footprint of the new structure and parking area would be available for the contractor’s exclusive use. Because parking areas and tail track/storage track areas may be available, the contractor could make use of these areas as a construction yard. If necessary, adjacent landowners may furnish temporary easements for the contractor to use as a construction yard during construction.

B. TYPICAL CONSTRUCTION SEQUENCE (CONSTRUCTION METHOD)

The typical construction sequence would be:

- Demolition and site preparation—Vacate identified areas within existing structures. Construct new entrances to existing stations if necessary. Close the portion of existing structures to be removed. Construct/install construction fence and barriers. Demolish existing structures scheduled for removal on the worksite. For new facilities, perform earthwork, drainage work, and utility relocation/construction as necessary. For platform improvements or additional platform construction, the necessary track realignment and construction would be required.
- Structural shell and electrical/mechanical rough-in—Construct foundations and structural frames. Construct walls or platforms. Rough-in electrical and mechanical systems.
- Finishes and tenant improvements—Install electrical/mechanical equipment. Install finishes and communications equipment. Construct tenant improvements. The actual construction sequence may have several additional steps if the railroad agency determines that it needs to stage

construction, such as completing and occupying a portion of the new work before removing the last of the existing structure for replacement.

Demolition and Site Preparation

The contractor would construct detour roadways, new station entrances, and other elements required to take existing facilities in the worksite out of service. The other elements could be as significant as constructing a new utility company primary service and switchgear if the existing facility is in the way of the expansion.

The contractor would close the roadway, parking, or portion of the station to be removed, install construction fences or barriers, and demolish the existing improvements.

Structural Shell and Electrical/Mechanical Rough-In

The contractor would construct foundations and the structural frame of the new station. The contractor would enclose the new building or construct new platforms and connect the structure to site utilities. The contractor would rough-in electrical and mechanical systems and would install specialty items such as elevators, escalators, and ticketing equipment.

Finishes and Tenant Improvements

The contractor would install electrical and mechanical equipment. The contractor would install communications and security equipment, finishes, and signage. The contractor may install tenant improvements, or developers and other tenants may have their own contractors construct tenant improvements.

C. TYPICAL CONSTRUCTION IMPACTS

The largest impact would be the daily disruption of station activities. There would be little construction impact outside of the station site. Other impacts may include:

- Construction traffic in the vicinity of the station.
- Operations and planning coordination for platform improvements or new platforms that require trackwork realignment.
- The contractor must take care to maintain or replace the existing utilities as called for in the construction documents, but with care, drainage should not be a problem.
- There may be a substantial volume of demolition debris from the site preparation phase.
- Construction noise generally would be lost in the ambient station noise.
- Night work in the urban station areas would need to be assessed for impacts on residential and commercial (hotel) areas.

The additional worksites along the alignment may include:

- A central control facility.
- Revenue service vehicle storage and maintenance facilities.
- Maintenance-of-way shops and non-revenue vehicle storage.
- Traction power substations and signal/communications bungalows.
- Tunnel ancillary structures (e.g., tunnel emergency egress/access points, tunnel ventilation buildings, tunnel drainage pumping plants).

4 COSTS AND OPERATIONS

4.1 INTRODUCTION

This chapter summarizes the estimated capital and operations and maintenance (O&M) costs for each HST Alignment Alternative evaluated in this Program EIR/EIS.

4.2 CAPITAL COSTS

Capital costs for HST Alignment Alternatives and station location options were estimated in 2006 dollars. The costs are associated with HST-related infrastructure improvements and do not include the costs associated with the No Project Alternative. The programmed and funded improvements included under the No Project Alternative are assumed to have been implemented by 2020, regardless of proposed HST implementation.

Capital costs were estimated for all proposed HST Alignment Alternatives and station location options evaluated in this Program EIR/EIS (Tables 4.2-1 and 4.2-2). Costs also were aggregated for each representative network alternative, as identified in Chapter 2 and compared in Chapter 7. Some alignments (horizontal and vertical) and station configurations previously considered have evolved since preparation of the statewide program EIR/EIS, and therefore costs also have changed. The proposed alignment alternatives and station location options selected in this program review would be further evaluated at the project level to identify cost savings through application of value engineering practices.

The capital costs are representative of all aspects of implementation of the proposed HST system, including construction, right-of-way, environmental mitigation, and design and management services. The construction costs include procurement and installation of line infrastructure (e.g., tracks, bridges, tunnels, grade separations, and power distribution); facilities (e.g., passenger stations and storage and maintenance facilities); systems (e.g., communications and train control); and removal or relocation of existing infrastructure (e.g., utilities and rail tracks). The right-of-way costs include the estimated costs to acquire properties needed for construction of the HST infrastructure. The environmental mitigation costs include a rough estimate of the proportion of the capital cost required for mitigating environmental impacts, based on similar completed highway and rail line construction projects. No specific mitigation costs are identified at this program level of review. Agency costs associated with administration of the program (e.g., design, environmental review, and management) are estimated in terms of add-on percentages to construction costs.

The estimated total capital costs for each individual alignment alternative are presented in Appendix 4-A. The individual station location costs are presented in Appendix 4-B.

Table 4.2-1
High-Speed Train Alignment Alternatives Capital Cost (in 2006 dollars),
Including Contingencies and Program Implementation Cost

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
San Francisco to San Jose Corridor: Caltrain					
San Francisco to Dumbarton	44.58	27.70	49,175,138	79,139,713	2,192,227,640
Transbay Transit Center to 4th/Townsend (Caltrain 1)	2.50	1.55	159,522,378	256,726,381	398,805,944
4th/Townsend to Millbrae/SFO (Caltrain 2)	22.58	14.03	45,352,477	72,987,737	1,024,058,938
Millbrae/SFO to Redwood City (Caltrain 3)	18.75	11.65	37,489,586	60,333,640	702,929,734
Redwood City to Caltrain (Caltrain 4)	0.75	0.47	88,577,366	142,551,453	66,433,025
Dumbarton to San Jose	34.40	21.38	39,358,880	63,341,977	1,353,945,475
Caltrain Dumbarton Wye (Caltrain 5)	1.62	1.01	24,593,435	39,579,297	39,865,958
Dumbarton Wye to Palo Alto (Caltrain 6)	5.23	3.25	49,783,239	80,118,357	260,316,558
Palo Alto to Santa Clara (Caltrain 7)	22.55	14.01	26,212,143	42,184,355	591,083,820
Santa Clara to Diridon Station (Caltrain 8)	5.00	3.11	92,535,828	148,921,979	462,679,139
Station Location Options					
Transbay Transit Center (Terminal Option)					786,262,418
4th and King (Caltrain) (Terminal Option)					791,939,278
Millbrae/SFO					29,076,600
Redwood City (Caltrain)					67,516,558
Palo Alto (Caltrain)					67,516,558
Oakland to San Jose Corridor: Niles/I-880					
West Oakland to Niles Junction	44.64	27.74	35,744,748	57,525,595	1,595,717,028
West Oakland to Jack London Square (Niles/I-880 1A)	6.72	4.18	77,055,201	124,008,325	517,810,948
Jack London Square to Oakland Coliseum (Niles/I-880 2)	3.95	2.45	55,088,733	88,656,721	217,600,493
Oakland Coliseum to Union City (BART) (Niles/I-880 3A)	10.52	6.54	76,504,832	123,122,593	804,983,844
Union City (BART) to Niles Junction (Niles/I-880 4A)	23.45	14.57	2,359,136	3,796,662	55,321,742
12th Street/City Center to Niles Junction	43.02	26.73	34,949,176	56,245,246	1,503,583,436
12th Street/City Center to Jack London Square (Niles/I-880 1B)	5.10	3.17	83,466,148	134,325,745	425,677,356
Jack London Square to Oakland Coliseum (Niles/I-880 2)	3.95	2.45	55,088,733	88,656,721	217,600,493
Oakland Coliseum to Union City (BART) (Niles/I-880 3A)	10.52	6.54	76,504,832	123,122,593	804,983,844

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Union City (BART) to Niles Junction (Niles/I-880 4A)	23.45	14.57	2,359,136	3,796,662	55,321,742
Niles Junction to San Jose via Trimble (Structure)	27.43	17.04	66,893,831	107,655,186	1,834,964,679
Niles Junction to Niles Wye (S) (Niles/I-880 5A)	3.65	2.27	45,726,749	73,590,069	166,902,634
Niles Wye (S) to Warm Springs (Niles/I-880 5B)	8.45	5.25	16,691,618	26,862,555	141,044,170
Warm Springs to Trimble Rd (Niles/I-880 6)	2.33	1.45	214,189,581	344,704,717	499,275,914
Trimble Rd. Option (Structure) (Niles/I-880 7B)	8.00	4.97	70,632,853	113,672,558	565,062,822
Santa Clara to Diridon Station (Caltrain 8)	5.00	3.11	92,535,828	148,921,979	462,679,139
Niles Junction to San Jose via Trimble (Tunnel)	29.95	18.61	65,132,060	104,819,890	1,950,900,589
Niles Junction to Niles Wye (S) (Niles/I-880 5A)	3.65	2.27	45,726,749	73,590,069	166,902,634
Niles Wye (S) to Warm Springs (Niles/I-880 5B)	8.45	5.25	16,691,618	26,862,555	141,044,170
Warm Springs to Trimble Rd (Niles/I-880 6)	2.33	1.45	214,189,581	344,704,717	499,275,914
Trimble Rd. Option (Tunnel) (Niles/I-880 7B)	10.52	6.54	64,721,415	104,159,021	680,998,732
Santa Clara to Diridon Station (Caltrain 8)	5.00	3.11	92,535,828	148,921,979	462,679,139
Niles Junction to San Jose via I-880	26.10	16.22	48,553,043	78,138,548	1,267,234,412
Niles Junction to Niles Wye (S) (Niles/I-880 5A)	3.65	2.27	45,726,749	73,590,069	166,902,634
Niles Wye (S) to Warm Springs (Niles/I-880 5B)	8.45	5.25	16,691,618	26,862,555	141,044,170
Warm Springs to Trimble Rd (Niles/I-880 6)	2.33	1.45	214,189,581	344,704,717	499,275,914
I-880—Trimble Rd. to Diridon (Niles/I-880 7A)	11.67	7.25	39,421,689	63,443,059	460,011,694
Niles Junction to Altamont	13.13	8.16	55,263,716	88,938,329	725,723,114
Niles Junction to Niles Wye (S) (Niles/Dumbarton XN)	4.25	2.64	35,018,018	56,356,037	148,966,648
Niles Wye (S) to Warm Springs (Niles/Dumbarton XS)	8.88	5.52	64,964,684	104,550,525	576,756,466
Station Location Options					
West Oakland/7th Street					611,197,055
12th Street/City Center					611,197,055
Coliseum/Airport					61,735,853
Union City (Bart)					69,853,070
Fremont (Warm Springs)					156,875,180

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
San Jose to Central Valley Corridor: Pacheco Pass					
Pacheco	92.50	57.48	38,800,727	62,443,717	3,589,067,255
Diridon to Morgan Hill (Pacheco 1)	32.50	20.19	20,366,713	32,777,047	661,918,165
Morgan Hill to Gilroy (Pacheco 2)	16.00	9.94	23,730,117	38,189,921	379,681,864
Gilroy to San Luis Reservoir (Pacheco 3)	44.00	27.34	57,896,982	93,176,161	2,547,467,226
Henry Miller (UPRR Connection)	100.89	62.69	13,489,349	21,709,003	1,360,872,958
San Luis Reservoir to Valley Floor (Pacheco 4)	15.45	9.60	27,554,846	44,345,226	425,722,369
Western Valley to Henry Miller UP Wye (HM-1)	58.05	36.07	10,870,134	17,493,785	630,967,784
Henry Miller UP North Wye to UP South Wye (HM-2)	8.19	5.09	11,200,428	18,025,342	91,720,307
Henry Miller Wye North to UPRR (HM/UP-XN)	11.25	6.99	11,845,555	19,063,573	133,262,493
Henry Miller Wye South to UPRR (HM/UP-XS)	7.95	4.94	9,962,265	16,032,711	79,200,005
Henry Miller (BNSF Connection)	104.70	65.06	13,324,586	21,443,843	1,395,030,861
San Luis Reservoir to Valley Floor (Pacheco 4)	15.45	9.60	27,554,846	44,345,226	425,722,369
Western Valley to Henry Miller UP Wye (HM-1)	58.05	36.07	10,870,134	17,493,785	630,967,784
Henry Miller UP North Wye to UP South Wye (HM-2)	8.19	5.09	11,200,428	18,025,342	91,720,307
Henry Miller UP South Wye to BNSF Wyes (HM-3)	4.62	2.87	11,920,369	19,183,975	55,012,505
Henry Miller Wye North to BNSF (HM/BN-XN)	8.70	5.40	13,137,656	21,143,007	114,245,054
Henry Miller Wye South to BNSF (HM/BN-XS)	9.70	6.03	7,975,551	12,835,405	77,362,843
GEA North	80.25	49.87	16,775,455	26,997,477	1,346,230,241
San Luis Reservoir to Atwater Wye (GEA-1A)	47.70	29.64	12,125,069	19,513,408	578,365,814
GEA Wye to Atwater (GEA-1B)	9.30	5.78	7,483,268	12,043,153	69,594,395
GEA Wye to Arena (SR-99) (GEA XN-1)	10.85	6.74	13,768,794	22,158,725	149,350,104
Arena (SR-99) to Ballico West (GEA XN-2)	8.57	5.33	10,530,597	16,947,353	90,247,214
Arena (SR-99) to Ballico North (GEA XN-3)	9.40	5.84	22,965,148	36,958,823	215,941,283
GEA Atwater Wye South to Merced UP (GEA-UPRR XS)	11.10	6.90	27,186,344	43,752,180	301,768,423
Station Location Options					
San Jose (Diridon)					185,051,790
Morgan Hill (Caltrain)					284,985,295
Gilroy (Caltrain)					148,256,045

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
East Bay to Central Valley Corridor: Altamont Pass					
I-680/580/UPRR	49.43	30.71	48,015,427	77,273,339	2,373,258,499
Niles Canyon to Sunol (UPRR-2A/2B)	6.27	3.90	99,895,152	160,765,663	626,342,602
Sunol to Dublin/Pleasanton BART (I-680/580/UPRR-1)	11.72	7.28	43,125,032	69,403,012	505,382,254
Dublin/Pleasanton BART to El Charo Road (I-680/580/UPRR-2)	4.09	2.54	37,877,905	60,958,579	154,996,386
El Charo Road to Livermore (I-580) (I-680/580/UPRR-3)	5.32	3.31	37,708,288	60,685,606	200,608,090
Livermore (I-580) to Greenville (I-680/580/UPRR-4)	8.11	5.04	36,480,045	58,708,941	295,853,163
Greenville to Altamont Pass (I-680/580/UPRR-5)	8.66	5.38	61,995,084	99,771,416	536,567,450
Altamont Pass to County Line (UPRR-9)	5.26	3.27	10,170,795	16,368,308	53,508,554
I-580/UPRR	43.96	27.32	45,493,874	73,215,293	1,999,973,946
Niles Canyon to Sunol (UPRR-2A/2B)	6.27	3.90	99,895,152	160,765,663	626,342,602
Sunol to Pleasanton (UPRR-3)	3.30	2.05	44,840,606	72,163,960	147,876,695
Pleasanton to El Charo (UPRR-4)	2.59	1.61	26,405,269	42,495,161	68,510,055
UPRR to I-580 Connector (Pleasanton X)	4.45	2.77	15,878,585	25,554,105	70,707,337
El Charo Road to Livermore (I-580) (I-680/580/UPRR-3)	5.32	3.31	37,708,288	60,685,606	200,608,090
Livermore (I-580) to Greenville (I-680/580/UPRR-4)	8.11	5.04	36,480,045	58,708,941	295,853,163
Greenville to Altamont Pass (I-680/580/UPRR-5)	8.66	5.38	61,995,084	99,771,416	536,567,450
Altamont Pass to County Line (UPRR-9)	5.26	3.27	10,170,795	16,368,308	53,508,554
Patterson Pass/UPRR	41.19	25.60	41,847,512	67,347,043	1,723,804,068
Niles Canyon to Sunol (UPRR-2A/2B)	6.27	3.90	99,895,152	160,765,663	626,342,602
Sunol to Pleasanton (UPRR-3)	3.30	2.05	44,840,606	72,163,960	147,876,695
Pleasanton to El Charo (UPRR-4)	2.59	1.61	26,405,269	42,495,161	68,510,055
El Charo to Livermore (UPRR-5)	6.41	3.98	7,350,429	11,829,368	47,082,729
Livermore to Patterson Pass cut off (UPRR-6)	3.55	2.21	20,957,133	33,727,236	74,412,071
Patterson Pass	19.07	11.85	39,822,791	64,088,570	759,579,915
UPRR	41.62	25.86	40,377,726	64,981,651	1,680,501,168
Niles Canyon to Sunol (UPRR-2A/2B)	6.27	3.90	99,895,152	160,765,663	626,342,602
Sunol to Pleasanton (UPRR-3)	3.30	2.05	44,840,606	72,163,960	147,876,695
Pleasanton to El Charo (UPRR-4)	2.59	1.61	26,405,269	42,495,161	68,510,055
El Charo to Livermore (UPRR-5)	6.41	3.98	7,350,429	11,829,368	47,082,729

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Livermore to Patterson Pass cutoff (UPRR-6)	3.55	2.21	20,957,133	33,727,236	74,412,071
Patterson Pass cut off to Greenville (UPRR-7)	2.99	1.86	18,265,628	29,395,678	54,614,227
Greenville to Altamont Pass (UPRR-8)	11.25	6.99	54,058,154	86,998,166	608,154,234
Altamont Pass to County Line (UPRR-9)	5.26	3.27	10,170,795	16,368,308	53,508,554
Tracy Downtown (BNSF Connection)	86.22	53.58	17,787,134	28,625,617	1,533,677,808
County Line to Tracy Downtown (UPRR-10)	12.84	7.98	23,802,574	38,306,529	305,553,641
Tracy Downtown to I-205 (UPRR-11	7.34	4.56	15,988,833	25,731,533	117,358,035
I-205 to S. UPPRR (UPRR-12)	8.31	5.16	14,955,715	24,068,890	124,281,993
I-205 to Lathrop—Northern (UPRR-13)	13.14	8.16	18,113,361	29,150,629	238,009,562
Southwestern Manteca (MC-1)	1.46	0.91	27,687,372	44,558,506	40,340,501
Southeastern Manteca (MC-2)	1.83	1.14	25,102,875	40,399,161	45,963,364
Northern Escaton Wye to BNSF (MC-5)	4.30	2.67	23,422,722	37,695,217	100,717,704
Southern Escaton Wye to BNSF (part 1) (MC-6)	22.84	14.19	8,972,327	14,439,561	204,945,893
Southern Escaton Wye to BNSF (part 2) (MC-7)	14.17	8.80	25,164,616	40,498,524	356,507,116
Tracy ACE Station (BNSF Connection)	86.87	53.98	18,877,113	30,379,768	1,639,835,922
County Line to South of Tracy (S UPRR-1)	2.09	1.30	13,128,290	21,127,935	27,398,741
South of Tracy to Tracy ACE Station (S UPRR-2)	15.51	9.64	25,499,265	41,037,089	395,493,599
Tracy ACE Station to I-205 (S UPRR-3)	7.14	4.44	11,856,678	19,081,474	84,656,684
I-205 to Southeast of Manteca (S UPRR-4)	6.46	4.02	15,269,787	24,574,340	98,673,364
I-205 to Lathrop—Southern (S UPRR-5)	11.07	6.88	25,750,831	41,441,946	285,138,957
Southwestern Manteca (MC-1)	1.46	0.91	27,687,372	44,558,506	40,340,501
Southeastern Manteca (MC-2)	1.83	1.14	25,102,875	40,399,161	45,963,364
Northern Escaton Wye to BNSF (MC-5)	4.30	2.67	23,422,722	37,695,217	100,717,704
Southern Escaton Wye to BNSF (part 1) (MC-6)	22.84	14.19	8,972,327	14,439,561	204,945,893
Southern Escaton Wye to BNSF (part 2) (MC-7)	14.17	8.80	25,164,616	40,498,524	356,507,116
Tracy ACE Station (UPRR Connection)	47.93	29.78	29,956,447	48,210,228	1,435,902,370
County Line to South of Tracy (S UPRR-1)	2.09	1.30	13,128,290	21,127,935	27,398,741
South of Tracy to Tracy ACE Station (S UPRR-2)	15.51	9.64	25,499,265	41,037,089	395,493,599
Tracy ACE Station to I-205 (S UPRR-3)	7.14	4.44	11,856,678	19,081,474	84,656,684
I-205 to Southeast of Manteca (S UPRR-4)	6.46	4.02	15,269,787	24,574,340	98,673,364

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Southwestern Manteca (MC-1)	1.46	0.91	27,687,372	44,558,506	40,340,501
Southeastern Manteca (MC-2)	1.83	1.14	25,102,875	40,399,161	45,963,364
Eastern Manteca UPRR South to BNSF (MC-3)	9.17	5.70	74,962,364	120,640,230	687,254,951
Manteca to Escaton Wye (MC-4)	4.28	2.66	13,118,552	21,112,263	56,121,166
Tracy Downtown (UPRR Connection)	58.36	36.26	27,670,588	44,531,495	1,614,883,212
County Line to Tracy Downtown (UPRR-10)	12.84	7.98	23,802,574	38,306,529	305,553,641
Tracy Downtown to I-205 (UPRR-11)	7.34	4.56	15,988,833	25,731,533	117,358,035
I-205 to S. UPPRR (UPRR-12)	8.31	5.16	14,955,715	24,068,890	124,281,993
I-205 to Lathrop—Northern (UPRR-13)	13.14	8.16	18,113,361	29,150,629	238,009,562
Southwestern Manteca (MC-1)	1.46	0.91	27,687,372	44,558,506	40,340,501
Southeastern Manteca (MC-2)	1.83	1.14	25,102,875	40,399,161	45,963,364
Eastern Manteca UPRR South to BNSF (MC-3)	9.17	5.70	74,962,364	120,640,230	687,254,951
Manteca to Escaton Wye (MC-4)	4.28	2.66	13,118,552	21,112,263	56,121,166
East Bay Connections	13.13	8.16	55,263,716	88,938,329	725,723,114
Niles to Union City—Niles Wye (E) to Niles Wye (N) (Dumbarton/Niles XN)	4.25	2.64	35,018,018	56,356,037	148,966,648
Niles to Fremont—Niles Wye (E) to Niles Wye (S) (Dumbarton/Niles XS)	8.88	5.52	64,964,684	104,550,525	576,756,466
Station Location Options					
Pleasanton (I-680/Bernal Rd)					72,639,578
Pleasanton (BART)					316,675,328
Livermore (Downtown-At Grade)					73,297,263
Livermore (Downtown-Aerial)					314,667,658
Livermore (I-580)					151,769,468
Livermore (Greenville Road/UPRR)					72,639,578
Livermore (Greenville Road/I-580)					160,180,913
Tracy (Downtown)					310,150,400
Tracy (ACE)					314,667,658

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
San Francisco Bay Crossings Corridor					
Transbay Crossing—Transbay Transit Center	11.71	7.28	338,317,199	544,468,754	3,961,694,398
Transbay Transit Center tube to SF Bay (TB-1)	2.48	1.54	252,855,279	406,931,126	627,081,091
SF Bay to West Oakland (TB-3)	9.23	5.74	361,279,882	581,423,610	$3,334,613,307
Transbay Crossing—4th & King	11.06	6.87	343,054,247	552,092,294	3,794,179,969
4th/Townsend tube to SF Bay (TB-2)	1.83	1.14	251,129,323	404,153,470	459,566,662
SF Bay to West Oakland (TB-3)	9.23	5.74	361,279,882	581,423,610	3,334,613,307
Dumbarton (High Bridge)	30.67	19.06	63,990,228	102,982,290	1,962,452,322
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [High Bridge])	10.01	6.22	88,615,763	142,613,246	886,866,552
Dumbarton Bay Crossing to Don Edwards (Dumbarton-2 [High Bridge])	13.00	8.08	60,644,584	97,597,998	788,379,595
Shinn to Niles Canyon (UPRR-1)	4.50	2.80	25,166,985	40,502,336	113,251,431
Dumbarton (Low Bridge)	32.21	20.01	47,523,861	76,482,241	1,530,743,565
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [Low Bridge])	11.55	7.18	53,574,758	86,220,216	618,788,460
Dumbarton Bay Crossing to Don Edwards (Dumbarton-2 [Low Bridge])	13.00	8.08	48,057,610	77,341,226	624,748,930
Shinn to Niles Canyon (UPRR-1)	4.50	2.80	25,166,985	40,502,336	113,251,431
Dumbarton (Tube)	30.67	19.06	75,782,552	121,960,196	2,324,099,311
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [Tube])	10.01	6.22	100,498,996	161,737,456	1,005,793,953
Dumbarton Bay Crossing to Don Edwards (Dumbarton-2 [Tube])	13.00	8.08	79,315,322	127,645,637	1,031,099,183
Shinn to Niles Canyon (UPRR-1)	4.50	2.80	25,166,985	40,502,336	113,251,431
Fremont Central Park (High Bridge)	32.36	20.11	84,449,717	135,908,645	2,732,623,930
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [High Bridge])	10.01	6.22	88,615,763	142,613,246	886,866,552
Fremont Central Park (Fremont Central Park [High Bridge])	19.19	11.92	87,118,428	140,203,519	1,671,802,634
Fremont Central Park (Low Bridge)	34.94	21.71	64,246,458	103,394,652	2,244,771,247
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1 [Low Bridge])	11.55	7.18	53,574,758	86,220,216	618,788,460
Fremont Central Park (Fremont Central Park [Low Bridge])	20.23	12.57	71,775,978	115,512,240	1,452,028,043
Fremont Central Park (Tube)	34.94	21.71	88,556,605	142,518,041	3,093,990,660
Dumbarton Wye North to Caltrain (Dumbarton-XN)	2.20	1.37	73,361,640	118,064,116	161,395,609
Dumbarton Wye South to Caltrain (Dumbarton-XS)	0.96	0.60	13,082,432	21,054,134	12,559,135
Dumbarton Bay Crossing to Don Edwards (Dumbarton-1)	10.01	6.22	100,498,996	161,737,456	1,005,793,953
Don Edwards to Niles Wye (E) via Fremont Central Park (Fremont Central Park [Tube])	21.77	13.53	87,930,269	141,510,051	1,914,241,964
Station Location Option					
Union City (Shinn)					310,150,400
Central Valley Corridor					
BNSF—UPRR	149.65	92.99	15,891,685	25,575,188	2,378,190,686
North Stockton South to UPRR Connection (BNSF N/S-1)	17.50	10.87	8,362,619	13,458,330	146,345,827
BNSF Parallel to UPRR Tracks (BNSF N/S-2)	3.50	2.17	8,090,264	13,020,018	28,315,925
Parallel tracks South through Escaton (BNSF N/S-3)	13.55	8.42	13,929,771	22,417,794	188,748,403
Escaton South to Amtrak Briggsmore (BNSF N/S-4)	13.85	8.61	18,871,199	30,370,251	261,366,107
Amtrak Briggsmore to UPRR/BNSF Connection (BNSF N/S-5)	39.85	24.76	15,645,491	25,178,977	623,472,816
UPRR/BNSF Connection to Atwater (BNSF N/S-6)	6.30	3.91	16,322,332	26,268,248	102,830,695
Atwater to Downtown Merced (BNSF N/S-7)	17.00	10.56	25,661,185	41,297,674	436,240,142
Merced South to BNSF Connection (BNSF N/S-8)	4.75	2.95	32,162,740	51,760,913	152,773,015
BNSF Connection South to Henry Miller Wye (BNSF N/S-9)	17.45	10.84	8,686,037	13,978,822	151,571,352
BNSF Henry Miller Wye (BNSF N/S-10)	15.90	9.88	18,020,529	29,001,230	286,526,405
BNSF	161.55	100.38	15,203,210	24,467,194	2,456,078,506
North Stockton South to UPRR Connection (BNSF N/S-1)	17.50	10.87	8,362,619	13,458,330	146,345,827
BNSF Parallel to UPRR tracks (BNSF N/S-2)	3.50	2.17	8,090,264	13,020,018	28,315,925

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Parallel tracks South through Escaton (BNSF N/S-3)	13.55	8.42	13,929,771	22,417,794	188,748,403
Escaton South to Amtrak Briggsmore (BNSF N/S-4)	13.85	8.61	18,871,199	30,370,251	261,366,107
Amtrak Briggsmore to UPRR/BNSF Connection (BNSF N/S-5)	39.85	24.76	15,645,491	25,178,977	623,472,816
UPRR/BNSF Connection to Atwater (BNSF N/S-6)	6.30	3.91	16,322,332	26,268,248	102,830,695
Atwater to Downtown Merced (BNSF N/S-7)	17.00	10.56	25,661,185	41,297,674	436,240,142
Merced South to UPRR Connection (BNSF N/S-8)	8.00	4.97	32,682,285	52,597,039	261,458,279
UPRR Connection East to Castle Connection (BNSF N/S-9)	17.66	10.97	9,825,892	15,813,240	173,495,771
Castle Connection to Henry Miller Wye (BNSF N/S-10)	13.44	8.35	10,838,922	17,443,554	145,707,628
Henry Miller Wye (BNSF N/S-11)	10.90	6.77	8,082,286	13,007,178	88,096,913
UPRR N/S	134.95	83.85	18,862,722	30,356,608	2,545,524,294
French Camp to Lathrop (UPRR N/S-1)	8.00	4.97	13,627,270	21,930,965	109,018,159
Lathrop through Manteca (UPRR N/S-2)	8.70	5.41	21,359,159	34,374,234	185,824,683
Manteca South to BNSF/UPRR (UPRR N/S-3)	3.30	2.05	7,761,402	12,490,765	25,612,626
BNSF/UPRR South to Modesto (UPRR N/S-4)	18.50	11.50	15,559,246	25,040,179	287,846,051
UPRR Modesto South—Western Option (UPRR N/S-5a*)	4.20	2.61	84,115,056	135,370,061	353,283,237
South Modesto to BNSF Connection (UPRR N/S-6)	20.90	12.99	21,150,677	34,038,714	442,049,140
BNSF Connection South to Merced (UPRR N/S-7)	33.25	20.66	16,572,019	26,670,079	551,019,624
Merced South to BNSF Connection (UPRR N/S-8)	4.75	2.95	32,162,740	51,760,913	152,773,015
BNSF Connection South to Henry Miller Wye (UPRR N/S-9)	17.45	10.84	8,686,037	13,978,822	151,571,352
BNSF Henry Miller Wye (UPRR N/S-10)	15.90	9.88	18,020,529	29,001,230	286,526,405
BNSF Castle	148.74	92.42	14,323,359	23,051,212	2,130,413,453
North Stockton South to UPRR Connection (BNSF N/S-1)	17.50	10.87	8,362,619	13,458,330	146,345,827
BNSF Parallel to UPRR tracks (BNSF N/S-2)	3.50	2.17	8,090,264	13,020,018	28,315,925
Parallel tracks South through Escaton (BNSF N/S-3)	13.55	8.42	13,929,771	22,417,794	188,748,403
Escaton South to Amtrak Briggsmore (BNSF N/S-4)	13.85	8.61	18,871,199	30,370,251	261,366,107
Amtrak Briggsmore to UPRR/BNSF Connection (BNSF N/S-5)	39.85	24.76	15,645,491	25,178,977	623,472,816
From BNSF Southeast to Castle AFB (BNSF Castle-1)	17.60	10.94	9,100,491	14,645,821	160,168,647
Castle AFB South to BNSF Connect (BNSF Castle-2)	10.52	6.54	22,904,277	36,860,860	240,998,798
BNSF South of Castle to UPRR Connect (BNSF Castle-3)	8.02	4.98	30,814,309	49,590,824	247,192,389
Castle Connection to Henry Miller Wye (BNSF N/S-10)	13.44	8.35	10,838,922	17,443,554	145,707,628

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Henry Miller Wye (BNSF N/S-11)	10.90	6.77	8,082,286	13,007,178	88,096,913
UPRR—BNSF Castle	139.24	86.52	17,417,257	28,030,358	2,425,126,621
French Camp to Lathrop (UPRR N/S-1)	8.00	4.97	13,627,270	21,930,965	109,018,159
Lathrop through Manteca (UPRR N/S-2)	8.70	5.41	21,359,159	34,374,234	185,824,683
Manteca South to BNSF/UPRR (UPRR N/S-3)	3.30	2.05	7,761,402	12,490,765	25,612,626
BNSF/UPRR South to Modesto (UPRR N/S-4)	18.50	11.50	15,559,246	25,040,179	287,846,051
UPRR Modesto South—Western Option (UPRR N/S-5a*)	4.20	2.61	84,115,056	135,370,061	353,283,237
South Modesto to BNSF Connection (UPRR N/S-6)	20.90	12.99	21,150,677	34,038,714	442,049,140
North South Connection East of Stockton (South Portion) (UPRR-BNSF X-2)	15.15	9.41	9,196,591	14,800,478	139,328,349
From BNSF Southeast to Castle AFB (BNSF Castle-1)	17.60	10.94	9,100,491	14,645,821	160,168,647
Castle AFB South to BNSF Connect (BNSF Castle-2)	10.52	6.54	22,904,277	36,860,860	240,998,798
BNSF South of Castle to UPRR Connect (BNSF Castle-3)	8.02	4.98	30,814,309	49,590,824	247,192,389
Castle Connection to Henry Miller Wye (BNSF N/S-10)	13.44	8.35	10,838,922	17,443,554	145,707,628
Henry Miller Wye (BNSF N/S-11)	10.90	6.77	8,082,286	13,007,178	88,096,913
UPRR—BNSF	140.15	87.09	19,071,736	30,692,985	2,672,903,854
French Camp to Lathrop (UPRR N/S-1)	8.00	4.97	13,627,270	21,930,965	109,018,159
Lathrop through Manteca (UPRR N/S-2)	8.70	5.41	21,359,159	34,374,234	185,824,683
Manteca South to BNSF/UPRR (UPRR N/S-3)	3.30	2.05	7,761,402	12,490,765	25,612,626
BNSF/UPRR South to Modesto (UPRR N/S-4)	18.50	11.50	15,559,246	25,040,179	287,846,051
UPRR Modesto South—Western Option (UPRR N/S-5a*)	4.20	2.61	84,115,056	135,370,061	353,283,237
South Modesto to BNSF Connection (UPRR N/S-6)	20.90	12.99	21,150,677	34,038,714	442,049,140
North South Connection East of Stockton (South Portion) (UPRR-BNSF X-2)	15.15	9.41	9,196,591	14,800,478	139,328,349
UPRR/BNSF Connection to Atwater (BNSF N/S-6)	6.30	3.91	16,322,332	26,268,248	102,830,695
Atwater to Downtown Merced (BNSF N/S-7)	17.00	10.56	25,661,185	41,297,674	436,240,142
Merced South to BNSF Connection (BNSF N/S-8)	4.75	2.95	32,162,740	51,760,913	152,773,015
BNSF Connection South to Henry Miller Wye (BNSF N/S-9)	17.45	10.84	8,686,037	13,978,822	151,571,352
BNSF Henry Miller Wye (BNSF N/S-10)	15.90	9.88	18,020,529	29,001,230	286,526,405

Alignment Alternative by Corridor and Segment	Length		Average Cost (in dollars)		Cost (in dollars)
	Km	Miles	Per Km	Per Mile	
Station Location Options					
Modesto (Downtown)					71,428,053
Briggsmore (Amtrak)					71,428,053
Merced (Downtown)					71,428,053
Castle Air Force Base					71,428,053

* *Option 5B more expensive by $26,806,470.*

Table 4.2-2
High-Speed Train Passenger Station Cost Summary

Station		Quantity	Cost (in 2006 dollars)
	Terminal Station		
S1	4th & King Station (Caltrain1-2, Caltrain Urban Tunnel)	Each	791,939,278
S2	Transbay Transit Center Station (Caltrain1-TB1, Urban—Tunnel)	Each	786,262,418
S3	West Oakland/7th Street Station (Niles/I-880 1A, Urban—Tunnel)	Each	611,197,055
S4	12th Street/City Center Station (Niles/I-880 1B, Urban—Tunnel)	Each	611,197,055
	Intermediate Station		
S5	San Jose Diridon Station (Caltrain 8-Pacheco 1, Urban—Aerial)	Each	185,051,790
S6	Millbrae/SFO Station (Caltrain 2-3, Urban—At Grade)	Each	29,076,600
S7	Redwood City Station (Caltrain 3-4, Urban—At Grade)	Each	67,516,558
S8	Palo Alto (Caltrain 6-7, Urban—At Grade)	Each	67,516,558
S9	Coliseum/Airport Station (Niles/I-880 2-3, Urban—At Grade)	Each	61,735,853
S10	Union City (BART) Station (Niles/I-880 3-4, Urban—Aerial)	Each	69,853,070
S11	Union City (Shinn) Station (Niles/I-880 4-5, Urban—Aerial)	Each	310,150,400
S12	Fremont (Warm Springs) Station (Niles/I-880 5-6, Suburban—Aerial)	Each	156,875,180
S13	Newark Station (Caltrain 2-3, Suburban—Aerial)	Each	310,150,400
S14	Pleasanton (BART) Station (I-680/580/UPRR 1-2, Suburban—Aerial)	Each	316,675,328
S15	Pleasanton (I-680/Bernal) Station (UPRR 3-4, Suburban—At Grade)	Each	72,639,578
S16	Livermore 1 (I-580) Station (I-680/580/UPRR 3-4, Undeveloped—Aerial)	Each	151,769,468
S17	Livermore 2 (Downtown) Station (UPRR 5-6, Urban—At Grade)	Each	73,297,263
S18	Livermore 2 (Downtown) Station (UPRR 5-6, Urban—Aerial)	Each	314,667,658
S19	Livermore (Greenville Road/I-580) Station (I-680/580/UPRR 4-5, Undeveloped—Aerial)	Each	160,180,913
S20	Livermore (Greenville Road/UPRR) Station	Each	72,639,578
S21	Tracy 1 (Downtown) Station (UPRR 10-11, Urban—Aerial)	Each	310,150,400
S22	Tracy 2 (Existing ACE) Station (SUPRR 2-3, Suburban—Aerial)	Each	314,667,658
S23	Gilroy (Caltrain) Station (Pacheco 2-3, Urban—Aerial)	Each	148,256,045
S24	Morgan Hill (Caltrain) Station (Pacheco 1-2, Suburban—Aerial)	Each	284,985,295
S25	Modesto Downtown Station (UPRR N/S 4-5A/B, Urban—At Grade)	Each	71,428,053
S26	Briggsmore (Amtrak) Station (BNSF N/S 4-5, Suburban—At Grade)	Each	71,428,053
S27	Merced Downtown Station (UPRR N/S 7-8, BNSF N/S 7-8, Urban—At Grade)	Each	71,428,053
S28	Castle Air Force Base Station (BNSF N/S 6-7, BNSF Castle 1-2, Suburban—At Grade)	Each	71,428,053
	Intermediate Station (Local Service Option)		
S29	Union City (Shinn) Station (Niles/I-880 4-5, Urban—Aerial)	Each	300,146,665
S30	Newark Station (Caltrain 2-3, Suburban—Aerial)	Each	300,146,665
S31	Pleasanton (BART) Station (I-680/580/UPRR 1-2, Suburban—Aerial)	Each	297,325,543
S32	Pleasanton (I-680/Bernal) Station (UPRR 3-4, Suburban—At Grade)	Each	58,118,585
S33	Livermore 1 (I-580) Station (I-680/580/UPRR 3-4, Undeveloped—Aerial)	Each	132,402,375
S34	Livermore 2 (Downtown) Station (UPRR 5-6, Urban—At Grade)	Each	58,758,963
S35	Livermore 2 (Downtown) Station (UPRR 5-6, Urban—Aerial)	Each	300,146,665
S36	Livermore (Greenville Road/I-580) Station (I-680/580/UPRR 4-5, Undeveloped—Aerial)	Each	140,813,820
S37	Livermore (Greenville Road/UPRR) Station	Each	58,118,585
S38	Tracy 1 (Downtown) Station (UPRR 10-11, Urban—Aerial)	Each	300,146,665
S39	Tracy 2 (Existing ACE) Station (SUPRR 2-3, Suburban—Aerial)	Each	300,146,665

As defined in Chapter 2, the HST Network Alternatives represent different ways to combine HST Alignment Alternatives and station location options to implement the HST system in the study region. The estimated capital costs for each network alternative are presented in Table 4.2-3. The breakdown of these costs by the alignment alternatives and alignment segments that comprise each network alternative are presented in Appendix 4-C.

Because of the variations in alignment alternatives and station location options being considered in the Program EIR/EIS process, there is a potential range of capital costs associated with any given network alternative.

The capital costs have been categorized into discrete cost elements. In general, the capital costs were estimated by determining the appropriate unit costs for the identified cost elements and the cost element quantities from conceptual alignment alternative and station location option plans prepared for each alignment alternative (Appendices 2-E, 2-F, and 2-G). Each cost element is defined in Appendix 4-D, along with the methods, assumptions, and description of the unit cost applied in each case.

The unit costs were reviewed as part of previous studies by HST owners, operators, and manufacturers, various agencies, and consultants. Formal peer reviews of the Authority's Corridor Evaluation were also conducted. Application of these unit costs and assumptions is consistent with past studies for the HST, including the Business Plan, and provides sufficient detail for the comparison of alignment alternatives and station location options at this program level. The unit costs for all individual elements are presented in Table 4.2-4. The unit costs were adjusted to account for inflation from September 2003 to November 2006, based on the *Engineering News Record Construction Cost Index Report* (McGraw-Hill Construction ENR 2007). Unit costs for the Oakland to San Francisco transbay tube, Dumbarton rail bridge (high-bridge and low-bridge options), and Dumbarton tube were obtained from MTC as part of the *Regional Rail* planning studies.

Table 4.2-3
High-Speed Train Network Alternatives Cost Summary (in 2006 dollars)

		Stations	Segment Length		Average Total Cost (dollars)		Cost (dollars)		
No.	Network Alternative		Km	Miles	Per Km	Per Mile	Segment	Station	Total
A	ALTAMONT PASS								
1	San Francisco and San Jose Termini	S2, S5, S6, S7, S12, S15, S21, S25, S27	327.24	203.34	38,880,394	62,571,929	10,972,862,793	1,750,428,628	12,723,291,421
2	Oakland and San Jose Termini	S3, S5, S9, S10, S15, S21, S25, S27	293.17	182.16	34,208,979	55,054,015	8,575,425,642	1,453,483,850	10,028,909,492
3	San Francisco, Oakland, and San Jose Termini	S2, S3, S5, S6, S7, S9, S10, S15, S21, S25, S27	388.12	241.16	38,787,079	62,421,753	12,717,546,470	2,336,339,425	15,053,885,895
4	San Jose Terminus	S5, S12, S15, S21, S25, S27	257.78	160.18	29,863,432	48,060,536	6,830,741,966	867,573,053	7,698,315,019
5	San Francisco Terminus	S2, S6, S7, S11, S15, S21, S25, S27	308.27	191.55	35,729,340	57,500,799	9,295,774,550	1,718,652,058	11,014,426,607
6	Oakland Terminus	S3, S9, S10, S15, S21, S25, S27	274.97	170.86	29,700,584	47,798,456	6,898,337,399	1,268,432,060	8,166,769,459
7	Union City Terminus	S10, S15, S21, S25, S27	254.16	157.93	23,423,990	37,697,258	5,357,942,113	595,499,153	5,953,441,266
8	San Francisco, and San Jose—via SF Peninsula	S2, S5, S6, S8, S11, S15, S21, S25, S27	343.27	213.30	36,606,277	58,912,092	10,662,279,160	1,903,703,848	12,565,983,007
9	San Francisco, San Jose, and Oakland—with no San Francisco Bay Crossing	S2, S3, S5, S6, S7, S9, S10, S15, S21, S25, S27	393.81	244.70	36,713,165	59,084,112	12,121,598,757	2,336,339,425	14,457,938,182
10	Oakland, and San Francisco—via Transbay Tube	S2, S3, S9, S10, S15, S21, S25, S27	289.11	179.64	44,670,632	71,890,413	10,860,031,797	2,054,694,478	12,914,726,275
11	San Jose, Oakland and San Francisco—via Transbay Tube	S2, S3, S5, S9, S10, S15, S21, S25, S27	320.44	199.11	46,114,588	74,214,235	12,537,120,041	2,239,746,268	14,776,866,308
P	PACHECO PASS								
1	San Francisco and San Jose Termini	S2, S5, S6, S8, S23, S26, S27	430.55	267.53	28,771,881	46,303,853	11,028,569,783	1,359,019,515	12,387,589,298
2	Oakland and San Jose Termini	S3, S5, S9, S10, S23, S26, S27	413.40	256.87	27,973,967	45,019,736	10,345,348,109	1,218,949,918	11,564,298,026

		Stations	Segment Length		Average Total Cost (dollars)		Cost (dollars)		
No.	Network Alternative		Km	Miles	Per Km	Per Mile	Segment	Station	Total
3	San Francisco, Oakland and San Jose Termini	S2, S3, S5, S6, S8, S9, S10, S23, S26, S27	498.26	309.60	32,098,678	51,657,815	13,891,521,223	2,101,805,493	15,993,326,716
4	San Jose Terminus	S5, S23, S26, S27	343.04	213.15	23,200,433	37,337,478	7,482,396,668	476,163,940	7,958,560,608
5	San Jose, San Francisco and Oakland—via Transbay Tube	S2, S3, S5, S6, S7, S23, S26, S27	444.69	276.31	38,140,438	61,381,085	14,990,264,181	1,970,216,570	16,960,480,751
6	San Jose, Oakland and San Francisco—via Transbay Tube	S2, S3, S5, S9, S10, S23, S26, S27	427.54	265.66	38,154,198	61,403,229	14,307,042,507	2,005,212,335	16,312,254,842
PA	PACHECO PASS WITH ALTAMONT PASS (LOCAL SERVICE)								
1	San Francisco and San Jose Termini	S2, S5, S6, S8, S23, S25, S27, S29, S32, S38	545.83	339.16	33,558,079	54,006,494	16,299,474,324	2,017,431,430	18,316,905,754
2	Oakland and San Jose Termini	S3, S5, S9, S10, S23, S25, S27, S32, S38	512.50	318.45	31,135,039	50,106,988	14,379,523,442	1,577,215,168	15,956,738,609
3	San Francisco, Oakland and San Jose Termini (with Dumbarton Bridge)	S2, S3, S5, S6, S8, S9, S10, S23, S25, S27	629.32	391.04	34,942,461	56,234,439	19,888,148,879	2,101,805,493	21,989,954,371
4	San Francisco, Oakland and San Jose Termini (without Dumbarton Bridge)	S2, S3, S5, S6, S8, S9, S10, S23, S25, S27, S32, S38	580.81	360.90	35,098,797	56,486,038	17,925,696,556	2,460,070,743	20,385,767,299
5	San Jose Terminus	S5, S12, S23, S25, S27, S32, S38	460.34	286.04	29,237,801	47,053,679	12,467,937,131	991,304,370	13,459,241,501

Table 4.2-4
High-Speed Train Unit Cost (in November 2006 Dollars)

	Cost Elements	Unit	Unit Cost (dollars)
Alignment Cost			
Track Items			
	Double Track Section—Total	Kilometers	
1	Double Track Section—At Grade	Kilometers	993,167
2	Double Track Section—On Structure	Kilometers	1,878,243
3	Double Track Section—In Tunnel or Subway	Kilometers	1,878,243
4	Double Track Section—In Trench	Kilometers	1,878,243
	Single Track Section—Total	Kilometers	
5	Single Track Section—At Grade	Kilometers	496,583
6	Single Track Section—On Structure	Kilometers	939,121
7	Single Track Sections—In Tunnel or Subway	Kilometers	939,121
8	Single Track Section—In Trench	Kilometers	939,121
9	Freight Double Track—At Grade	Kilometers	993,167
10	Freight Single Track—At Grade	Kilometers	496,583
Earthwork Items			
1	Site Preparation—Undeveloped	Hectares	12,081
2	Total Cut	$Meters^3$	9
3	Total Fill	$Meters^3$	9
4	Borrow	$Meters^3$	13
5	Spoil	$Meters^3$	0
4	Landscape/Erosion Control	Hectares	8,075
5	Security Fencing (Both Sides of R/W)	Kilometers	101,733
6	Special Drainage Facilities	5% of Earthwork Cost	
Structures, Tunnels, Walls			
1	Standard Structure	Kilometers	13,733,933
2	High Structure	Kilometers	16,480,720
3	Long Span Structure	Kilometers	37,577,568
4	Waterway Crossing—Primary	Kilometers	28,876,734
5	Waterway Crossing—Secondary (Irrigation/Canal Crossing)	Kilometers	23,119,226
6	Twin Single Track Drill & Blast (<6 Miles)	Kilometers	75,040,254
7	Twin Single Track TBM (<6 Miles)	Kilometers	55,464,535
8	Twin Single Track TBM w/3rd Tube (>6 Miles)	Kilometers	78,846,643
9	Double Track Drill & Blast	Kilometers	83,740,573
10	Double Track Mined (Soft Soil)	Kilometers	96,247,282
11	Seismic Chamber (Drill & Blast/Mined)	Each	94,803,899
12	Crossovers	Each	94,803,899
13	Cut & Cover Double Track Tunnel	Kilometers	48,123,641
14	Trench Short	Kilometers	49,668,587
15	Trench Long	Kilometers	39,272,836
16	Mechanical & Electrical for Tunnels	Kilometers	1,931,362
17	Retaining Walls	Kilometers	4,399,945
18	Containment Walls	Kilometers	1,500,559
19	Single Track Cut and Cover Subway	Kilometers	30,077,276
Grade Separations			
1	Street Overcrossing HSR—(Urban)	Each	17,167,417
2	Street Overcrossing HSR—(Suburban)	Each	6,485,469
3	Street Overcrossing HSR—(Undeveloped)	Each	1,093,628
4	Street Undercrossing HSR—(Urban)	Each	17,930,413
5	Street Undercrossing HSR—(Suburban)	Each	6,866,967

Cost Elements		Unit	Unit Cost (dollars)
6	Street Undercrossing HSR—(Undeveloped)	Each	1,157,211
7	Street Bridging HSR Trench	Each	
8	Minor crossing closures	Each	178,032
Rail and Utility Relocation			
1	Single Track Relocation (Temporary)	Kilometers	1,271,661
2	Single Track Relocation (Permanent)	Kilometers	1,271,661
3	Single Track Removal	Kilometers	63,372
4	Major Utility Relocations—Dense Urban	Kilometers	890,162
5	Major Utility Relocations—Urban	Kilometers	680,338
6	Major Utility Relocations—Dense Suburban	Kilometers	476,873
7	Major Utility Relocations—Suburban	Kilometers	273,407
8	Major Utility Relocations—Undeveloped	Kilometers	13,988
Right–of-Way Items			
1	Right-of-Way Required for Each Segment		
	Dense Urban	Hectares	4,106,412
	Urban	Hectares	2,737,608
	Dense Suburban	Hectares	1,368,804
	Suburban	Hectares	479,081
	Undeveloped	Hectares	342,201
Environmental Mitigation			
Environmental Mitigation		3% of Line Cost	
System Elements			
1	Signaling (ATC)	Kilometers	845,654
2	Communications (w/Fiber Optic Backbone)	Kilometers	699,413
3	Wayside Protection System	Kilometers	67,144
Electrification Items			
1	Traction Power Supply	Kilometers	432,365
2	Traction Power Distribution	Kilometers	806,233
Program Implementation Costs (per screening)			
Program Implementation Costs		25.5% of Total Cost and Procurement	
Contingencies (per screening)			
Contingencies		25% of Total Construction Cost	
Total Construction			
Total Construction and Right-of-Way (includes environmental mitigation)			
Grand Total			

4.3 OPERATIONS AND MAINTENANCE COSTS

O&M costs were developed for each of the HST Network Alternatives for comparative purposes. The annual O&M costs of the HST Alignment Alternatives and Network Alternatives are based on daily train miles, operating speed, travel time, station configuration, maintenance and storage facilities, and assumed operating frequencies. Daily train miles, operating speeds, and travel times are all outputs of the California high-speed rail simulation model as documented in the operations report prepared as part of the statewide Program EIR/EIS. (Parsons Brinckerhoff 2003.)

A. OPERATING SPEEDS

For the HST system, higher operating speed (150–220 mph [241–354 kph]) are proposed for areas where the alignment is less constrained, and lower operating speeds (less than 125 mph [201 kph]) are proposed in the more heavily developed areas. Local and semi-express services would not necessarily reach the maximum speeds on a given segment. Figure 4.3-1 shows the maximum speeds that could be attained on the various alignment alternatives.

B. TRAVEL TIMES

Table 4.3-1 shows the optimal express trip times between several example city pairs. These times represent the estimated travel times between city pairs without interference from other trains or stops at intermediate stations. A complete listing of station-to-station travel times is included as Appendix 4-E. Express travel times are possible on the proposed HST system because all intermediate stations would have four tracks, with two through-tracks for express service.

Table 4.3-1
Optimal Express Trip Times between City Pairs (220 mph [350 kph] maximum speed)

ALTAMONT Travel Time (hh:mm) / PACHECO Travel Time (hh:mm)	SAN FRANCISCO	OAKLAND	SAN JOSÉ	SACRAMENTO	FRESNO	LOS ANGELES	SAN DIEGO	
San Francisco	N/A	N/A	N/A	01:06	01:18	02:36	03:54	San Francisco
Oakland	N/A	N/A	N/A	00:53	01:04	02:23	03:40	Oakland
San José	00:30	00:22	N/A	00:49	01:01	02:19	03:37	San José
Sacramento	01:47	01:38	01:18	N/A	00:59	02:17	03:35	Sacramento
Fresno	01:20	01:12	00:51	00:53	N/A	01:24	02:42	Fresno
Los Angeles	02:38	02:30	02:09	02:11	01:24	N/A	01:18	Los Angeles
San Diego	03:56	03:48	03:27	03:29	02:42	01:18	N/A	San Diego
	San Francisco	Oakland	San Jose	Sacramento	Fresno	Los Angeles	San Diego	N/A

N/A Not Applicable; White: Altamont Pass Test Alignment; Gray: Pacheco Pass Test Alignment

Note: Based on Altamont Pass Test Alignment B (I-580/UPRR) and Pacheco Pass Test Alignment B (Caltrain/Gilroy/Henry Miller/UPRR).

C. MAINTENANCE FACILITIES AND STORAGE YARDS

The train sets used for the HST system would need to be maintained at several points along the HST corridor. To estimate maintenance costs, it was assumed that the overall statewide HST system would have four maintenance facilities. Three of these facilities would be the primary locations for cleaning, servicing, inspecting, and maintaining the vehicles, as well as storing the trains overnight. A fourth facility would serve as a heavy maintenance facility. In addition to these maintenance facilities, each of the terminal stations would have some light maintenance and cleaning capabilities. The cost of these support facilities is not included in specific segments or network alternatives. These costs are considered in total for the HST system.

D. CONCEPTUAL OPERATING PLAN

The service levels tested in the ridership demand model were 124 trains per day in each direction (i.e., north and south) (248 total), assuming 1,175 seats per train. The service type and stopping patterns are summarized below.

- <u>Express (16 trains per day in each direction)</u>: Trains running from Sacramento, San Jose, or San Francisco to Los Angeles and San Diego with one intermediate stop between origin and destination.
- <u>Semi-Express (34 trains per day in each direction)</u>: Trains running between similar endpoints as the express, with a limited number of intermediate stops.
- <u>Suburban-Express (33 trains per day in each direction)</u>: Trains running express between major metropolitan regions but stopping frequently in these regions.
- <u>Local (36 trains per day in each direction)</u>: Trains stopping at all intermediate stops, with potential for skipping stops to improve service, depending on demand.
- <u>Regional (5 trains per day in each direction)</u>: Trains running locally that begin or end in the Central Valley, operating mostly during commute hours.

Many HST Network Alternatives studied in this document involve dividing points, such as just north of San Jose for the Pacheco route to serve both sides of the Bay Area, or east of Pleasanton for the Altamont route to serve San Francisco, San Jose, and/or Oakland. Other dividing points exist in the HST system, including one in the Merced area and one south of Los Angeles Union Station. The conceptual HST operating plan assumes separate and distinct trains operating on all defined routes. This would mean that some trains from Los Angeles or Sacramento would go to San Francisco and some to San Jose, while others might go to Oakland. Although it is possible to create long multiunit trains and physically separate the units at specific points on the route to serve more than one terminus from a single origin, this is considered undesirable for the reasons discussed below. Additionally, it is unlikely that the application of such operational practices would benefit one alignment alternative over another.

Some HST systems physically separate trainsets ("splitting and joining trains") at some point on the route. However, the percentage of HST trains actually using this practice worldwide is <u>very</u> small. In France, about 10% of the TGV trainsets are physically split, whereas in Japan the percentage is even smaller. HST trainsets generally are not split during peak hours or at peak traffic points. For example, the TGVs that split in southwest France have already served the major Paris-Bordeaux market, and do not add time to the passengers on this critical city-pair. The Paris-Bordeaux passengers in the other direction also do not lose time waiting for the trains to be combined into one, since they board after consolidation. The mini-Shinkansen that splits to Yamagata, does so after the major stations at Fukushima and Sendai. The Thalys HST does not split until after Brussels passengers get off. The HST splits are generally done in places where the traffic demands are low—not on the main trunk line between the major markets.

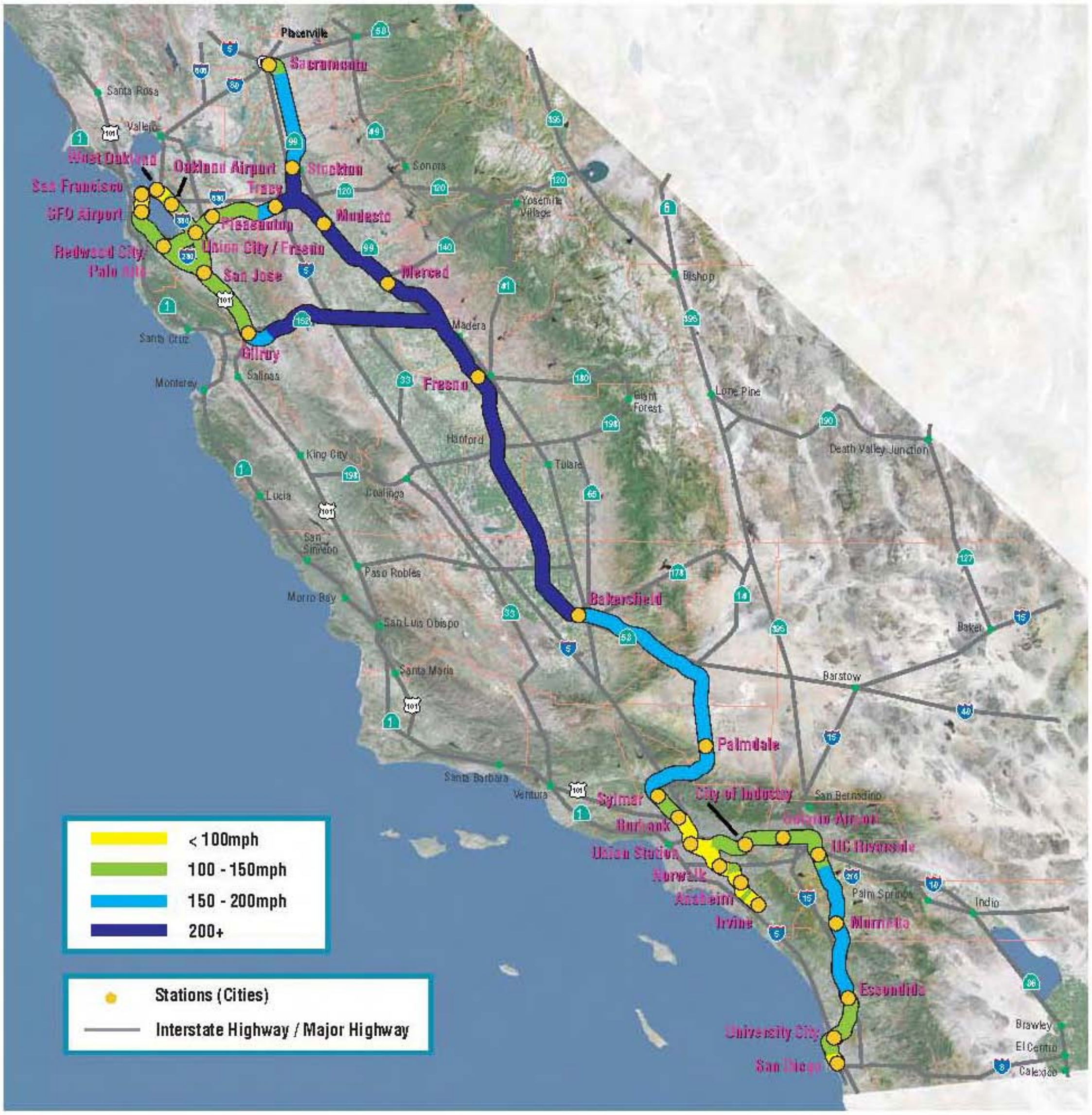

Figure 4.3-1
Maximum Speeds Attained on Alignment Alternatives

It is unlikely that the application of splitting and joining trains would benefit one alignment alternative over the other. Practically, only one such train split could be accomplished for each scheduled train operation. Limited and appropriate splitting of trainsets could be used for either the Altamont Pass or Pacheco Pass alternatives (at Fresno or Los Angeles for example). A key operational benefit of the Pacheco Pass is that it minimizes the number of HST network branches and splits.

E. OPERATIONS AND MAINTENANCE ANNUAL COSTS

The HST projected annual O&M costs are based on the train miles and frequencies assumed in the ridership forecasting analysis (as described in Chapter 2) (Cambridge Systematics 2007) and the unit costs applied in the statewide Program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). A cost estimation method and unit costs were developed for the previous corridor evaluation study to provide an order of magnitude cost estimate for HST service on particular alignments. This method was peer reviewed by the operators of several HST systems, as discussed above in Section 4.2, and found to be adequate for this level of analysis. The same method has been applied in this analysis. Table 4.3-2 presents the operating and maintenance costs on a per-train-mile and per-train-kilometer basis summarized by each operating and maintenance cost element.

Table 4.3-3 summarizes the systemwide operations and maintenance costs according to the alignment alternatives and station location options included in each network alternative. The costs are based primarily on length and frequency of service.

Table 4.3-2
Annual Operating and Maintenance Costs (in 2006 dollars)

Item	Dollars per Train Mile	Annual Cost (million dollars)
Station Services	0.83	24.6
Insurance	2.02	60.1
General Support	1.45	43.3
Maintenance of Way	4.31	128.5
Train Operations	10.05	299.5
Equipment Maintenance	11.79	351.2
Marketing and Reservations	2.12	63.0
Power	7.11	211.9
Total per Year		1.182
Source: Parsons Brinckerhoff 2007.		

Table 4.3-3
Annual Costs of Operating and Maintaining High-Speed Train Infrastructure (in 2006 dollars)

		Network Alternative Length		Systemwide O&M Costs (dollars)
		Km	Miles	
A	ALTAMONT PASS			
1	San Francisco and San Jose Termini	327.24	203.34	1,099,301,000
2	Oakland and San Jose Termini	293.17	182.16	1,085,313,000
3	San Francisco, Oakland, and San Jose Termini	388.12	241.16	1,097,940,000
4	San Jose Terminus	257.78	160.18	1,076,391,000
5	San Francisco Terminus	308.27	191.55	1,124,271,000
6	Oakland Terminus	274.97	170.86	1,092,689,000
7	Union City Terminus	254.16	157.93	1,072,954,000
8	San Francisco and San Jose—via SF Peninsula	343.27	213.30	1,115,288,000
9	San Francisco, San Jose, and Oakland—with no San Francisco Bay Crossing	393.81	244.70	1,122,869,000
10	Oakland and San Francisco—via Transbay Tube	289.11	179.64	1,106,098,000
11	San Jose, Oakland and San Francisco—via Transbay Tube	320.44	199.11	1,092,654,000
P	PACHECO PASS			
1	San Francisco and San Jose Termini	430.55	267.53	1,182,186,000
2	Oakland and San Jose Termini	413.40	256.87	1,165,923,000
3	San Francisco, Oakland, and San Jose Termini	498.26	309.60	1,174,114,0000
4	San Jose Terminus	343.04	213.15	1,099,200,000
5	San Jose, San Francisco, and Oakland—via Transbay Tube	444.69	276.31	1,195,595,000
6	San Jose, Oakland, and San Francisco—via Transbay Tube	427.54	265.66	1,179,332,000
PA	PACHECO PASS WITH ALTAMONT PASS (LOCAL SERVICE)			
1	San Francisco and San Jose Termini	545.83	339.16	1,171,052,000
2	Oakland and San Jose Termini	512.50	318.45	1,139,579,000
3	San Francisco, Oakland, and San Jose Termini (without Dumbarton Bridge)	580.81	360.90	1,179,011,000
4	San Jose Terminus	460.34	286.04	1,130,210,000

5 ECONOMIC GROWTH AND RELATED IMPACTS

5.1 Introduction

Transportation investments can lead to reduced travel time and cost, improved accessibility to regions or parts of regions, and reduced accidents or air pollution. These effects contribute to economic growth by allowing time and money previously spent on travel to be used for other purposes, attracting businesses and residents to places with increased accessibility or improved quality of life, and reducing overall costs to society. The population and employment growth that result make up the *growth-inducing effects* of transportation investments. Growth can contribute to additional effects on human and natural resources beyond those directly attributable to the changes in the transportation system. These effects are known as *indirect impacts*.

This chapter presents an analysis of the potential growth-inducing effects and related indirect impacts of the alternatives considered in the Bay Area to Central Valley Program EIR/EIS. The intent of the analysis is to understand the extent of potential statewide, regional, and local growth effects in terms of population and employment change and land consumption associated with these changes. This section identifies and describes the following.

- Existing population and employment conditions both for the Bay Area to Central Valley study area and the entire state.
- Methodology and data sources used to assess potential growth-induced effects.
- Potential employment and population changes associated with each system alternative.
- Urban area size needed to accommodate projected population and employment growth associated with each alternative.
- Potential impacts related to growth and development, and potential strategies for managing these impacts;
- Potential for employment and population concentration in the vicinity of HST stations.
- Differences between the HST alignment and station options in the Bay Area to Central Valley study area.

5.2 Affected Environment

5.2.1 Existing Conditions

Over the last 30 years, California's population has grown from 20 million to more than 36 million people. At the same time, more than 10 million additional jobs have been created in California. Starting with the gold rush in 1849, California has been continuously experiencing rapid population and economic growth. Distance from eastern urban areas, location on the Pacific Rim, an abundance of natural resources, a desirable climate, and many other factors have contributed to California's growth into the most populous state in the nation.

California's economy is one of the most diverse in the world. Manufacturing, wholesale and retail trade, services, and government each account for more than 10% of total employment, and together have consistently made up more than three-quarters of total employment over the past 30 years. California's economy, like the nation's, has become less focused on production of goods and more focused on services, entertainment, and trade. Three service-sector industries—business, social, and legal—are among the 10 fastest-growing industries in California, with business services' contribution to gross state product (GSP) growing by 1,400% since 1977. The overall services sector has grown by more than 800% since 1977. The finance, insurance, and real estate (FIRE) sectors and services sector have accounted for nearly one-half of the growth in GSP since 1977, with the combined contribution of these groups growing from 33% to 46% of the total economy in California.

As of 2005, California was estimated to have about 36.1 million people and 20.9 million jobs. Table 5.2-1 lists year 2005 population and employment totals, as well as an estimate of current urbanization magnitudes for select locations in 2002. Data are presented for major regions in California as well as individual counties in the Bay Area to Central Valley corridor. As expected, the inner Bay Area counties, Sacramento County, and Southern California have the highest levels of land considered to be urbanized, while less than 10% of land in most other counties is at urbanized densities.

Table 5.2-1
Existing Population, Employment, and Urbanized Densities

County	Population Year 2005	Employment Year 2005	Acreage of Land at Urbanized Densities for Employment and/or Population Year 2002	Percent of Land Area at Urbanized Densities Year 2002
Alameda County	1,451,065	953,937	141,654	30
Contra Costa County	1,017,644	508,854	142,467	31
San Francisco County	741,025	779,357	23,277	78
San Mateo County	701,175	522,830	70,869	25
Santa Clara County	1,705,158	1,323,920	184,481	22
Study Area—Bay Area	*5,616,067*	*4,088,898*	*562,748*	*29*
Fresno County	878,089	435,769	96,977	3
Madera County	142,530	56,892	23,255	2
Merced County	242,249	87,365	31,712	3
Sacramento County	1,363,423	805,978	157,101	25
San Joaquin County	664,796	274,155	74,250	8
Stanislaus County	505,492	224,491	55,426	6
Study Area—Central Valley	*3,796,579*	*1,884,650*	*438,721*	*12*
Core Study Area	*9,412,646*	*5,973,548*	*1,001,469*	*22*
Southern Sacramento Valley	658,108	456,834	116,980	4
Southern San Joaquin Valley	1,311,579	576,935	189,603	2
Southern California	16,843,742	9,290,841	1,530,221	25
San Diego County	2,936,609	1,895,002	340,837	13
Rest of California	4,991,463	2,709,974	3,105,348	6
Statewide Total	36,154,147	20,903,134	6,284,458	6

Sources: U.S. Bureau of the Census (population data); MTC/California High-Speed Rail Travel Demand Model (employment data); and *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, July 2003.

5.2.2 Study Area and Alternatives

For the purposes of the growth inducement analysis, California's 58 counties were grouped into seven geographic regions that would contain components of the statewide HST system[1]:

- Core Study Area—Bay Area
  - Alameda County
  - Contra Costa County
  - San Francisco County
  - San Mateo County
  - Santa Clara County
- Core Study Area—Central Valley
  - Fresno County
  - Madera County
  - Merced County
  - Stanislaus County
  - San Joaquin County
  - Sacramento County
- Southern San Joaquin Valley: Kern, Kings, and Tulare Counties
- Southern California: Los Angeles, Orange, Riverside, and San Bernardino Counties
- San Diego County
- Southern Sacramento Valley: El Dorado, Placer, Sutter, Yolo, and Yuba Counties
- Rest of California: Remaining 34 counties not included in any of the other 15 regions.

The regions reflect the economic interdependence among some counties and relate to widely recognized geographic regions in California. The five counties that compose the core study area in the Bay Area (Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara) were kept as separate economic modeling regions in order to better simulate the population and employment growth effects for each system alternative. A similar process was followed for the six counties that compose the core study area in the Central Valley. The counties grouped into Southern Sacramento Valley, Southern San Joaquin Valley, Southern California, and San Diego regions were gathered based on economic relationships between the counties; with the exception of the Southern Sacramento Valley, all of these regions were identified for direct HST service in the Final Statewide Program EIR/EIS. The counties gathered as *rest of California* would not be directly served by any of the HST Network Alternative. The county groupings that compose these regions are displayed in Figure 5.2-1.

This analysis of potential induced growth and indirect impacts considered two HST Network Alternatives as described in Chapter 2, "Alternatives." The analysis considered the No Project/No Action (No Project) Alternative, which represents the region's (and state's) transportation system (highway, air, and conventional rail) as it is today and with implementation of programs or projects that are in regional transportation plans and have identified funds for implementation by 2030, and two HST Network Alternatives (one each for Pacheco and Altamont).

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[1] All counties that would have an improvement under the HST Alternative were grouped into one of the 15 core regions. *Rest of California* includes all counties without an improvement under the HST Alternative.

Quantitative analysis of induced growth and secondary impacts was performed on two specific HST Network Alternatives, one for the Altamont Pass and one for Pacheco Pass. For both HST Network Alternatives, quantitative modeling was performed using the alignments shown in Table 2.5-1 for the San Francisco and San Jose Termini because prior studies conducted by the HSRA suggested that these termini are likely to produce the highest system ridership, and hence the highest potential for induced growth and secondary impacts. Within the core study area, the following HST stations were included in the Network Alternatives used for quantitative modeling:

- Pacheco Pass: Transbay Transit Center; Millbrae-SFO; Redwood City; San Jose (Diridon Station); Morgan Hill; Gilroy; Merced (SP Downtown); and Modesto (Amtrak Briggsmore).
- Altamont Pass: Transbay Transit Center, Millbrae-SFO, Redwood City, Fremont (Warm Springs), San Jose (Diridon Station), Pleasanton (I-680/Bernal Road), Tracy (SP), Modesto (SP Downtown), and Merced (SP Downtown).

The potential induced growth effects and secondary impacts of other alignment and station options were assessed qualitatively by comparing travel demand model results, reviewing comparable results from the Final Statewide Program EIR/EIS[2], and professional experience.

5.2.3 Analysis Years

The growth-inducement analysis was conducted for the year 2030, which provides a long time horizon to consider full market response after completion of the proposed HST Network Alternatives, as well as a better basis for understanding the full range of possible secondary impacts.

The extent of potential growth-inducing effects in any given year is sensitive to the length of time over which changes in economic conditions are assumed to occur. In terms of this analysis, the number of jobs or people that would be generated in an area in 2030 is sensitive to the year in which HST service is assumed first to be available in that area. For both HST Network Alternatives, HST service along a trunk line between the Bay Area and LAUS was assumed to begin on January 1, 2016. Service to Irvine, San Diego and Sacramento was assumed to begin on January 1, 2019 for all alignment options.

5.3 Potential Growth-Inducing Effects

5.3.1 Methodology and Data Sources

The potential economic growth stimulus of a transportation investment can be measured not only in terms of its *overall magnitude* (number of new jobs and people), but also in terms of its *relative distribution* (location of new jobs and people) among different geographic areas. In economic terms, this distinction is the generative (i.e., creates growth) versus distributive (i.e., redistributes existing population and infrastructure) dimension of growth. Transportation investments, such as airports, highways, transit, and HST, compose just one of many factors that determine how much growth will occur and whether it will be generative or distributive in nature. Other major growth factors, such as education level of residents, housing affordability, and land availability, interact in complex and sometimes unpredictable ways for communities, regions, and states. Land use planning and zoning, enterprise development zones, and infrastructure funding also can influence both the magnitude and the distribution of economic growth.

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[2] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, July 2003.

Figure 5.2-1
Regions and Counties

A. SCOPE OF ANALYSIS

The growth inducement results presented in this section were developed using the TREDIS[3] macroeconomic simulation model, which estimates the economic impact of transportation investments on business output, business attraction, employment, and population. Transportation demand, travel times and costs by mode for each system alternative were assembled by the newly developed California Statewide High-Speed Rail Travel Demand Model, with additional transportation performance information synthesized from the Final Statewide Program EIR/EIS.

The analysis process considered the potential effects that changes in transportation congestion and delay between existing conditions and future years would have on the state's economic growth. The process also modeled several dimensions of growth and spatial reallocation that could occur under any of the alignment alternatives and considered many possible impacts of the proposed HST Alignment Alternatives on jobs, population, and land development, including the following:

- Increased employment because of attraction of new businesses to California, or expansion of businesses already located in the state.
- Reallocation of employment because of changes in location of businesses already located in California.
- Population growth associated with business attraction, expansion, and spatial shift.
- Shift in residential population between counties (with fixed employment location) as a result of changed accessibility because of the Modal or HST Network Alternatives (i.e., long-distance commutes).
- Shift in employment for retail and personal service establishments that follow shifts in residential location.
- Changes in densification and development patterns both with and without the presence of a HST station.
- Allocation of population and employment between currently developed and undeveloped areas in each county.
- Consumption of currently undeveloped land to house projected population and employment growth.

B. KEY DATA SOURCES

The growth-inducement analysis required a baseline forecast of future population and employment for the 2030 year. This baseline forecast represented the No Project Alternative for the analysis year, and was also used as an economic modeling input to estimate incremental population and employment changes of the HST Network Alternatives. The analysis of potential induced growth and indirect effects necessitated that county-level population and employment forecasts be developed for 2030, with employment forecasts broken out by one-digit standard industrial classification (SIC) codes. Baseline population forecasts for each county were taken from the California Department of Finance. Baseline employment forecasts were taken from the *California Statewide High-Speed Rail Travel Demand Model* and aggregated to the county level.

[3] The Transportation Economic Development Impact System (TREDIS) model is designed specifically to evaluate the full economic development impacts of multimodal transportation investments. For this analysis, TREDIS was run in conjunction with the ReDYN economic modeling system to capture full dynamic economic feedback.

C. METHODOLOGY OVERVIEW

The analytical process to estimate the growth-inducing effects of the alternatives required significant modeling tools and data. Nonetheless, the entire process, depicted in Figure 5.3-1, can be summarized in a few key steps.

- Define transportation investments: This analysis considers the HST Network Alternatives described in Chapter 2. For this analysis, the future baseline conditions are assumed to represent the No Project Alternative, and the economic modeling process is used to forecast the incremental changes associated with the implementation of the Altamont and Pacheco network alternatives.
- Estimate transportation benefits: Using results from the California Statewide High-Speed Rail Travel Demand Model, benefits such as reduced travel times and/or costs of each alternative for air, highway, and conventional rail trips were estimated using travel demand model results. Congestion, pollution, and crash reduction benefits as well as accessibility benefits were directly estimated using travel demand model results for the two HST Network Alternatives in comparison to the No Project Alternative. Mode shift benefits arising from the introduction of HST service were estimated by scaling benefits calculated for the statewide program EIR/EIS using HST ridership and other output from the current travel demand model[4].
- Estimate direct economic impacts: Direct economic impacts, which are generated from the transportation benefits of each alternative, generally fall into one of three categories.

– Business cost savings: Reductions in travel time and/or cost for long-distance business travelers and commuters benefiting from the transportation improvements.

– Business attraction effects: New and relocated firms taking advantage of market accessibility improvements provided through transportation investments.

– Amenity (quality of life) changes: Non-business travel time and/or cost benefits and other societal benefits improve the attractiveness of a region.

- Determine total regional economic impacts for regions and counties: The direct economic impacts all have the potential to create additional multiplier effects on the regional and statewide economies of California. Total regional impacts were estimated using the TREDIS-ReDyn macroeconomic simulation model. For this analysis, total economic impacts include population and industry-specific employment, with impacts forecasted for the 11 counties in the core study area and the remaining five multi-county regions.
- Forecast land consumption: County-level population and employment were allocated throughout each county to determine the infill potential and magnitude of land needed to accommodate population and employment growth for each alternative. This analysis, which was conducted for the 11 counties in the core study area, was driven by three key pieces of information.

– Local land use, zoning, and employment data.

– National and international experience with station-area development trends related to HST and fixed guideway transit.

– County-level industry employment and population estimates.

- Assess Potential for Secondary Impacts: The population, employment, and land consumption forecasts for each system alternative were reviewed to characterize the nature and magnitude of potential secondary impacts on the human and natural environment. For resource topics in

[4] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, Appendix F, July 2003.

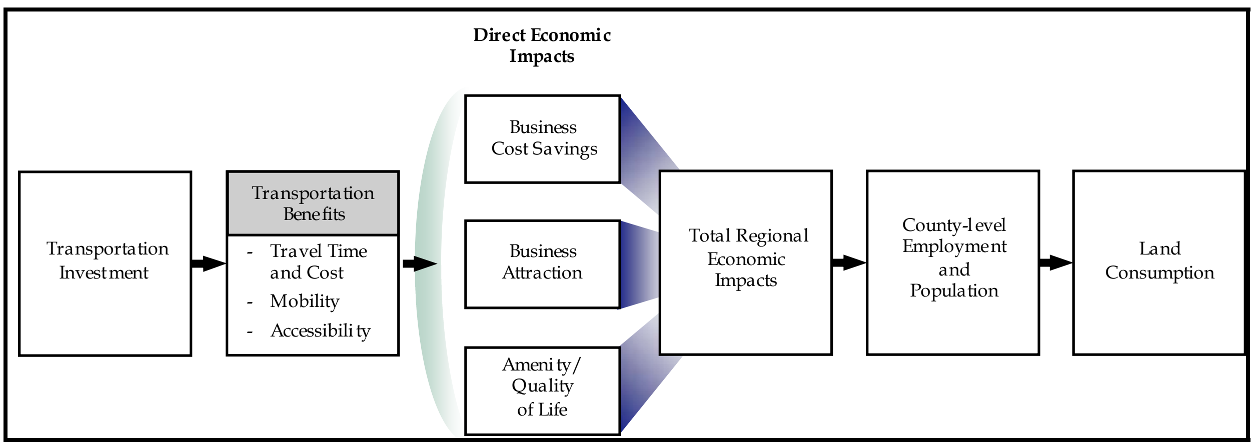

Figure 5.3-1
Methodology Overview

which specific spatial information was available, a GIS-based analysis was conducted to estimate the quantity of resources in each of the 11 core study area counties that could be affected by future urbanization patterns for each system alternative.

Essentially, this land consumption analysis provided an estimate of the population and employment growth that can fit within the currently urbanized areas of each county (i.e., infill potential), and additional acreage of currently undeveloped land that would need to be converted to urbanized densities to accommodate any remaining growth. Estimates of land needed to accommodate employment uses were developed using a statistical analysis based on current development patterns in California, adjusted to reflect expected densification trends over time.[5] The California Urbanization and Biodiversity Analysis (CURBA) model was used to allocate population growth to various locations in each county and to predict land consumption resulting from residential construction.

5.3.2 Financing of Alternatives

In any analysis of proposed public investments, it is important to consider the potential sources of public financing and how they may affect future public revenue needs (i.e., government expenditures) and consumer spending. The HST Network Alternative is projected to have significant capital costs in excess of the costs needed to fund the No Project Alternative. For the purposes of this analysis, it was assumed that the total cost of the HST Network Alternative would be funded through revenue sources that would not require direct tax increases or significant diversion of general fund revenues. Examples of these revenue sources include general obligation bonds,[6] federal grants or loans, existing airport user fees and passenger facility charges, private sector participation, local funds (from existing sources), and existing state transportation revenue sources (e.g., gas tax, sales tax on gas). The net effect of this assumption is that the induced growth and secondary impacts presented in this chapter are in no way influenced by whatever financing plan is eventually established for a potential HST system.

5.3.3 Statewide Comparison of Alternatives

A. POPULATION

Statewide population is expected to grow by about 33% between 2005 and 2030 under the No Project Alternative (Table 5.3-1). Compared to the No Project Alternative, population growth under the Pacheco and Altamont network alternatives will not have a significant difference between them, with Pacheco growing an additional 1.4% and Altamont growing an additional 1.3%. Outside the core study area, the Southern San Joaquin Valley and San Diego County exhibit noticeable increases in population growth rates between the No Project and HST Network Alternatives, with an additional 5% of growth for the HST Network Alternatives in both regions. Population growth rates are very similar between the two HST Network Alternatives outside of the core area, and are nearly indistinguishable on a statewide level.

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[5] Because this analysis was conducted at the county level, it does not explicitly reflect potential land designation or policy constraints that are included in each jurisdiction's general plan. Rather, the analysis reflects market forces that currently exist and are projected to exist in the future for counties of similar location, size, development intensity, and potential HST service. The densities that are allowed under zoning and general plan designations are implicitly included in the analysis to the extent that existing development patterns and market forces have been influenced by past zoning and general plan decisions.

[6] The debt service on General Fund State Revenue bonds often is paid through a commitment of the general fund revenue with no additional tax or other revenue source. A preliminary analysis by the project team suggests that the annual debt service on a $10 billion bond may be within the range of the state's historical and future bonding patterns. While this source of funding does not directly increase taxes, it does divert state expenditures from budget items to debt service. Nevertheless, this diversion is not assumed in this analysis to result in any significant reduction in state expenditures.

Table 5.3-1
Projected Population Growth Rate by Region

Area	Year 2005 Population	Growth Rate (Year 2005 to 2030) (%)		
		No Project Alternative	HST Network Alternative	
			Pacheco	Altamont
Alameda County	1,451,065	40.5	41.4	41.6
Contra Costa County	1,017,644	51.6	52.3	51.9
San Francisco County	741,025	7.4	9.3	8.1
San Mateo County	701,175	16.1	17.1	17.9
Santa Clara County	1,705,158	26.3	28.1	28.8
Study Area—Bay Area	*5,616,067*	*30.8*	*32.0*	*32.2*
Fresno County	878,089	47.8	49.7	49.5
Madera County	142,530	54.2	61.1	61.0
Merced County	242,249	80.8	86.7	84.7
Sacramento County	1,363,423	68.2	69.1	69.8
San Joaquin County	664,796	85.0	86.7	88.7
Stanislaus County	505,492	47.3	50.0	55.1
Study Area—Central Valley	*3,796,579*	*63.9*	*66.0*	*67.1*
Core Study Area	*9,412,646*	*44.1*	*45.7*	*46.3*
Southern Sacramento Valley	658,108	65.7	66.0	66.2
Southern San Joaquin Valley	1,311,579	51.7	56.2	56.1
Southern California	16,843,742	23.8	24.6	24.4
San Diego County	2,936,609	36.4	41.2	40.7
Rest of California	4,991,463	32.5	32.6	32.5
Statewide Total	36,154,147	33.1	34.5	34.4

Sources: U.S. Bureau of the Census; California Department of Finance; Cambridge Systematics 2007.

In the core study area, population growth rates are very similar among the system alternatives for the five Bay Area counties. The HST Network Alternatives have higher population growth rates than the No Project Alternative for all five counties, and the Altamont network alternative has the highest project growth rate for three of the five counties. The six Central Valley counties in the core study area all have population growth rates that greatly exceed the statewide average under the No Project Alternative. All six counties have noticeably higher population growth rates for the HST Network Alternatives, with Merced and Madera Counties showing the largest numeric difference in growth rates between the No Project and HST Network Alternatives; this result also holds for Stanislaus County in the Altamont network alternative. As a group, the population growth rate in these Central Valley counties is highest for the Altamont network alternative, although Fresno, Madera, and Merced Counties actually have slightly higher growth rates for the Pacheco network alternative.

The greatest population increase is projected between 2005 existing conditions and the 2030 No Project Alternative, with relatively small differences in population growth occurring between the No Project and HST Network Alternatives. Compared to the No Project Alternative, the population growth rates shown in Table 5.3-1 equate to an additional 502,000 people for the Pacheco network alternative and 495,000 people for the Altamont network alternative.

B. EMPLOYMENT

Statewide and regional employment growth patterns are projected to be very similar to the population patterns. Employment growth under either the Pacheco or Altamont network alternative will be an additional 1.5% over the No Project Alternative. Outside the core study area, the Southern San Joaquin Valley exhibits noticeable increases in employment growth rates between the No Project and HST Network Alternatives, with an additional 5% of growth for the HST Network Alternatives. Employment growth rates are very similar between the two HST Network Alternatives outside the core area and are nearly indistinguishable on a statewide level.

Statewide employment is forecasted to grow by 37% under the No Project Alternative, with an additional increase of 1.53% under the Pacheco network alternative and 1.52% under the Altamont network alternative, as shown in Table 5.3.2. All five Bay Area Counties in the core study areas exhibit employment growth rates under the HST Network Alternatives that are about 1% more than under the No Project Alternative, with the Pacheco network alternative showing the highest growth rate for three of the counties.

Table 5.3-2
Projected Employment Growth Rate

Area	Year 2005 Employment	Growth Rate (Year 2005 to 2030) (%)		
		No Project Alternative	HST Network Alternative	
			Pacheco	Altamont
Alameda County	953,937	30.8	32.0	31.9
Contra Costa County	508,854	50.0	51.2	50.8
San Francisco County	779,357	25.2	26.2	25.9
San Mateo County	522,830	37.2	38.4	38.5
Santa Clara County	1,323,920	33.7	34.8	34.8
Study Area—Bay Area	*4,088,898*	*33.9*	*35.0*	*34.9*
Fresno County	435,769	35.2	38.2	38.0
Madera County	56,892	60.6	69.0	69.3
Merced County	87,365	31.7	40.1	38.5
Sacramento County	805,978	56.3	57.4	57.7
San Joaquin County	274,155	34.5	37.0	38.4
Stanislaus County	224,491	41.1	44.2	48.2
Study Area—Central Valley	*1,884,650*	*45.4*	*48.0*	*48.7*
Core Study Area	*5,973,548*	*37.4*	*39.1*	*39.2*
Southern Sacramento Valley	456,834	59.6	60.4	60.7
Southern San Joaquin Valley	576,935	40.1	44.8	44.6
Southern California	9,290,841	32.5	33.8	33.7
San Diego County	1,895,002	46.9	49.3	49.7
Rest of California	2,709,974	39.3	40.1	39.9
Statewide Total	20,903,134	36.9	38.4	38.4

Source: MTC/California High-Speed Rail Travel Demand Model; Cambridge Systematics 2007.

The six Central Valley counties in the core study area have a wide variation in employment growth rates under the No Project Alternative with values ranging between 31% and 60%. All six counties have noticeably higher employment growth rates for the HST Network Alternatives, with Merced and Madera Counties showing the largest numeric difference in growth rates between the No Project and HST Network Alternatives; this result also holds for Stanislaus County in the Altamont network alternative. The population growth rate in these Central Valley counties as a group is highest for the Altamont network alternative, with the Altamont network alternative having the highest growth rate in four of the six counties.

Compared to the No Project Alternative, the employment growth rates shown in Table 5.3-2 equate to an additional 320,000 jobs under the Pacheco network alternative and 316,000 jobs under the Altamont network alternative in the year 2030. As with population growth, however, this level of difference between the No Project and HST Network Alternatives is very small compared to the overall level of growth represented by the No Project Alternative relative to the 2005 conditions.

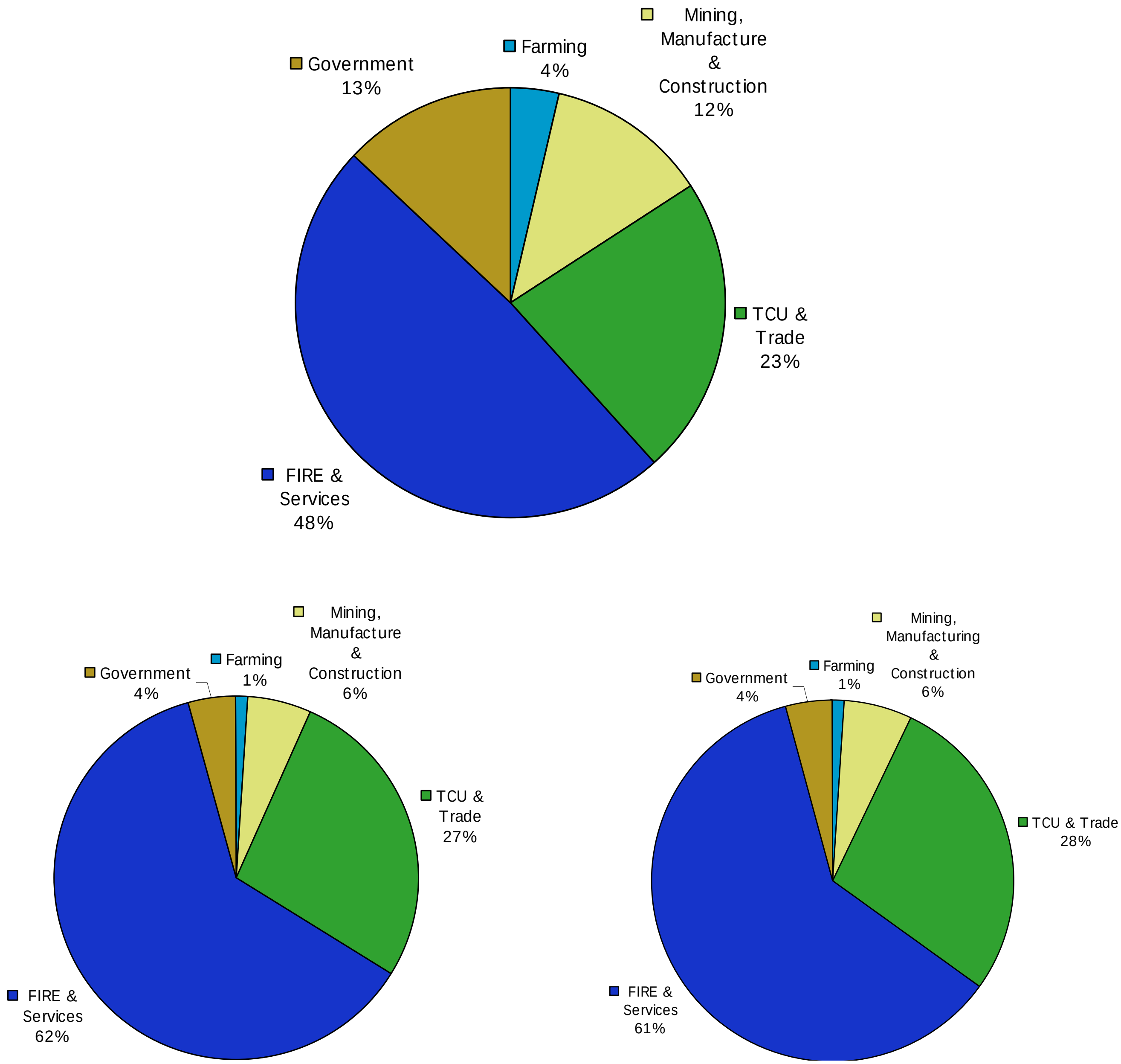
The No Project Alternative is projected to continue historical patterns of employment growth across a diverse range of industry sectors, while also following recent trends toward increases in services and trade. As shown in Figure 5.3-2, nearly one-half of the employment growth for the No Project Alternative is projected in the FIRE (Finance, Insurance and Real Estate) and services sectors, while nearly one-quarter is in TCU (transportation, communications, and utilities), retail trade, and wholesale trade. The incremental employment growth under the HST Network Alternatives does not completely follow this historical pattern. Both HST Network Alternatives show a much greater propensity to job growth in the FIRE, services, TCU, wholesale trade, and retail trade categories.

The Pacheco and Altamont network alternatives exhibit subtle differences in the types of jobs they are projected to attract to different regions. Table 5.3-3 depicts the percentage of growth by major industry group for the increment of jobs that may be "induced" by these two alternatives (i.e., job growth above and beyond that of the No Project Alternative). While the patterns are generally similar, the Altamont network alternative shows a greater propensity for generating jobs in the FIRE and Services sectors in the Central Valley and in San Diego, and in the TCU and trade sectors in the "rest of California." The Pacheco network alternative shows a greater propensity for generating jobs in the TCU and trade sectors in the Central Valley and in San Diego, and in the FIRE and services sectors in the "rest of California." The FIRE and Services sectors tend to be the most compatible for location in higher density settings, such as near potential HST sites where offices and retail development could be expected.

C. URBANIZATION

Urbanized areas in the core study area are expected to grow by about 40% between 2005 and 2030 under the No Project Alternative, as shown in Table 5.3-4. This growth would represent an increase of about 400,000 ac (162,000 ha) over today's 1.0 million ac (0.4 million ha) within the core analysis counties. Compared to urbanized area growth under the No Project Alternative, urbanized area growth is expected to be 0.9% (9,000 ac [3,650 ha]) higher under the Pacheco network alternative and 1.4% (14,000 ac [5,670 ha]) more under the Altamont network alternative. As with the population and employment growth, the level of difference between alternatives for urbanized area size is small compared to the overall level of growth represented by the No Project Alternative relative to the 2002 existing conditions. Noticeable differences in these general patterns can be seen for Madera and Merced Counties, both of which are projected to have sizable urbanization increases for the HST Network Alternatives compared to the No Project Alternative.

No Project Alternative—Growth Compared to Year 2002 Conditions



Altamont HST Alternative
Incremental Growth Compared
to No Project Alternative

Pacheco HST Alternative
Incremental Growth Compared
to No Project Alternative

Source: Cambridge Systematics 2007.

Table 5.3-3
Percent of Incremental Growth by Industry

	Farming and Mining		Construction and Manufacturing		TCU and Trade		FIRE and Services		Government	
Incremental Growth Rate for Induced Employment (Year 2005 to 2030)	Pacheco HST	Altamont HST	Pacheco HST	Altamont HST	Pacheco HST	Altamont HST	Pacheco HST	Altamont HST	Pacheco HST	Altamont HST
Study Area—Bay Area	0	0	6	5	28	29	62	63	3	3
Study Area—Central Valley	2	2	6	4	25	21	63	68	5	4
Subtotal—Core Study Area	*1*	*1*	*6*	*5*	*27*	*25*	*62*	*66*	*4*	*4*
Southern Sacramento Valley	1	2	10	9	34	33	50	52	6	5
Southern San Joaquin Valley	5	5	4	4	20	19	66	67	4	4
Southern California	0	1	6	7	27	29	62	60	4	4
San Diego	0	0	4	3	32	26	59	66	4	4
Rest of California	4	4	9	10	38	45	44	36	5	6
Statewide Total	1	1	6	5	28	27	61	62	4	4

Source: Cambridge Systematics 2007.

Table 5.3-4
Increase in Urbanized Area Acreage

Area	Year 2002 Urbanized Area Acreage	Growth Rate (Year 2002 to 2030) (%)		
		No Project Alternative	HST Network Alternative	
			Pacheco	Altamont
Alameda County	141,654	31.8	32.6	32.0
Contra Costa County	142,467	29.1	29.6	29.4
San Francisco County	23,277	28.9	29.9	29.6
San Mateo County	70,869	13.3	13.4	13.7
Santa Clara County	184,481	12.7	13.5	14.6
Study Area—Bay Area	*562,748*	*22.4*	*23.0*	*23.2*
Fresno County	96,977	54.9	58.4	58.0
Madera County	23,255	56.4	62.5	62.5
Merced County	31,712	90.6	96.2	94.3
Sacramento County	157,101	51.4	51.5	52.3
San Joaquin County	74,250	96.3	95.3	96.8
Stanislaus County	55,426	34.0	33.8	38.7
Study Area—Central Valley	*438,721*	*60.7*	*62.0*	*62.9*
Core Study Area	*1,001,469*	39.2	40.1	40.6

Sources: *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, July 2003; Cambridge Systematics 2007.

5.3.4 Detail for No Project Alternative

On a statewide basis, population is projected to increase between 2005 and 2030 by about 12 million (33%), which averages to about 480,000 more people each year. The long-term growth rate averages to about 1.1% annually, which is lower than California's 1.8 % annual population growth rate between 1970 and 2005 but consistent with long-term population forecasts by California Department of Finance. Employment growth rates are similar, with jobs increasing by 8 million (37%) between 2005 and 2030; this increase equates to average annual growth of about 320,000 jobs. The long-term growth rate averages about 1.3% per year, which is one-half of the 2.6% annual employment growth rate since 1970.

For the 11 counties in the core study area, population and employment growth under the No Project Alternative are expected to require approximately an additional 400,000 ac (162,000 ha) of urbanized land in 2030 than the current estimated urbanized area of approximately 1.0 million ac (1,271,523 ha).[7] Urbanization of land in these core counties is projected to occur at slightly lower rates than overall population and employment growth, reflecting a number of factors:

- A reduction in availability of land for development in some Bay Area counties, creating higher land costs and market forces for denser development.
- Slight increases in infill and redevelopment, as seen recently in many urban communities, and blighted areas that receive new development.

[7] Estimates of current urbanized area are based on urban land cover data provided by the California Farmland Mapping and Monitoring Program (CFMMP), a division of the California Department of Conservation.

- An increase in marginal residential densities that has occurred over recent years.[8]

5.3.5 Detail for HST Network Alternatives

As noted earlier, statewide population and employment forecasts for the HST Network Alternatives are similar to those for the No Project Alternative. For Year 2030, the Pacheco network alternative is projected to add about 502,000 (1.4%) more people and 320,000 (1.5%) more jobs compared to the No Project Alternative. The Altamont network alternative is projected to add about 495,000 (1.3%) more people and 316,000 (1.5%) more jobs compared to the No Project Alternative. The incremental effect of both HST Network Alternatives is to add the equivalent of about 1 year's population and employment growth to California by year 2030.

Land consumption for both HST Network Alternatives is projected to be of the same magnitude because of the predominant effect of population growth. In the 11 core area counties, the Altamont network alternative is projected to consume an additional 5,000 ac (0.5%) of land for urbanized densities compared to the Pacheco network alternative. This increment compares to a total of 1.4 million ac of urbanized land projected for these 11 counties in the No Project Alternative. The HST Network Alternatives are able to accommodate population and employment growth at a larger rate than urbanized area growth because of stronger employment growth in the services and FIRE sectors and market forces supporting denser station-area development for office-style facilities.

5.3.6 Study Area Effects

Each of the HST Network Alternatives has varied effects on different parts of the state. Part of this difference is in terms of overall population, employment, and urbanization projections. Another part of the difference is related to the type of industries that are projected to experience employment growth under each alternative.

Table 5.3-5 presents population and employment projections for each county and region analyzed. Values are provided for Year 2005 existing conditions, and year 2030 projections are provided for the No Project Alternative and the two HST Network Alternatives. On an absolute basis, the areas currently most populous are projected to exhibit the largest increases in population and employment from 2005 to 2030. San Diego County and Southern California are together projected to add about 5 million people and 4 million jobs during this period. The five Bay Area counties in the core study area are projected to add about 1.7 million people and 1.4 million jobs during this period. The six counties in the Central Valley study area are projected to add about 2.4 million people and 0.9 million jobs.

A. POPULATION GROWTH RATES

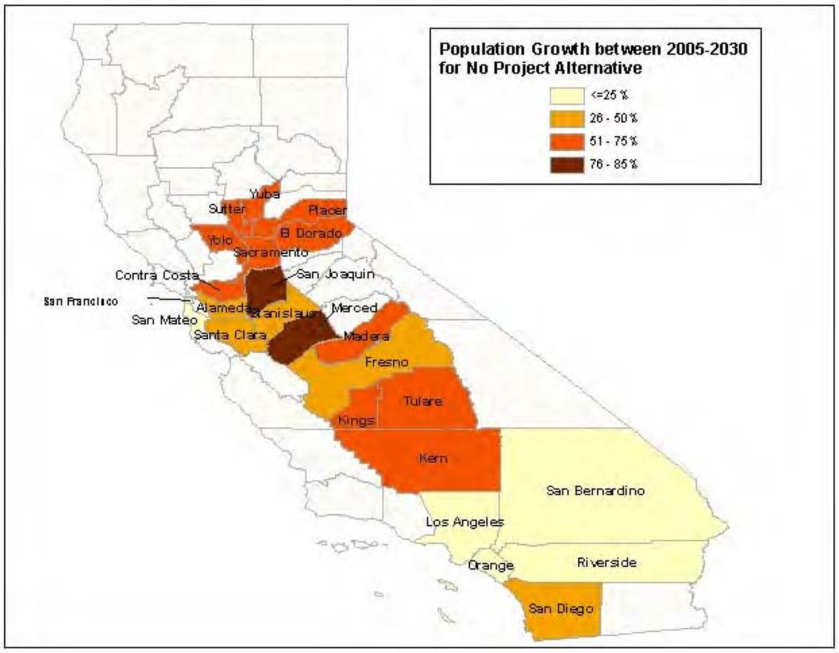
A relative comparison of county-level population growth rates is depicted graphically in Figures 5.3-3 through 5.3-5. Figure 5.3-3 displays the relative change in population for each analysis region from 2005 to 2030 under the No Project Alternative. These data illustrate that Merced and San Joaquin Counties are projected to exhibit the largest population growth rates, followed by Southern Sacramento Valley, Southern San Joaquin Valley, and Contra Costa County. The lowest relative population growth rates are projected to occur in the core areas of the Bay Area and Southern California.

[8] California's housing plan update (*Raising the Roof: California Housing Development Projections and Constraints, 1997–2020*; California Department of Housing and Community Development; May 2000; Exhibit 17) analyzed changes in gross population densities between 1984 and 1986. This analysis included data for 11 of the 21 counties in the study area (see Section 5.2). In 9 of these 11 counties, the density of new residential development that occurred between 1984 and 1996 was between 50% and 585% higher than the average residential density that existed in 1984.

Table 5.3-5
Year 2030 Employment and Population: County and Regional Totals

Region	Employment				Population			
	2005 Conditions	2030			2005 Conditions	2030		
		No Project	Pacheco Alternative	Altamont Alternative		No Project	Pacheco Alternative	Altamont Alternative
Alameda County	953,937	1,247,413	1,259,563	1,257,894	1,451,065	2,038,482	2,051,196	2,054,014
Contra Costa County	508,854	763,445	769,521	767,521	1,017,644	1,543,053	1,549,526	1,546,206
San Francisco County	779,357	975,823	983,634	981,068	741,025	796,208	809,680	801,192
San Mateo County	522,830	717,526	723,835	723,899	701,175	814,065	821,063	826,885
Santa Clara County	1,323,920	1,769,498	1,785,181	1,784,281	1,705,158	2,152,963	2,183,649	2,196,405
Study Area—Bay Area	*4,088,898*	*5,473,705*	*5,521,734*	*5,514,663*	*5,616,067*	*7,344,771*	*7,415,114*	*7,424,702*
Fresno County	435,769	589,226	602,155	601,294	878,089	1,297,476	1,314,824	1,312,891
Madera County	56,892	91,364	96,173	96,293	142,530	219,832	229,648	229,492
Merced County	87,365	115,054	122,374	121,040	242,249	437,880	452,166	447,409
Sacramento County	805,978	1,259,792	1,268,687	1,271,311	1,363,423	2,293,028	2,305,071	2,314,484
San Joaquin County	274,155	368,745	375,491	379,476	664,796	1,229,757	1,241,285	1,254,281
Stanislaus County	224,491	316,686	323,679	332,624	505,492	744,599	758,256	783,839
Study Area—Central Valley	*1,884,650*	*2,740,867*	*2,788,559*	*2,802,038*	*3,796,579*	*6,222,572*	*6,301,250*	*6,342,396*
Core Study Area	*5,973,548*	*8,214,572*	*8,310,293*	*8,316,701*	*9,412,646*	*13,567,343*	*13,716,364*	*13,767,098*
Southern Sacramento Valley	456,834	729,293	732,903	733,942	658,108	1,090,299	1,092,658	1,093,615
Southern San Joaquin Valley	576,935	808,196	835,245	833,977	1,311,579	1,989,111	2,048,889	2,047,375
Southern California	9,290,841	12,308,179	12,435,533	12,421,683	16,843,742	20,844,795	20,988,962	20,950,544
San Diego County	1,895,002	2,783,258	2,828,805	2,837,183	2,936,609	4,005,624	4,147,239	4,132,577
Rest of California	2,709,974	3,774,366	3,795,828	3,791,032	4,991,463	6,613,499	6,618,328	6,614,836
Statewide Total	20,903,134	28,617,864	28,938,605	28,934,518	36,154,147	48,110,671	48,612,439	48,606,045

Sources: U.S. Bureau of the Census; MTC/California High-Speed Rail Travel Demand Model; Cambridge Systematics 2007



Source: Cambridge Systematics 2007.

Figures 5.3-4 and 5.3-5 display county-level population growth rates compared to the No Project Alternative for the Pacheco and Altamont network alternatives, respectively. For Pacheco, incremental population growth is highest in Madera County, followed by Merced County, San Diego County, and the Southern San Joaquin Valley; incremental growth rates are lowest in Southern California (except San Diego County) and areas from San Joaquin County northward. For Altamont, incremental population growth is highest in Madera and Stanislaus Counties, followed by Merced County, San Diego County, and the Southern San Joaquin Valley; incremental growth rates are lowest in Southern California (except San Diego County) and areas from Sacramento County northward.

B. EMPLOYMENT GROWTH RATES

Figures 5.3-6 through 5.3-8 graphically depict county-level employment growth rates. Figure 5.3-6 displays the relative change in employment for each county from Year 2005 to Year 2030 under the No Project Alternative. These data illustrate that Madera, Sacramento, Contra Costa, and San Diego Counties and the Southern Sacramento Valley are projected to exhibit the largest employment growth rates. The lowest relative employment growth rates are projected to occur in the San Francisco, Alameda, and Merced Counties and Southern California.

Figures 5.3-7 and 5.3-8 display county-level employment growth rates compared to the No Project Alternative for the Pacheco and Altamont network alternatives, respectively. For Pacheco, incremental employment growth is highest in Madera and Merced Counties, followed by Fresno and Stanislaus Counties and the Southern San Joaquin Valley; incremental growth rates are lowest in Southern California (except San Diego County), the Bay Area, and the greater Sacramento area. For Altamont, incremental employment growth is highest in Madera, Merced, and Stanislaus Counties, followed by San Joaquin County and the Southern San Joaquin Valley; incremental growth rates are lowest in Southern California (except San Diego County), the Bay Area, and the greater Sacramento area.

The Northern Central Valley region historically has exceeded statewide averages for government and farming jobs while lagging in all other industry groups. This general pattern is projected to change slightly under the No Project Alternative, with employment shifts from government into farming, and from manufacturing, trade, and TCU into FIRE and services. Incremental job growth under the HST Network Alternatives is projected to have incremental job growth that is oriented much more heavily toward FIRE and services (about 62% of total), with trade, and TCU accounting for about 27% of incremental growth. This is the largest shift in the nature of employment for any region and suggests that either HST Network Alternative could be a strong influence in attracting higher-wage jobs to the Central Valley.

Taken together, the population and employment results suggest that the additional population growth under the HST Network Alternatives is driven by internal job growth (i.e., job growth that occurs in the same county as opposed to population growth) related to initiation of HST service, rather than by potential population shifts from the Bay Area and Southern California and associated long-distance commuting. For the six Central Valley Counties in the core study area, each new job generated between 2005 and 2030 (No Project) is projected to be accompanied by about 2.8 new people. However, each job induced by one of the HST Network Alternatives is projected to be accompanied by only 1.6 new people. Hence, the HST Network Alternatives are projected to induce proportionately more jobs than people in the Central Valley.

C. URBANIZATION

Table 5.3-6 presents projections for increases in urbanized areas for the 11 counties in the core study area. While population and employment increases were projected to be concentrated in the counties that currently are most populous, urbanization patterns do not follow this trend. Although the six

Central Valley Counties are projected to account for 38% of the job growth for the No Project Alternative, they are projected to account for 68% of the urbanization increase in the core study area. Among all 11 core area counties, Sacramento, San Joaquin, and Fresno Counties are projected to experience by far the largest absolute increases in urbanized acreage for the No Project Alternative.

This pattern changes somewhat for the HST Network Alternatives. The six Central Valley Counties account for about one-half of the total incremental job growth in the core study area, but their share of the urbanization increase drops to 60% (from the 68% under the No Project Alternative). Absolute increases in urbanization for the HST Network Alternatives are largest in Santa Clara County (for Altamont), Stanislaus County (for Altamont), and Fresno County (both HST Network Alternatives).

Table 5.3-6
Year 2030 Size of Urbanized Area by Alternative

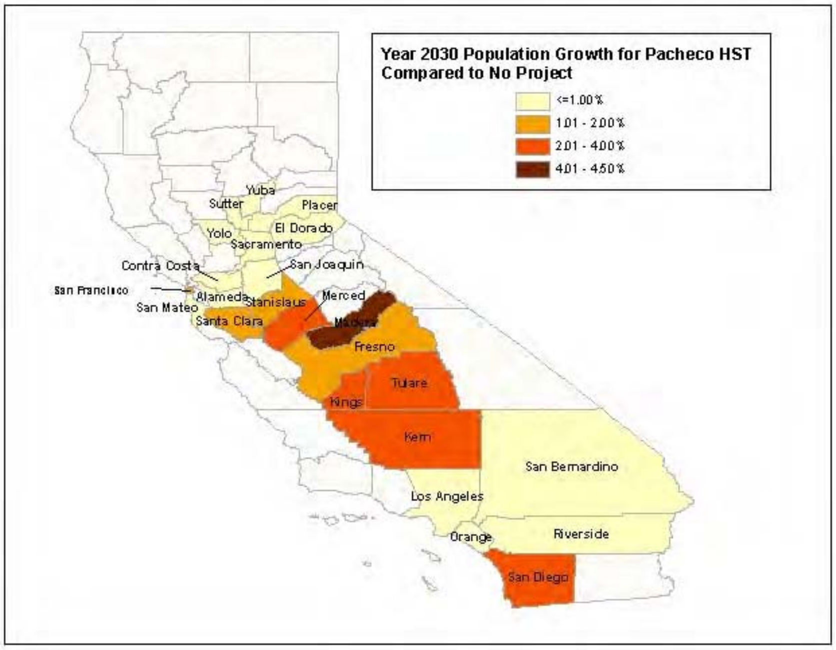
Area	Year 2002 Urbanized Area Acreage	Year 2030 Urbanized Area (Acres)		
		No Project Alternative	HST Network Alternative	
			Pacheco	Altamont
Alameda County	141,654	186,683	187,808	186,942
Contra Costa County	142,467	183,869	184,596	184,288
San Francisco County	23,277	30,013*	30,246*	30,172*
San Mateo County	70,869	80,304	80,386	80,543
Santa Clara County	184,481	207,833	209,352	211,324
Study Area—Bay Area	*562,748*	*688,702*	*692,388*	*693,269*
Fresno County	96,977	150,223	153,574	153,243
Madera County	23,255	36,366	37,793	37,778
Merced County	31,712	60,455	62,212	61,611
Sacramento County	157,101	237,818	238,066	239,245
San Joaquin County	74,250	145,776	145,046	146,104
Stanislaus County	55,426	74,267	74,179	76,886
Study Area—Central Valley	*438,721*	*704,905*	*710,870*	*714,867*
Core Study Area	1,001,469	1,393,607	1,403,258	1,408,136

*Note: Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Because "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table.

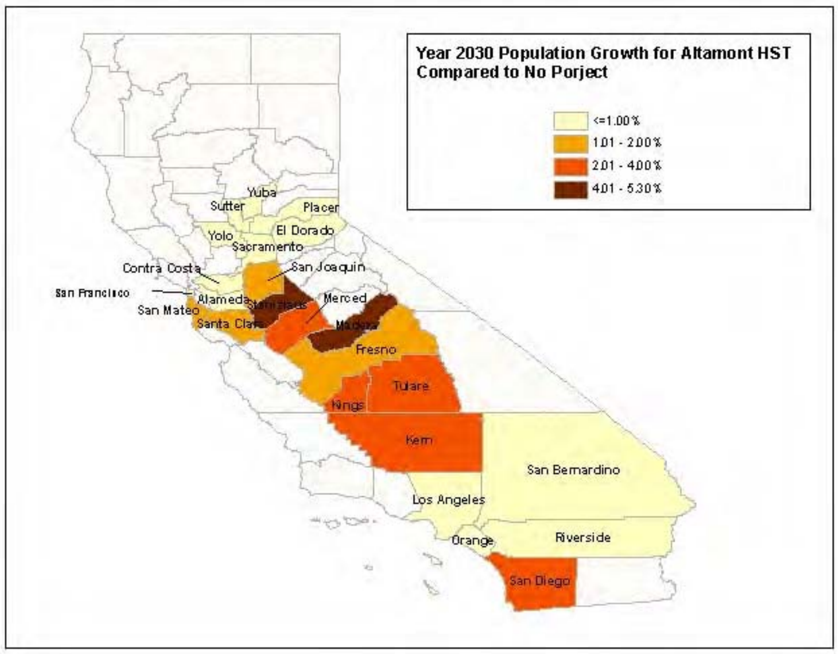
Source: Cambridge Systematics 2007.

5.3.7 Summary of Effects

Overall, the system alternatives exhibit very similar levels of growth-inducing effects in terms of population, employment, and urbanization patterns. The additional effect of either HST Network Alternative relative to the No Project Alternative is small compared to the difference between the No Project Alternative and existing conditions.

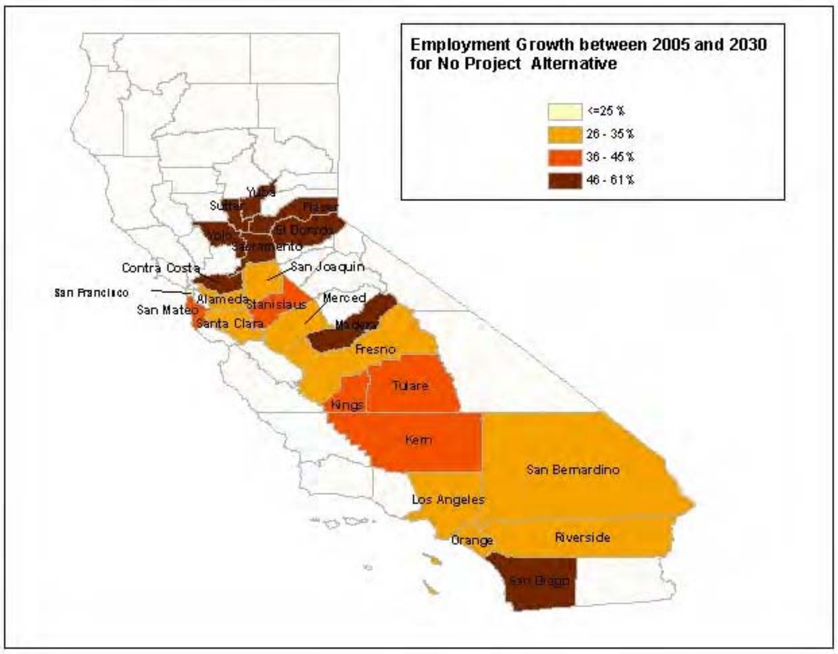


Source: Cambridge Systematics 2007.



Source: Cambridge Systematics 2007.

Figure 5.3-5
County-Level Population Growth under the
Altamont Network Alternative

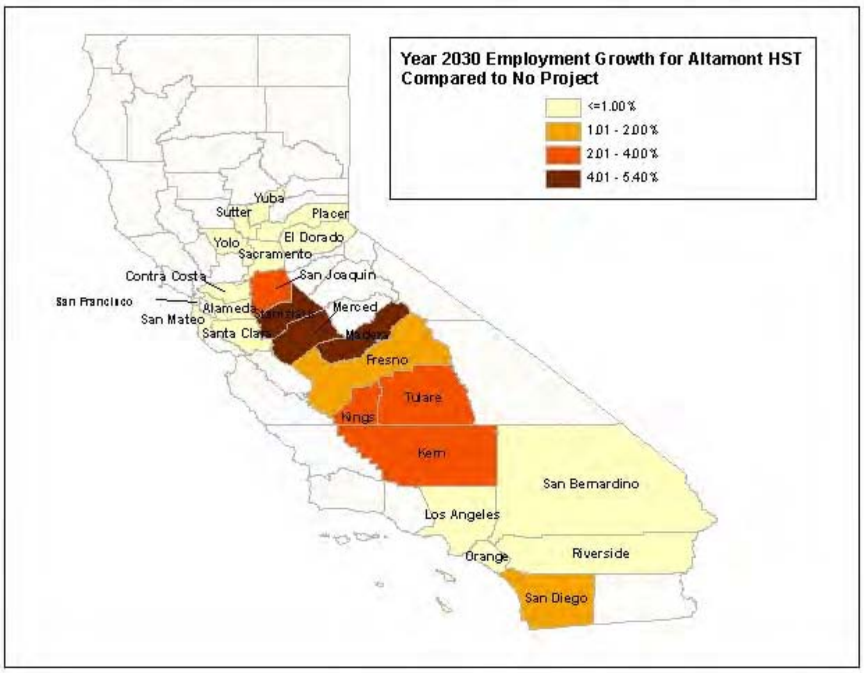


Source: Cambridge Systematics 2007.

Figure 5.3-6
County-Level Employment Growth
under the No Project Alternative

Source: Cambridge Systematics 2007.

Figure 5.3-7
County-Level Employment Growth under the Pacheco Network Alternative



Source: Cambridge Systematics 2007.

Figure 5.3-8
County-Level Employment Growth under
the Altamont Network Alternative

The HST Network Alternatives would stimulate additional growth relative to the No Project Alternative in many Central Valley counties between Sacramento and Fresno. The incremental employment effect is much larger than the incremental population effect in all Central Valley counties, suggesting that the HST Network Alternatives might be more effective at distributing employment throughout the state. Also, this result suggests that the HST Network Alternatives would not stimulate large shifts in residential location from the Bay Area into the Central Valley.

Experiences in other countries have shown that HST systems can provide a location advantage to those areas that are near an HST station, while at the same time facilitating broader economic expansion for a much wider geographic region. The HST Network Alternatives would contribute to a potential economic boost in two ways.

- An HST system would provide user benefits (travel-time savings, cost reductions, accident reductions) and accessibility improvements for California's citizens; in addition to HST travelers, travelers on other modes of transportation can accrue these user benefits, as trips are diverted from highways and airports, resulting in reduced congestion.
- An HST system would improve accessibility to labor and customer markets, thereby potentially improving the competitiveness of the state's industries and the overall economy. With this second effect, businesses that locate close to an HST station could operate more efficiently than businesses that locate elsewhere. Experience from overseas suggests that this competitive advantage may be quite pronounced in high-wage employment sectors that are frequently in high demand in many communities. This second effect would be much stronger under the proposed HST than under the No Project Alternative.

One of the most telling summary statistics comes from combining population and employment growth projections with land consumption forecasts, providing a measure of "land consumed per new job and resident." Essentially, this calculation tells us how efficient each network alternative is at accommodating the projected growth. Because the alternatives have similar levels of overall growth, the efficiency by which that growth would be accommodated becomes more important. Table 5.3-7 provides the relevant data for each alternative; lower values suggest greater efficiency. The results indicate that the Pacheco network alternative is the most efficient of the alternatives, providing an incremental development density that is 1.3% more efficient than the No Project Alternative, while the Altamont network alternative is 0.8% more efficient than the No Project Alternative. The efficiency gains for both HST Network Alternatives are achieved in conjunction with higher population and employment projections than under the No Project Alternative.

Table 5.3-7
Potential Land Consumption Efficiencies in the Core Study Area

	No Project Alternative	Pacheco HST Network Alternative	Altamont HST Network Alternative
Land Consumption (thousands of acres)	392.1	402	407
Job Growth (thousands of jobs)	2,241	2,337	2,343
Population Growth (thousands of people)	4,155	4,304	4,354
*Acres Consumed per New Job and Resident**	*0.0613*	*0.0605*	*0.0608*
Efficiency Gain/Loss Relative to No Project Alternative	-	+1.3%	+0.8%

* Value found by dividing land consumption by the sum of job growth and population growth.
Source: Cambridge Systematics 2007.

5.4 Potential Indirect Impacts of Induced Growth

This section explores the potential indirect impacts related to incremental population and employment growth and associated changes in urbanization. Potential indirect impacts are described for the Altamont and Pacheco network alternatives, with the No Project Alternative used as the reference point.

As described above, both HST Network Alternatives may have positive, albeit relatively small, statewide effects on population and employment growth compared to the No Project Alternative. At the sub-state level, San Joaquin Valley counties are projected to experience population and employment growth rates that are noticeably higher than the statewide average, with the Altamont network alternative experiencing higher growth rates in areas north of Fresno County and the Pacheco network alternative experience higher growth rates from Fresno County southward.

Despite the relatively small magnitude of this additional population and employment growth compared to under the No Project Alternative, these changes could contribute to indirect impacts on the human or natural environment in addition to the direct impacts created by construction and operation of an HST. Many of these impacts may derive from the increased urbanization needed to accommodate the additional population and employment. In 2030, the total size of urbanized areas in the study area would be virtually the same under the proposed HST Network Alternatives as under the No Project Alternative, although the HST Network Alternatives will lead to increased urbanization in Fresno, Madera, Merced, and Santa Clara Counties.

Much of the potential incremental growth associated with each alternative is likely to focus around HST stations because these are the locations that receive the highest accessibility benefit with HST service. While county and regional effects may differ only slightly between alternatives, the localized effects could be larger near these proposed HST stations compared to under the No Project Alternative.

5.4.1 Transportation

This section discusses the potential impacts of induced growth on traffic conditions for highways, roadways, passenger transportation services (bus, rail, air, intermodal), goods movement, parking, and transit facilities in the study area.

Currently, the study area highway and roadway corridors considered in this analysis represent some of the worst traffic conditions in the nation. Traffic conditions throughout the study area are expected to worsen. Vehicle V/C ratios are projected to deteriorate between Years 2005 and 2030, and there would be more level of service F segments under the No Project Alternative compared to existing conditions. When compared to this projected degradation in traffic conditions under the No Project Alternative, the traffic conditions projected for the HST Network Alternatives would improve throughout the study area, despite the approximate 1.2% increase in study area population and employment under the proposed HST Network Alternative. The potential impacts of the induced growth, to the degree that they can be detected, would be most apparent around urban HST stations where the additional traffic generated by induced growth is expected to be concentrated.

The largest increase in population and employment would occur in Madera and Merced Counties for the Pacheco network alternative, and in Madera, Merced, and Stanislaus Counties for the Altamont network alternative. This increase has the greatest potential to generate impacts from traffic accessing the potential HST station sites. Most of these communities have considerable capacity on roadways and intersections in areas surrounding potential downtown or outlying HST station sites. The potential traffic generation impacts of the projected 4% to 6% more residents and employees, such as that projected for Madera County, would be unlikely to have measurable impacts on roadway and intersection levels of service.

As an overall conclusion, the potential transportation impacts of induced growth under the HST Network Alternatives are likely to concentrate around proposed HST station sites. Because the Altamont network alternative is projected to experience higher population and employment growth than the Pacheco network alternative for nearly all counties north of Fresno County, the secondary transportation impacts could be expected to be proportionately larger for the Altamont network alternative. Project-level environmental studies would be expected to provide the appropriate opportunity to investigate more localized impacts.

5.4.2 Air Quality

Section 3.3, "Air Quality," describes the potential impact of induced growth on air pollution. Under high-end assumptions, the HST Network Alternatives annually would accommodate an estimated 95 million travelers that would otherwise use the roadways and airports. This diversion to HST could lead to a projected 5% statewide VMT reduction on the highway system, with VMT reductions of between 7% and 12% in Bay Area and Central Valley Counties. Thus, the HST Network Alternatives are projected to decrease the amount of mobile-source air quality pollutants in the study area and the state as compared to the No Project Alternative. The additional increase in population and employment in each county from induced growth generally would be expected to increase traffic and mobile-source air pollutants by an amount proportional to that growth. Even with induced growth, mobile-source air emissions under all HST Network Alternatives would be lower than No Project emissions in all counties because the projected VMT reduction is larger than the projected population and employment growth.

At the local level, the HST Network Alternatives have somewhat more potential to affect air quality because of expected increases in local traffic near HST station locations. It is expected that the induced growth could concentrate near HST stations, and thus the direct and indirect air quality effects could be larger around the station areas. The severity of these local impacts, however, cannot be reliably quantified without local and detailed traffic modeling and impact analysis, which is outside the scope of analysis for this Program EIR/EIS. Project-level environmental studies would be expected to provide the appropriate opportunity to investigate more localized impacts.

5.4.3 Noise and Vibration

Increased population and employment related to induced growth would not increase the likelihood or levels of potential noise and vibration impacts. Therefore, no indirect impacts from induced growth are expected in the areas of noise and vibration.

5.4.4 Energy

There would not be any significant differences in potential energy use among the alignment alternatives resulting from general population and employment growth projections because the magnitude of the incremental statewide population and employment growth is expected to be similar, regardless of which alternative is chosen. However, the expected propensity of the proposed HST Network Alternatives to concentrate employment and population near HST stations, and the resulting incremental development density benefit, would tend to reduce the number and length of vehicle trips for work, leisure, and commerce compared to the No Project Alternative. Such an effect would decrease the amount of energy directly used for transportation. The potential increased density in the vicinity of proposed HST station sites also would limit the amount of energy required for construction of and access to future infrastructure projects by reducing the distance between structures and reducing the number of structures that would be required to serve new population and employment growth. In addition, higher density would reduce demand for the large-volume transportation-related infrastructure projects required for a highly automobile-oriented transportation network. Finally, if growth around HST stations occurs at higher densities than would occur with more dispersed growth under the No Project Alternative, savings in building-related energy use also could be realized because multi-unit and multi-story structures tend to require less energy per square foot for heating and cooling needs.

The projected population and employment distributive effect of the project could create the need for some change in the incremental development of overall energy and electricity generation and/or transmission capacity among regions. For example, Madera, Merced, and Stanislaus Counties would exhibit the largest relative increase in both population and employment with implementation of the HST Network Alternatives. Relatively high incremental growth is also expected in other counties in the Central Valley. The Southern San Joaquin Valley and San Diego County also would exhibit induced employment and population growth that is above the statewide average. These differences in growth rates among counties potentially would require more incremental production and/or transmission capacity to be developed in some areas with implementation of the HST Network Alternatives as compared to the No Project Alternative. Regional differences in production and transmission needs may also be seen among the HST Network Alternatives, with the Altamont network alternative exhibiting more energy use in areas north of Fresno County and the Pacheco network alternative exhibiting more energy use from Fresno County southward (including Southern California).

5.4.5 Electromagnetic Frequency and Electromagnetic Interference

Increased population or employment related to induced growth would not increase the likelihood or potential severity of EMF and EMI associated with operation of the proposed HST Network Alternatives. Therefore, no indirect impacts from induced growth are expected in the areas of EMF/EMI.

5.4.6 Land Use, Communities and Neighborhoods, Property, and Environmental Justice

This section describes the potential impacts of induced growth attributable to the HST Network Alternatives on land use compatibility, communities and neighborhoods, property, environmental justice, and socioeconomics.

A. COMPATIBILITY WITH EXISTING LAND USE AND FUTURE LAND USE PLANS

The analysis results indicate that employment is projected to increase under the HST Network Alternatives, with employment potentially available for a broad range of education or job skills. Increased employment opportunities generally lead to personal income growth. The relationship between employment, income growth, and the socioeconomic composition of a community is complex. Increases in employment and income opportunities, however, would tend to make a community more attractive to a broader range of individuals. Because induced growth under the HST Network Alternatives would be relatively small (compared to the growth under the No Project Alternative), it is expected that socioeconomic changes also would be small.

The HST Network Alternatives are projected to push employment growth in the study area 1.2% higher than under the No Project Alternative, with the Altamont network alternative experiencing higher growth in the Central Valley and the Pacheco network alternative experiencing higher growth in the Bay Area. The development pressures associated with the HST Network Alternatives would be concentrated in the service and FIRE industries, which generally occupy office developments and have been shown to have a higher propensity to locate close to transit stations. Increased residential growth might also be expected in HST station areas and adjacent communities.

The HST Network Alternatives include potential station location options that were identified through consultation with local planning agencies and selected to be compatible to the extent possible with future planned land uses. Recent trends among local jurisdictions show a growing consideration of land use policies that are intended to encourage high-density, mixed-use development in downtowns and other areas in which HST stations may be located. Section 3.7, “Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice,” describes community plans in the various HST station area options and assesses the level of compatibility of an HST with these plans. Overall, most station locations for the proposed HST Network Alternatives would be highly compatible with local and regional plans, which generally support rail systems and transit-oriented development. Potential inconsistencies were noted for a few stations, including Livermore (Greenville Road/I-580), Tracy (ACE), Union City (Shinn), Briggsmore (Amtrak), Merced (Downtown), and Castle AFB. As induced growth may lead to intensified development in HST station areas, secondary land use impacts are possible with these same potential station locations. However, it is possible that some of these inconsistencies will be addressed through further land use planning that occurs at the local level.

B. COMMUNITIES AND NEIGHBORHOODS

The induced growth associated with either HST Network Alternative would have some modest potential to increase office/commercial development densities around HST station sites and residential growth in adjacent communities. In general, this growth would not be expected to create new barriers within neighborhoods or reduce community cohesion because the growth would generally follow existing transportation corridors and rights-of-way. In some cases, growth could provide positive community and neighborhood benefits by helping to fill in vacant or underutilized areas with higher-intensity uses that generate and encourage pedestrian activity. Any induced development that does occur would be expected to be consistent with locally adopted land use plans and developed through a public process that considers both positive and negative community and neighborhood impacts.

C. PROPERTY

The induced population and employment growth that would be attributable to the HST Network Alternatives is not projected to create the need for any additional right-of-way for wider highways, new interchanges, additional runways, or other auto or air travel infrastructure.

The highest potential for secondary property impacts under the HST Network Alternatives would be expected to occur near the HST stations, where the transportation accessibility benefits of HST are expected to lead to increased land values and development pressures. Increased land values would represent a benefit to property owners near stations. As a result of the accessibility benefits of HST access, more and denser development would be expected to occur near HST stations. While some of this development might represent a net increase in development in the region (as a result of induced population and employment growth), other development simply might be shifted from an alternative location (e.g., near an outlying highway interchange). Therefore, some properties in other parts of the region, not near HST stations, might not experience the same development pressure that they would have under the No Project Alternative. These effects are likely to be very dispersed and minor from a regional perspective, and any specific locations that might be affected outside of HST station areas cannot be predicted. Furthermore, any induced development that occurs (whether inside or outside HST station areas) would be expected to be consistent with locally adopted land use plans that reflect community input into preferred development patterns. The planning policies and general plans of most jurisdictions in which potential HST station sites would be located are directing present and future development into their urban centers and to infill sites independent of possible future HST implementation.

D. ENVIRONMENTAL JUSTICE

The induced growth attributable to the HST Network Alternatives should not have disproportionate impacts on minority and low-income populations. The induced growth from the HST Network Alternatives would have the potential to offer improved employment opportunities to local communities. These opportunities may arise from more diversified regional economies and robust employment growth in regions that would not benefit in the same way under the No Project Alternative.

Section 3.7, "Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice," identifies the extent to which environmental justice populations are present in potential HST station areas. Stations with such populations identified include West Oakland/7th Street, 12th Street/City Center, Coliseum/Airport, Union City (BART), Fremont (Warm Springs), Gilroy (Caltrain), Union City (Shinn), Merced (Downtown), and Castle AFB. Impacts in specific station areas and adjacent communities could be both positive and negative—positive to property owners as a result of increased property values and to workers as a result of increased job opportunities, but potentially negative to non-property owners if rising property values reduce housing affordability. It would be speculative to attempt to further characterize potential impacts at the program level without more specific information about what development impacts might occur.

The consequence of growing employment in the service industries would be a diversification in the Central Valley away from agriculture and into more non-agricultural jobs. The impact of these new jobs (and the population growth and new development that it would stimulate) on minority and low-income populations in each county cannot be identified in this Program EIR/EIS. In general, FIRE and service job growth would tend to be attracted to station areas and adjacent communities under the HST Network Alternatives. The extent to which this development would potentially use land occupied by minority and low-income populations would deserve consideration at the project-level review of potential environmental justice issues. The growth in FIRE and service sector employment would tend to offer more jobs to high-skilled members of the work force than to low-skilled workers. Many service-sector jobs, however, would be accessible to low-skilled workers, and any increase in employment generally would have multiplier effects that tend to generate indirect and induced job growth across many occupations. Lower-skilled workers could also benefit from the additional job opportunities in building construction and related industries as a result of induced employment and population growth that occurs in the region. As with many of the resource areas, there are potential regional differences in these opportunities between the HST Network Alternatives because of differences in the pattern of induced population and employment growth. In northern San Joaquin Valley counties, more employment opportunities would be expected for environmental justice populations with the Altamont network alternative. In other San Joaquin Valley and Southern California counties, more employment opportunities would be expected with the Pacheco network alternative. Opportunities may be relatively similar between the HST Network Alternatives in the Bay Area.

5.4.7 Farmland and Agriculture

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in the 11 core study area counties. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based information used in Chapter 3 showing the location of lands in agricultural use to produce estimates of the extent to which farmland might be converted to urbanized areas.

Table 5.4-1 provides estimates of farmland acreage that could be converted to urbanized land uses for the No Project and HST Network Alternatives. Results are presented separately for categories of prime farmland, farmland of statewide importance, unique farmland, and farmland of local importance. The difference between the No Project and HST Network Alternatives provides an estimate of the indirect impact of induced growth on farmland and agriculture.

Table 5.4-1 Farmland Resources Potentially Affected by Future Urbanization

	Acreage of Resource Potentially Affected by Future Urbanization* (Percent Change from No Project Alternative)		
		HST Network Alternatives	
Area	No Project Alternative	Pacheco	Altamont
Prime Farmland			
Alameda County	3,062	3,089 (1%)	3,062 (0%)
Contra Costa County	8,108	8,607 (6%)	8,394 (4%)
San Francisco County	0	0	0
San Mateo County	398	398 (0%)	398 (0%)
Santa Clara County	4,935	4,952 (0%)	5,113 (4%)
Study Area—Bay Area	*16,502*	*17,045 (3%)*	*16,966 (3%)*
Fresno County	29,092	31,694 (9%)	31,563 (8%)
Madera County	2,899	2,955 (2%)	2,955 (2%)
Merced County	15,073	16,035 (6%)	15,587 (3%)
Sacramento County	163	163 (0%)	163 (0%)
San Joaquin County	25,113	24,496 (-2%)	25,136 (0%)
Stanislaus County	12,420	12,333 (-1%)	13,776 (11%)
Study Area—Central Valley	*84,760*	*87,675 (3%)*	*89,180 (5%)*
Core Study Area	101,261	104,721 (3%)	106,147 (5%)
Farmland of Statewide Importance			
Alameda County	835	890 (7%)	835 (0%)
Contra Costa County	2,743	2,733 (0%)	2733 (0%)
San Francisco County	0	0	0
San Mateo County	0	0	0
Santa Clara County	813	815 (0%)	870 (7%)
Study Area—Bay Area	*4,391*	*4,438 (1%)*	*4,438 (1%)*
Fresno County	3,754	4,248 (13%)	4,043 (8%)
Madera County	1,497	1,527 (2%)	1,512 (1%)
Merced County	3,729	4,060 (9%)	3,912 (5%)
Sacramento County	32,746	32,793 (0%)	33,320 (2%)
San Joaquin County	23,991	23,851 (-1%)	24,164 (1%)
Stanislaus County	2,716	2713 (0%)	3,593 (32%)
Study Area—Central Valley	*68,433*	*69,192 (1%)*	*70,544 (3%)*
Core Study Area	72,824	73,630 (1%)	74,982 (3%)
Unique Farmland			
Alameda County	588	657 (12%)	588 (0%)
Contra Costa County	1,184	1,176 (-1%)	1,176 (-1%)
San Francisco County	0	0	0
San Mateo County	156	156 (0%)	156 (0%)
Santa Clara County	91	91 (0%)	91 (0%)
Study Area—Bay Area	*2,019*	*2,081 (3%)*	*2,011 (0%)*

Area	Acreage of Resource Potentially Affected by Future Urbanization* (Percent Change from No Project Alternative)		
		HST Network Alternatives	
	No Project Alternative	Pacheco	Altamont
Fresno County	3,818	4,038 (6%)	4,055 (6%)
Madera County	3,430	4,260 (24%)	4,260 (24%)
Merced County	3,195	3,361 (5%)	3,361 (5%)
Sacramento County	1,878	1,878 (0%)	1,900 (1%)
San Joaquin County	2,861	2,861 (0%)	2,864 (0%)
Stanislaus County	974	974 (0%)	1,100 (13%)
Study Area—Central Valley	*16,156*	*17,372 (8%)*	*17,540 (9%)*
Core Study Area	18,175	19,452 (7%)	19,551 (8%)
Farmland of Local Importance			
Alameda County	7	7 (0%)	7 (0%)
Contra Costa County	9,543	9,640 (1%)	9,585 (0%)
San Francisco County	0	0	0
San Mateo County	126	126 (0%)	143 (14%)
Santa Clara County	1,100	1,129 (3%)	1,161 (6%)
Study Area—Bay Area	*10,776*	*10,902 (1%)*	*10,897 (1%)*
Fresno County	3,630	3,660 (1%)	3,637 (0%)
Madera County	1,623	1,767 (9%)	1,767 (9%)
Merced County	3,884	4,013 (3%)	4,013 (3%)
Sacramento County	13,467	13,494 (0%)	13,554 (1%)
San Joaquin County	10,277	10,285 (0%)	10,336 (1%)
Stanislaus County	106	106 (0%)	168 (58%)
Study Area—Central Valley	*32,989*	*33,325 (1%)*	*33,475 (1%)*
Core Study Area	43,765	44,227 (1%)	44,373 (1%)
All Farmland Lost			
Alameda County	4,492	4,643 (3%)	4,492 (0%)
Contra Costa County	21,577	22,155 (3%)	21,889 (1%)
San Francisco County	0	0	0
San Mateo County	680	680 (0%)	697 (3%)
Santa Clara County	6,939	6,988 (1%)	7,235 (4%)
Study Area—Bay Area	*33,688*	*34,466 (2%)*	*34,313 (2%)*
Fresno County	40,293	43,639 (8%)	43,298 (7%)
Madera County	9,449	10,509 (11%)	10,495 (11%)
Merced County	25,882	27,468 (6%)	26,873 (4%)
Sacramento County	48,255	48,329 (0%)	48,937 (1%)
San Joaquin County	62,243	61,492 (-1%)	62,500 (0%)
Stanislaus County	16,215	16,126 (-1%)	18,637 (15%)
Study Area—Central Valley	*202,337*	*207,564 (3%)*	*210,739 (4%)*
Core Study Area	236,025	242,030 (3%)	245,052 (4%)

Area	Acreage of Resource Potentially Affected by Future Urbanization* (Percent Change from No Project Alternative)		
		HST Network Alternatives	
	No Project Alternative	Pacheco	Altamont

* Values in the table indicate the resource acreage that is located in areas that are projected to become urbanized between the years 2002 and 2030 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics and Parsons Brinckerhoff 2007.

The potential induced growth associated with the HST Network Alternatives is projected to affect about 6,000 to 9,000 ac (2,429 to 3,652 ha) more of farmland for the core study area than the No Project Alternative, with the larger impacts being for the Altamont network alternative because of the overall higher amount of urbanization under this alternative. These impacts include an additional 3 to 5% more prime farmland, 1 to 3% farmland of statewide importance, 7 to 8% unique farmland, and 1% local farmland compared to the No Project Alternative. Fresno County is expected to experience the greatest absolute loss, about 3,000 ac (1,215 ha) under either HST Network Alternative, or one-third to one-half of the total impact. Madera and Merced Counties both will experience impacts of 1,000 ac (405 ha) or more under either HST Network Alternative, while Stanislaus County will experience impacts of 2,400 ac (972 ha) under the Altamont network alternative. On the other hand, Stanislaus and San Joaquin Counties could experience slight gains in farmland under the Pacheco network alternative. The already highly urbanized counties of the Bay Area are expected to experience minimal farmland impacts.

Projected farmland losses beyond the No Project Alternative would include 3,500 to 4,900 ac (1,417 to 1,984 ha) of prime farmland across the core study area, 800 to 2,200 ac (324 to 891 ha) of farmland of statewide interest, 1,300 to 1,400 ac (526 to 567 ha) of unique farmland, and 500 to 600 ac (202 to 243 ha) of farmland of local importance. Impacts on each category would be greater under the Altamont network alternative than the Pacheco network alternative.

5.4.8 Aesthetics and Visual Resources

Aesthetics and visual resources refer to the natural and human-made features of a landscape that characterize its form, line, texture, and color. The character of the existing landscape takes shape and would change in each region over time as a result of land uses, development, and urban growth that may occur under any of the alternatives. Increased population or employment related to induced growth could contribute to these impacts, as could the redirection of growth into HST station areas and adjacent communities. Whether these impacts are viewed as positive or negative depends on the specific nature and design of the growth that does occur as well as the subjective opinions of different viewers. In general, however, community land use plans and policies increasingly are emphasizing more compact development patterns as a preferred alternative to dispersed, low-density development. To the extent that the HST Network Alternatives encourage more compact and focused development in station areas, and support the preservation of undeveloped land elsewhere in the study area, this could represent a positive aesthetic and visual benefit. However, it would be speculative to attempt to characterize potential changes at the program level without more specific information about what might be built.

5.4.9 Utilities and Public Services

Utilities and public services include electrical transmission lines, natural gas facilities, and wastewater treatment facilities. The capacity and extent of these utilities and services would be expected to expand gradually or in increments to accommodate the growth in population, employment, and urbanized land area expected to occur in California between now and 2030. Because the additional population, employment, and land consumption related to growth potentially induced by the HST Network Alternatives are relatively small compared to the total growth from existing conditions under the No Project Alternative, no considerable impacts are expected in the areas of utilities and public services. As with many of the resource areas, there are potential county-level differences between the HST Network Alternatives as a result of patterns of induced population and employment growth. In northern San Joaquin Valley counties, utility and public service needs may be greater under the Altamont network alternative. In other San Joaquin Valley and Southern California counties, utility and public service needs may be greater under the Pacheco network alternative. Utility and public service needs may be relatively similar for the HST Network Alternatives in the Bay Area.

To the extent that the HST Network Alternatives encourage more compact growth patterns, however, the costs of providing utilities and public services potentially could be reduced compared to the costs of serving a more dispersed pattern of development. Costs also might be reduced to the extent that specific alignments and station locations encourage development in existing, developed areas versus areas that currently are undeveloped.

5.4.10 Hazardous Materials and Wastes

Increased population or employment related to growth potentially induced by either HST Network Alternative would not be expected to increase the likelihood or potential severity of exposure to hazardous materials and wastes. No indirect impacts from induced growth are expected in the areas of hazardous materials and wastes.

5.4.11 Cultural and Paleontological Resources

Future growth is expected to result in large areas of land within and outside of cities being developed to urban density levels. However, it would be speculative to identify the likelihood or extent of potential impacts of development on prehistoric archaeological sites, historic archaeological sites, traditional cultural properties, historic structures, and paleontological resources at the program level without knowledge of the precise locations where development projects may be built. In general, both HST Network Alternatives are projected to have similar urbanization patterns as the No Project Alternative, with increased population and employment growth under the HST Network Alternatives offset by higher development density potential in the HST station areas.

Increased population or employment related to growth potentially induced by either HST Network Alternative would not increase the likelihood or extent of potential impacts on cultural or paleontological resources. No indirect impacts from induced growth are expected in the areas of cultural and paleontological resources.

5.4.12 Geology and Soils

Increased population or employment related to growth potentially induced by either HST Network Alternative would not increase the likelihood or extent of potential impacts related to geologic formations, seismic hazards, slope stability, oil and gas fields, or mineral resources. No indirect impacts from induced growth are expected in the areas of geology and soils.

5.4.13 Hydrology and Water Resources

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in the 11 core study area counties. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based maps showing general waterway locations to identify waterways that would be located in areas of future urbanization. Table 5.4-2 provides estimates of the miles of waterways that are in future growth areas and that, in turn, could be affected by this future growth. The difference between the No Project and the HST Network Alternatives provides an estimate of the potential indirect impact of induced growth on hydrology and water resources.

Induced growth associated with the HST Network Alternatives is projected to affect about 22 to 30 mi (35 to 48 km) more of waterways (2 to 3%) across the core study area than the No Project Alternative. Higher impacts are expected under the Altamont network alternative than the Pacheco network alternative because of the greater amount of urbanization projected under this alternative. The Bay Area would experience 9 to 10 mi (14 to 16 km) of waterway impacts, and the Central Valley would experience 13 to 20 mi (21 to 32 km) of impacts. The greatest impacts on an individual county level would be 8 mi in Santa Clara County under the Altamont network alternative, and 8 mi in Fresno County under the Pacheco network alternative.

Table 5.4-2 Hydrology and Water Resources Potentially Affected by Future Urbanization

	Waterways in Areas of Projected Urbanization*, in Miles (Percent Change from No Project Alternative)		
		HST Network Alternatives	
Area	No Project Alternative	Pacheco	Altamont
Prime Farmland			
Alameda County	215	218 (2%)	215 (0%)
Contra Costa County	84	86 (2%)	85 (1%)
San Francisco County	0	0	0
San Mateo County	51	51 (1%)	51 (1%)
Santa Clara County	77	80 (4%)	84 (10%)
Study Area—Bay Area	*426*	*435 (2%)*	*436 (2%)*
Fresno County	115	123 (7%)	121 (5%)
Madera County	34	35 (5%)	35 (4%)
Merced County	53	58 (9%)	56 (6%)
Sacramento County	135	135 (0%)	139 (3%)
San Joaquin County	191	190 (0%)	193 (1%)
Stanislaus County	54	54 (-1%)	60 (10%)
Study Area—Central Valley	*583*	*596 (2%)*	*603 (3%)*
Core Study Area	1,009	1,031 (2%)	1,040 (3%)

* Values in the table indicate the resource acreage that is located in areas that are projected to become urbanized between the years 2002 and 2030 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics and Parsons Brinckerhoff 2007.

5.4.14 Biological Resources

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in the 11 core study area counties. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based maps showing general locations of habitats in which threatened and endangered species may be found, to identify biological resources that could be affected by areas of future urbanization. Table 5.4-3 provides estimates of the acreage of potential habitat for threatened and endangered species that could be affected by this projected future growth. The difference between the No Project and the HST Network Alternatives provides an estimate of the indirect impact of induced growth on biological resources.

Induced growth associated with the HST Network Alternatives is projected to affect about 2,600 to 3,600 ac (1,053 to 1,457 ha) more of threatened and endangered habitat (2–3%) across the core study area than the No Project Alternative. Impacts are expected to be greater under the Altamont network alternative than the Pacheco network alternative. The largest increases (1,300–1,500 ac [526–607 ha) are expected to occur in the Bay Area—particularly Alameda, Contra Costa, and Santa Clara Counties—representing an increase in affected land area of 4% across all five counties. In the Central Valley, about 650 ac (263 ha) are expected to be affected under the Altamont network alternative, with little or no net impact under the Pacheco network alternative. Fresno and Madera Counties are not expected to experience additional impacts under either HST Network Alternative.

Table 5.4-3 Biological Resources Potentially Affected by Future Urbanization

	Habitat of Threatened and Endangered Species in Areas of Projected Urbanization*, in Acres (Percent Change from No Project Alternative)		
		HST Network Alternatives	
Area	No Project Alternative	Pacheco	Altamont
Prime Farmland			
Alameda County	17,297	17,675 (2%)	17,557 (2%)
Contra Costa County	11,372	11,826 (4%)	11,639 (2%)
San Francisco County	0	0	0
San Mateo County	3,002	3,015 (0%)	3,022 (1%)
Santa Clara County	4,356	4,828 (11%)	5,288 (21%)
Study Area—Bay Area	*36,027*	*37,344 (4%)*	*37,506 (4%)*
Fresno County	7,225	7,225 (0%)	7,225 (0%)
Madera County	40	40 (0%)	40 (0%)
Merced County	1,290	1,334 (3%)	1,334 (3%)
Sacramento County	9,442	9,459 (0%)	9,699 (3%)
San Joaquin County	32,714	32,687 (0%)	32,848 (0%)
Stanislaus County	5,098	5,041 (-1%)	5,313 (4%)
Study Area—Central Valley	*55,809*	*55,786 (0%)*	*56,459 (1%)*
Core Study Area	127,863	130,474 (2%)	131,471 (3%)

* Values in the table indicate the resource acreage that is located in areas that are projected to become urbanized between the years 2002 and 2030 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics and Parsons Brinckerhoff 2007.

5.4.15 Wetlands

The urbanization footprints described above in the discussion of farmland and agriculture were combined with GIS-based maps showing general wetland locations to identify wetlands that could be affected by areas of future urbanization. (See Section 3.15, Biological Resources and Wetlands.) Table 5.4-4 shows estimates of the wetland acreage that could be affected by this future growth. The difference between the No Project and the HST Network Alternatives provides an estimate of the potential indirect impact of induced growth on wetlands.

In total, induced growth associated with the HST Network Alternatives is projected to affect about 72 to 111 ac (29 to 45 ha) more of wetlands across the core study area than the No Project Alternative. This represents less than 0.5% of total study area wetlands. Under the Altamont network alternative, just over 100 ac (40 ha) are expected to be affected, primarily in Sacramento County. Under the Pacheco network alternative, the greatest impacts are expected to be in the Bay Area, particularly Alameda County (44 ac [18 ha]). Merced County is also projected to experience impacts of 15–17 ac (6– 7 ha), and Stanislaus County would see impacts of 12 ac (5 ha) under the Pacheco network alternative. Impacts in other counties would be no more than 5 ac (2 ha).

Table 5.4-4 Wetlands Potentially Affected by Future Urbanization

	Wetlands Within Areas of Projected Urbanization* (Acres) (Percent Change from No Project Alternative)		
		HST Network Alternatives	
Area	No Project Alternative	Pacheco	Altamont
Prime Farmland			
Alameda County	8,305	8,350 (1%)	8,305 (0%)
Contra Costa County	608	613 (1%)	608 (0%)
San Francisco County	0	0	0
San Mateo County	2,540	2,540 (0%)	2,540 (0%)
Santa Clara County	4,460	4,460 (0%)	4,465 (0%)
Study Area—Bay Area	*15,914*	*15,963 (0%)*	*15,919 (0%)*
Fresno County	1,050	1,048 (0%)	1,050 (0%)
Madera County	294	297 (1%)	297 (1%)
Merced County	418	435 (4%)	432 (4%)
Sacramento County	3,153	3,158 (0%)	3,225 (2%)
San Joaquin County	1,626	1,626 (0%)	1,631 (0%)
Stanislaus County	324	324 (0%)	336 (4%)
Study Area—Central Valley	*6,865*	*6,887 (0%)*	*6,971 (2%)*
Core Study Area	22,778	22,850 (0%)	22,889 (0%)

* Values in the table indicate the resource acreage that is located in areas that are projected to become urbanized between the years 2002 and 2030 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics and Parsons Brinckerhoff 2007.

5.4.16 Section 4(f) and 6(f) Resources (Public Parks and Recreation)

Increased population or employment related to induced growth would not increase the likelihood or extent of potential impacts on or uses of Section 4(f) and 6(f) resources, including publicly owned land from parks, recreation lands, wildlife and waterfowl refuges, and historic sites. No indirect impacts from induced growth are expected on Section 4(f) and 6(f) resources.

5.5 Growth Inducement and Secondary Impact Differences among HST Alignment Alternatives and Station Location Options

The discussion of induced growth secondary impacts compares the general nature of impacts associated with the HST Network Alternatives to the No Project Alternative. Although quantitative employment and population impacts were not generated for every alignment and station location option, qualitative distinctions nevertheless can be made among these options.

For this discussion, the difference in impacts will be most significant between the two general choices of the Altamont and Pacheco network alternatives. In the primary study area of this environmental analysis, the Altamont network alternative would be expected to have a greater influence on all secondary impact areas than the Pacheco network alternative for two reasons. First, the Altamont network alternative is projected to induce about 6,000 more jobs and 50,000 more residents than the Pacheco network alternative in the Bay Area to Central Valley study area. Second, the Altamont network alternative is likely to have more stations in total than the Pacheco network alternative, leading to more geographic locations that could experience secondary impacts on local and regional traffic, air quality, energy, land use, and related ecological resources.

Madera and Merced Counties are likely to experience the greatest magnitude of secondary impacts among all study area counties for both HST Network Alternatives. Based on projected levels of induced growth, Stanislaus County is likely to exhibit an equally high magnitude of secondary impacts with the Altamont network alternative; under the Pacheco network alternative, Stanislaus County's secondary impacts are likely to be much lower.

All of the Altamont HST Alignment Alternatives are likely to create equal magnitudes and spatial patterns of secondary impacts because all alignments offer relatively similar travel time and station location options in the Bay Area.

The two Pacheco HST Alignment Alternatives, Henry Miller and GEA North, also are likely to produce similar patterns of induced growth and secondary impacts for all counties in the core study area. Although these two Pacheco alignment alternatives provide noticeably different HST travel times between the Bay Area and northern Central Valley, there are equally noticeable, yet opposite, travel time differences between the Bay Area and locations south of Merced County. The net effect is that the slight congestion reduction and HST ridership benefits provided by the Henry Miller alignment offset the accessibility benefits (between the Bay Area and northern Central Valley) provided by the GEA North alignment.

Adding, dropping or changing station locations will lead to changes in potential secondary impacts at the station in question as well as in the HST system as a whole. In individual counties, the most notable situation is in Merced County, where the SP Downtown station could be on either the Sacramento or Southern California HST lines depending upon the alignment followed west of Merced; the Castle AFB station, on the other hand, always would be served by HST service between the Bay Area and Sacramento. In Stanislaus County, the Amtrak Briggsmore station could lead to the urbanization of 1,000 more acres in the county than the SP Downtown station site[9], leading to additional indirect impacts; this difference between station sites accounts for about 35% of the difference in urbanized area size between the Altamont and Pacheco network alternatives noted in Table 5.3-6 for Stanislaus County. In the East Bay, HST stations that interface with the BART system may induce larger overall growth and secondary impacts attributable to improved regionwide accessibility. On the San Francisco Peninsula, all proposed HST stations offer the opportunity for intermodal transfers with Caltrain, and all proposed station sites have substantial station-area activity of one form or another. The most likely location for differences in

[9] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, Section 5.2, July 2003.

areawide growth inducement and secondary impacts is with the San Francisco station location. The Transbay Transit Center offers better access than the 4^{th}/Townsend site to the high density employment and activity center in Downtown San Francisco; this improved accessibility is likely to lead to the potential for additional growth inducement and secondary impacts.

Alternative station locations in the same general vicinity may have different localized secondary impacts, but overall impacts throughout the study area are likely to be similar. Different areawide impacts will arise from adding or dropping an HST station for a community or subarea as a whole. For example, not providing an HST station in the Tri-Valley or Tracy areas likely would lower overall growth inducement and secondary impacts because job accessibility and business attraction benefits throughout the study area would be lower. A similar situation would occur for the Pacheco network alternative if a station were not provided in Gilroy or Morgan Hill; in such a situation, access to the HST system from Monterrey, San Benito, and Santa Cruz Counties would be reduced.

The extent of secondary impacts may not be directly proportional to the amount of induced growth. It will depend in part on the specific form of induced development in the study area, which in turn will depend on local land use plans and policies. For example, alignment and station locations that serve existing urban and community centers, rather than less-developed outlying areas, would be expected to result in lower ecological and natural resource impacts, but higher community and social impacts, because development would be concentrated in existing built-up areas. The community and social effects are likely to be both positive and negative because additional growth in existing communities could bring benefits such as jobs, increased property values, and enhancements to the community environment.

5.6 Managing Growth-Inducing and Indirect Effects

In general, HST station areas would offer a more attractive market for commercial and office development than the No Project Alternative. Research and analysis conducted for the Statewide Program EIR/EIS[10] of urban rail systems in North America and high-speed rail systems in Europe and Asia support this conclusion. This research found that industries needing many highly skilled and specialized employees are the most attracted to rail-station area development, and that a noticeable densification pattern would be likely to emerge in the vicinity of potential HST stations in response to real estate and market forces.

The research and analysis further indicated that an HST station is a considerably stronger draw for business development than a conventional intercity rail station or freeway interchange. This draw can encourage more compact development patterns, which have the potential to help avoid or minimize indirect impacts. These development patterns would likely offer many businesses a competitive advantage in their industry, because of proximity to ancillary industries (i.e., industry clustering) and access to a well-educated labor force. These advantages, known as economies of agglomeration, have emerged around the French and Japanese HST stations.

The research also found that regulatory-style efforts by cities to encourage increased density and a mix of land uses near rail stations have been effective in attracting higher-density development. A Central Valley city, for example, would have an easier time redirecting new development to downtown sites adjacent to their HST station site than the outlying real estate markets created by freeway interchanges under the No Project Alternative. Furthermore, the strong real estate markets around HST stations are likely to attract development that otherwise would locate throughout a dispersed suburban region. Thus, development around HST stations potentially would consist of both consolidation of currently projected

[10] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, Section 3.3, July 2003.

growth (under the No Project Alternative) and new regional employment and population associated with either HST Network Alternative.

The potential effect of regulatory style land-use strategies was tested in the Statewide Program EIR/EIS[11]. Results suggested that even a modest strategy focused on the immediate station areas could reduce the potential statewide urbanized acreage by an additional 30,000 ac (12,141 ha) (0.6% of total urbanized acreage in study area) under an HST Network Alternative. These results represent a low-end estimate of the possible densification effects of regulatory strategies in combination with the market forces likely to occur following the introduction of HST service. The research suggested that other jurisdictions have had some success in implementing more aggressive and regionwide regulatory-style strategies[12] in conjunction with high-capacity intercity and urban transit services. Experience in these areas suggests that more aggressive strategies might be more attractive to policy makers because HST could offer an economic rationale to developers to cluster new commercial, industrial, and residential development to provide easy access to the HST stations. In general, the No Project Alternative does not have the potential for such market incentive.

In short, either HST Network Alternative provides a strong incentive for directing urban growth and minimizing a variety of impacts that are frequently associated with growth. This outcome would be seen in results for resource topics such as farmland, hydrology, and wetlands, where the indirect effects of either HST Network Alternative are in some cases less than the No Project Alternative, even with more population and employment expected with the HST Network Alternative. Additional land use strategies, which would be highly compatible with either HST Network Alternative, could be considered to further reduce development impacts on sensitive natural resources; provide further concentration of employment in central areas that tend to be more readily accessible to minority and low-income populations; and provide further concentration of a wide variety of activities, making local transit options more feasible and possibly reducing local automobile travel.

[11] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, Section 5.1.3, July 2003.

[12] Examples of these strategies include urban growth boundaries, maximum parking requirements, jobs-housing balance, more diversity of land uses, higher densities, and higher service levels of mass transit.

6 HST STATION AREA DEVELOPMENT

There would be great benefits to enhancing development patterns and increasing development densities near proposed HST stations. To provide maximum opportunity for station area development in accordance with the purpose, need, and objectives for the HST system, the preferred HST station locations would be multi-modal transportation hubs and would typically be in traditional city centers. To further these objectives, when making decisions regarding both the final selection of station locations and the timing of station development, the Authority would consider the extent to which appropriate station area plans and development principles have been adopted by local authorities.

In addition to potential benefits from minimizing land consumption needs for new growth, dense development near HST stations would concentrate activity conveniently located to stations. This would increase the use of the HST system, generating additional HST ridership and revenue to benefit the entire state. It also would accommodate new growth on a smaller footprint. Reducing the land needed for new growth should reduce pressure for new development on nearby habitat areas, in environmentally fragile or hazardous areas, and on agricultural lands. Denser development allowances would also enhance joint development opportunities at and near the station, which in turn could increase the likelihood of private financial participation in construction and operations related to the HST system. A dense development pattern can better support a comprehensive and extensive local transit and shuttle system, bike[1] and pedestrian paths, and related amenities that can serve the local communities as well as provide access and egress to HST stations. The Authority's adopted policies would ensure that implementation of the HST in California would maximize station area development that serves the local community and economy while increasing HST ridership.

6.1 General Principles for HST Station Area Development

HST station area development principles draw on TOD strategies that have been successfully applied to focus compact growth within walking distance of rail stations and other transit facilities. Applying TOD measures around HST stations is a strategy that works for large, dense urban areas, as well as smaller central cities and suburban areas. TOD can produce a variety of other local and regional benefits by encouraging walkable, bikable compact and infill development. Local governments would play a significant role in implementing station area development by adopting plans, policies, zoning provisions, and incentives for higher densities, and by approving a mix of urban land uses. Almost all TOD measures adopted by public agencies involve some form of overlay zoning that designates a station area for development intensification, mixed land uses, and improvements to the pedestrian/bicycle environment. TOD measures are generally applied to areas within one-half mile of transit stations, and this principal would be followed for HST stations.

Station area development principles that would be applied at the project level for each HST station and the areas around the stations would include the following features:

- Higher density development in relation to the existing pattern of development in the surrounding area, along with minimum requirements for density.
- A mix of land uses (e.g., retail, office, hotels, entertainment, residential) and a mix of housing types to meet the needs of the local community.
- A grid street pattern and compact pedestrian-oriented design that promotes walking, bicycle, and transit access with streetscapes that include landscaping, small parks, pedestrian spaces, bike lanes and bike racks.

[1] HST will include facilities to accommodate bicycles.

- Context-sensitive building design that considers the continuity of the building sizes and that coordinates the street-level and upper-level architectural detailing, roof forms, and the rhythm of windows and doors should be provided. New buildings should be designed to complement and mutually support public spaces, such as streets, plazas, other open space areas, and public parking structures.
- Limits on the amount of parking for new development and a preference that parking be placed in structures. TOD areas typically have reduced parking requirements for retail, office, and residential uses due to their transit access and walkability. Sufficient train passenger parking would be essential to the system viability, but this should, as appropriate, be offered at market rates (not free) to encourage the use of access by transit and other modes. Shared parking would be planned when the mix of uses would support it.

6.2 Implementation of HST Station Area Development Guidelines

The statewide HST system is likely to have more than 20 stations. The Authority has the powers necessary to oversee the construction and operation of a statewide high-speed rail system and to purchase the land required for the infrastructure and operations of the system. The responsibility and powers needed to focus growth and station area development guidelines in the areas around high-speed stations are likely to reside primarily with local government.

The primary ways in which the Authority can help ensure that the HST system becomes an instrument for encouraging maximizing implementation of station area development principles include:

- Select station locations that are multi-modal transportation hubs with a preference for traditional city centers.
- Adopt HST station area development policies and principles that require TOD, and promote value-capture at and around station areas as a condition for selecting a HST station site.
- Provide incentives for local governments where potential HST stations may be located to prepare and adopt Station Area Plans and to amend City and County General Plans that incorporate station area development principles in the vicinity of HST stations.

6.2.1 Select Station Locations that Are Multi-Modal Transportation Hubs, Preferably in Traditional City Centers.

HST stations in California would be multi-modal transportation hubs. To meet the Authority's adopted objectives[2], the locations that were selected as potential HST stations would provide linkage with local and regional transit, airports, and highways. In particular, convenient links to other rail services (heavy rail, commuter rail, light rail, and conventional intercity) would promote TOD at stations by increasing ridership and pedestrian activity at these *hub* stations. A high level of accessibility and activity at the stations can make the nearby area more attractive for additional economic activity.

Most of the potential stations identified for further evaluation are located in the heart of the downtown/central city area of California's major cities. By eliminating potential *greenfield* sites[3], the Authority has described a proposed HST system that meets the objectives of minimizing potential impacts on the environment and maximizing connectivity with other modes of transportation. These locations also would have the most potential to support infill development and TOD.

2 See the final statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005), Section 1.2.1 ,Purpose of High-Speed Train System.

3 Sites in rural areas with very limited or no existing infrastructure.

6.2.2 Adopt HST Station Area Development Policies that Require TOD, and Promote Value-Capture at and around Stations as a Condition for Selecting a HST Station Site

Through subsequent CEQA and NEPA processes, the Authority would determine where stations would be located and how many HST stations there would be. The Authority has identified TOD and value-capture at and around stations sites as essential for promoting HST ridership. The Authority would work with local governments to ensure these policies are adopted and implemented.[4]

Local government would be expected to promote TOD and to use value-capture techniques to finance and maintain station amenities and the public spaces needed to create an attractive pedestrian environment. Because the HST stations would be public gathering places, value-capture techniques should be used to enhance station designs with additional transportation or public facilities. It is the Authority's policy that parking for HST services at HST stations should, as appropriate, be provided at market rates (no free parking). The Authority would maximize application of TOD principles during the site-specific review of proposed station locations. In addition, for HST stations in the Central Valley, the Authority will undertake a comprehensive economic study of the kinds of businesses that would uniquely benefit from being located near HST station areas, including a thoroughgoing estimate of the kinds and numbers of jobs that such businesses would create.

The Authority has prescribed the following criteria for HST station locations:

- To be considered for a station, the proposed site must have the potential to promote higher density, mixed-use, pedestrian accessible development around the station.
- As the HST project proceeds to more detailed study, and before a final station location decision is made, the responsible local government(s) are expected to provide (through planning and zoning) for TOD around HST station locations.
- Give priority to stations for which the city and/or county has adopted station area TOD plans and general plans that focus and prioritize development on the TOD areas rather than on auto-oriented outlying areas.
- As the project proceeds to more detailed study, local governments are expected to finance (e.g., through value-capture or other financing techniques) the public spaces needed to support the pedestrian/bicycle traffic generated by hub stations, as well as identifying long-term maintenance of the spaces.

The imperative to link transportation investments with supportive land use was made clear in a recent study by the MTC. The study showed that people who both live and work within a half mile of a rail stop use transit for 42% of their work trips, more than 10 times as much as others in the region.[5]

Both BART and MTC have adopted policies that link funding for transit expansion with land use. In July 2005, MTC adopted a TOD policy for regional expansion projects to help improve the cost effectiveness of regional investments. The TOD policy calls for a minimum threshold of housing within a half mile of new transit stations. For communities that do not meet the threshold, MTC provides grants to cities for community-based planning processes.

4 As part of the "Staff Recommendations" adopted at the January 26, 2005, Authority Board Meeting in Sacramento.

5 Characteristics of Rail and Ferry Station Area Residents in the San Francisco Bay Area: Evidence from the 2000 Bay Area Travel Survey. Volume 1. MTC, September 2006.

BART's Strategic Plan mandates that BART partner with communities to make investment choices that encourage and support TOD and increased transit use. BART's System Expansion Policy helps determine where new expansions will go, in part based on a commitment by the municipality to help generate new ridership with transit-supportive growth and development, as well as a high level of access by local transit, bicycle, and walking to the new station. The BART and MTC policies offer different approaches for TOD; one uses minimum thresholds for housing units and the other that focuses on a level of ridership provided. The Authority will analyze these policies and others like it throughout the country in developing specific TOD guidelines.

6.2.3 Provide Incentives for Local Governments in which Potential HST Stations Would Be Located to Prepare and Adopt Station Area Plans, Amend City and County General Plans, and Encourage TOD in the Vicinity of HST Stations

Throughout future environmental processes and the implementation of the HST, the Authority would continue to work closely with the communities being considered for HST stations. It is important to understand HST as a system that will have regional as well as statewide ridership. It will provide an opportunity to improve and expand local transit systems leading to the HST stations and to have additional job and housing growth along those transit corridors.

Local governments can use a number of mechanisms to encourage higher density HST-oriented development in and around potential HST station locations and to minimize undesirable growth effects. These include developing plans (such as specific plans, transit village plans, regional plans, and greenbelts), development agreements, zoning overlays, and, in some cases, use of redevelopment authority.

Increased density of development in and around HST stations would provide public benefits beyond the benefits of access to the HST system itself. Such benefits could include relief from traffic congestion, improved air quality, promotion of infill development, preservation of natural resources, more affordable housing, promotion of job opportunities, reduction in energy consumption, and better use of public infrastructure. The Authority and local government working together would determine which mechanisms best suit each community and could be implemented to enhance the benefits possible from potential HST station development.

Most successful contemporary examples of urban development are the product of long-term strategic planning. For example, in France and Japan, where there has been considerable success guiding new development around HST stations, local governments typically prepare long-term plans that focus growth at each HST station area. Regional plans are also typically used to coordinate station area development with existing urban areas and reserves for parks, agriculture, and natural habitat.

Over the last 5 years, four of the major regions of California—Los Angeles, San Diego, Sacramento, and the Bay Area—have developed regional blueprints. Eight counties in the Central Valley are now conducting their own blueprint process. All of these blueprints focus on supporting the existing downtowns and increasing transit ridership as critical ways for future growth to be environmentally and economically sustainable. The HST could provide a major boost to these blueprints by greatly increasing access to the downtowns, directly supporting local and regional rail systems, and indirectly supporting bus and light rail systems with an infusion of additional riders.

A useful starting point for station area development is to work with the community to identify needs and missing assets they would like to see as part of any new development, such as parks, libraries, and food stores and to assess the market sizes needed to attract and retain such uses. Local government can also review the availability of land around potential station sites to achieve development that is of sufficient size to be economically viable. Then an illustrative site and phasing plan for a station area that is realistic from a market perspective can be developed and shared with the community. Finally, a station area plan can be prepared, which would ensure the community and potential developers of a public commitment to promote compact, efficient, TOD around station areas. Infrastructure improvements for station area development should be included in the station area plan.

Significant growth is expected in large areas of California with or without an HST system. The proposed HST system, however, would be consistent with and promote the state's adopted smart growth principles[6] and could be a catalyst for wider adoption of smart growth principles in communities near HST stations. With strong companion policies and good planning, HST stations should encourage infill development, help protect environmental and agricultural resources by encouraging more efficient land use, and minimize ongoing cost to taxpayers by making better use of our existing infrastructure.

The Authority's selection of station locations and the timing of station development would consider adherence to the principles in the section. In pursuing its objective of providing a profitable and successful HST, the Authority will use its resources, both financial and otherwise, to encourage the local government authority with development jurisdiction at and around potential HST stations to take the following steps:

- In partnership with the Authority, develop a station area plan[7] for all land within a half mile of the HST pedestrian entrance that adheres to the station area development principles (described above).
- Use a community planning process to plan the street, pedestrian, bicycle environment, parks and open spaces, and other amenities.
- Incorporate the station area plan through amendment of the city or county general plan and zoning.
- Use community planning processes to develop regional plans and conform amendments to general plans, which would focus development in existing communities and would provide for long-term protection of farmland, habitat, and open space.

6 As expressed in the Wiggins Bill (AB857, 2003), and in government code 65041.1.

7 Such a plan could take the form of a specific plan pursuant to California Government Code sections 65450–65457 or a Transit Village Development Plan pursuant to California Government Code sections 65460–65460.10, which specify the content for such a plan, or another form as determined appropriate by local government.

7 HIGH-SPEED TRAIN NETWORK AND ALIGNMENT ALTERNATIVES COMPARISONS

7.1 Introduction

7.1.1 Purpose and Content of This Chapter

The purpose of this chapter is to summarize and compare the physical and operational characteristics and potential environmental consequences associated with different combinations of alignment alternatives that comprise the HST Network Alternatives, as well as differences among alignment alternatives and potential station location options. This chapter summarizes potential environmental consequences for each of 21 representative network alternatives for the environmental resource areas where relative differences were identified (refer to Chapter 3 under Affected Environment, Environmental Consequences, and Mitigation Strategies for a comprehensive presentation of potential environmental consequences in each environmental resource area for each alignment alternative). The 21 representative network alternatives present a range of reasonable alternatives among the three basic approaches for linking the Bay Area and Central Valley: Altamont Pass (11 network alternatives); Pacheco Pass (6 network alternatives); and Pacheco Pass with Altamont Pass (local service) (4 network alternatives).

For many of the environmental topics discussed in this chapter, the quantities presented represent areas within which potential impacts might occur. For example, the area of floodplains includes all floodplains within 100 ft (30.5 m) of either side of the centerline of the alignment considered; whereas the right-of-way necessary for the improvements considered is smaller (e.g., only 25 ft [7.6 m] on either side of the centerline for the HST infrastructure). Therefore the magnitude of potential impacts reported in this document is considerably larger than the actual impacts that would be expected from the HST system within the study area.

7.1.2 Organization of This Chapter

The network alternatives and alignment alternatives comparisons are presented in tabular form. The station location options are presented individually and compared where multiple options are considered for the same general station area. The network alternatives, alignment alternatives, and station location options are briefly described in the tables and illustrated on the associated maps. For each alternative comparison, the following summary information is presented and compared where relative differences were identified.

- Physical/operational characteristics.
  - Alignment.
  - Length.
  - Capital cost.
  - Travel time.
  - Ridership.
  - Constructability.
  - Operational issues.
- Potential environmental impacts.
  - Transportation and related topics (travel conditions, noise and vibration).

- Human environment (land use and community impacts, farmlands and agriculture, aesthetics and visual resources, and socioeconomics).
- Cultural resources (archaeological resources, historical properties) and paleontological resources.
- Natural environment (geology and seismic hazards, hydrology and water resources, and biological resources and wetlands).
- Section 4(f) and 6(f) resources (certain types of publicly owned parklands, recreation areas, wildlife/waterfowl refuges, and historical sites).

The environmental topics for traffic, energy and air quality are not included in this chapter. The network alternatives have the potential to reduce overall air pollution, total energy consumption, and traffic congestion as compared to the No Project Alternative. The representative base HST forecast would result in a reduction of 22 million barrels of oil and 17.6 billion pounds of CO_2 emissions annually by 2030, as compared to the No Project Alternative. Diversions from the automobile to HST could lead to a projected 5% statewide reduction in vehicle miles traveled (VMT) on the highway system, with VMT reductions of between 7% and 12% in Bay Area and Central Valley counties.

The network alternatives with the highest ridership levels show the greatest reductions in VMT on the roadways in the region. The reduction in VMTs results in a corresponding reduction in vehicular emissions, energy consumption, and traffic. Therefore, in this chapter ridership is a proxy for traffic, energy and air quality benefits since the network alternatives with the highest ridership would have the greatest traffic, energy and air quality benefits.

7.2 Network Alternatives

The HST Network Alternatives represent different ways to implement the HST system in the study region along combinations of HST Alignment Alternatives and station location options. The HST system would continue outside the study region to the major metropolitan areas in the state, as described in the statewide program EIR/EIS (California High-Speed Rail Authority and Federal Railroad Administration 2005). Because there are many possible combinations of alignment alternatives and station location options, 21 representative network alternatives were selected (Section 2.5 and Table 2.5-1) and the findings for these alternatives are presented in tabular form in the following sections. Note that many other possible network combinations of alignment alternatives are possible. The following network alternatives have been selected as a representative sample to help identify major distinctions between network options and to define major tradeoffs among the possible networks for the Bay Area to Central Valley Region. The network alternatives vary in their ability to meet the purpose and need and objectives of the HST system and provide additional data to inform the future identification of preferred alignment alternatives and station location options. Although HST Alignment Alternatives and station location options were screened and evaluated to identify those that are likely to be reasonable and practicable and meet the project's purpose and need, the representative HST Network Alternatives have not yet been so evaluated. The network alternatives were developed to enable an evaluation and comparison of how various combinations of alignment alternatives would meet the project's purpose and need and how each would perform as a HST network (e.g., travel times between various station locations, anticipated ridership, operating and maintenance costs, energy consumption, and auto trip diversions). The different system characteristics as well as environmental factors of the network alternatives present complex choices that will be better supported and informed following public review and comment on this document.

7.2.1 Altamont Pass Alternatives

A. SAN FRANCISCO AND SAN JOSE TERMINI

The San Francisco and San Jose termini network alternative is shown in Figure 7.2-1 and described in Table 7.2-1. The segments used for this representative alternative are Caltrain Corridor (San Francisco to Dumbarton), Dumbarton (high bridge)[1], Niles/I-880 (Niles Junction to San Jose via I-880)[2], East Bay Connection (Dumbarton/Niles XS), UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

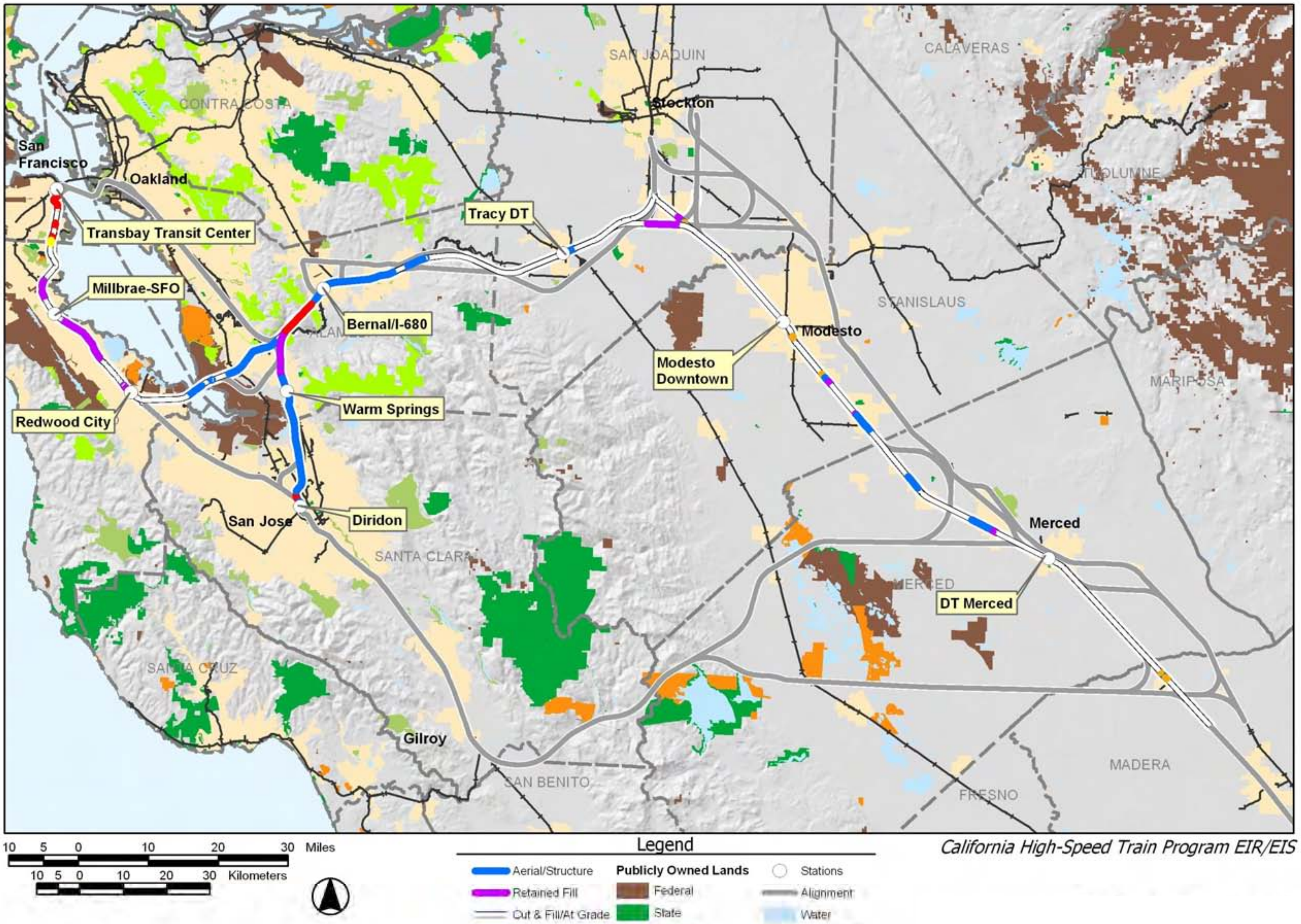
Table 7.2-1
Altamont Pass: San Francisco and San Jose Termini (Base Case for Altamont Pass)

Physical/Operational Characteristics	
Network Alternative Description	From San Francisco to Redwood City, this network alternative would use the existing Caltrain rail right-of-way and would cross the San Francisco Bay in the Dumbarton corridor. To San Jose, the Niles/I-880 alignment alternative would be used south of Niles. The Altamont Pass would use the UPRR alignment alternative through downtown Tracy, and the Central Valley would use the UPRR N/S alignment alternative. Station location options considered for this alternative are Transbay Transit Center, Millbrae/SFO, Redwood City (Caltrain), Fremont (Warm Springs), San Jose (Diridon), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	203.34 mi (327.24 km)
Cost (dollars)	$12.7 billion
Express Travel Times (minutes)	SF–LA=2:36; SF–Sac=1:06; SF–Fresno=1:18; SJ–LA=2:19 ; SJ–Sac=0:49; SJ–Fresno=1:01; Livermore–LA=2:06; Tracy–LA=1:59; SF–Tracy=0:42; SJ–Tracy=0:25.
Ridership	This network alternative would directly serve downtown San Francisco and SFO, San Jose, the I-580 corridor, and a portion of the I-880 corridor, and the Central Valley and would have high ridership and revenue potential. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 87.9–116 million passengers and $2.84–$3.8 billion per year by 2030[3].
Constructability	Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required. Portions of this network alternative include alignments in or along operating commuter and intercity rail lines. Maintaining operations on the existing commuter and intercity rail service while constructing grade separations, tunnels, elevated sections, and stations would involve considerable construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.

[1] Does not include “Dumbarton Wye South to Caltrain” segment.

[2] Does not include Niles Junction to Niles Wye S (“Niles/I-880 5A”) segment.

[3] The “Base Case” network alternative for the Altamont Pass and Pacheco Pass show a range for ridership and revenue forecasts where the “low-end” is the base forecast and the “high-end” is the high-end sensitivity analysis. For all other network alternatives, ridership and revenue numbers are only shown for the base case (low-end) assumptions.



FLY CALIFORNIA

U.S. Department of Transportation Federal Railroad Administration

Figure 7.2-1
Network Alternatives
Altamont Pass
San Francisco and San Jose Termini

Table 7.2-1
Altamont Pass: San Francisco and San Jose Termini (Base Case for Altamont Pass)

O & M Cost (dollars per year)	$1,099 million
Operational Issues	Average Speed SF–LA=168.8 mph (281.2kph); SF–Sac=129.5 mph (215.8 kph); SF–Fresno=148.0 mph (246.7 kph); SJ–LA=178.7 mph (297.9 kph);SJ–Sac=144.1 mph (240.2 kph);SJ–Fresno=165 mph (275 kph); Livermore–LA=182.9 mph (304.8 kph); Tracy–LA=183.4 mph (305.7 kph); SF–Tracy=107.1 mph (178.5 kph); SJ–Tracy=120.7 (201.2 kph). Maximum Speed SF–LA=210 mph (350 kph); SF–Sac=198 mph (330 kph); SF–Fresno=210 mph (350 kph); SJ–LA=210 mph (350 kph);SJ–Sac=198 mph (330 kph);SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); SF–Tracy=169.2 mph (282 kph); SJ–Tracy=180 mph (300 kph). This network alternative would require the system to split in two separate directions to serve both San Jose and San Francisco, given a constant number of trains. This decreases the frequency of service from southern California to these stations by a factor of two as compared to network alternatives using the Pacheco Pass alignment alternatives. Based on forecasted travel demand, two-thirds of the trains would be directed to San Francisco and one-third of the trains would be directed to San Jose. HST operations would need to be coordinated and integrated with Caltrain service on the San Francisco Peninsula and ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	This network alternative would cross the San Francisco Bay in the Dumbarton corridor. The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco, with potential stations in downtown San Francisco, at SFO (Millbrae), a mid-Peninsula station at Redwood City, an East Bay station at Fremont (Warm Springs), a South Bay station at San Jose (Diridon), a Tri-Valley station at Pleasanton (I-680/Bernal Road), a downtown station in Tracy, and Central Valley stations in Modesto and Merced. This network alternative would increase connectivity and accessibility to San Francisco, the northern peninsula and SFO (the hub international airport for northern California), southern Alameda County, San Jose, the I-580 corridor and Tri-Valley area, and the Central Valley. This network alternative would provide a safer, more reliable, energy-efficient intercity mode along the northern part of the San Francisco Peninsula, while improving the safety, reliability, and performance of the regional commuter service. This network alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Redwood City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S alignment alternative through the Central Valley. This network alternative would not provide direct HST service to Oakland, Oakland International Airport, or South Santa Clara County.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential for noise impacts for the overall alternative, with a high potential for noise impacts in the Dumbarton corridor. Medium potential for vibration impacts for the overall alternative. Medium potential for vibration impacts from San Francisco/San Jose to downtown Tracy, and an overall low potential in the Central Valley, with the exception of urban areas.

Table 7.2-1
Altamont Pass: San Francisco and San Jose Termini (Base Case for Altamont Pass)

	Along the Caltrain corridor from Redwood City to San Francisco, there would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at existing grade crossings.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway right-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It exhibits a medium to high compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, and in the Shinn area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice rating for the Caltrain Corridor (north of Redwood City) and the East Bay alignment to San Jose and low environmental justice rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice is rated as medium in the Central Valley, except in the Manteca area, where the rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway right-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon, Shinn, and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) Niles Junction to San Jose =medium; (3) UPRR =medium; (4) Tracy Downtown =low (5) Dumbarton High Bridge =medium; and (6) UPRR N/S =low. Overall network alternative rating is low to medium
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 764.2 ac (309.28 ha). Impact up to 429.1 ac (173.65 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative along with the San Francisco, Oakland, and San Jose Termini would have the greatest potential impact on farmland in the Altamont Pass network alternatives. The difference in overall farmland impacts in the Altamont Pass network alternatives is less than 9 ac (3.6 ha).
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 151 known cultural resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects, along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1890s. Archaeological resources in the area of the Dumbarton crossing include prehistoric sites associated with burials and historic sites from early 1900s industrial activities. Overall, this network alternative was identified as having a moderate sensitivity for cultural resources.

Table 7.2-1
Altamont Pass: San Francisco and San Jose Termini (Base Case for Altamont Pass)

Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 308.3 ac (124.76 ha) direct and 969.4 ac (392.30 ha) indirect. Streams: 16,824 linear ft (5,127.9 linear m) direct and 71,320 linear ft (21,738.30 linear m) indirect. Lakes/Waterbodies: 39.6 ac (16.03 ha) direct and 154.9 ac (62.68 ha) indirect. Of the Altamont Pass network alternatives, this network alternative along with four other network alternatives was identified as having the highest area of impact on lakes and the San Francisco Bay due to the Dumbarton crossing. This network alternative was also identified as having the potential to impact the most groundwater resources. Potentially affect San Francisco Bay, Guadalupe River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River, as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct, among other water resources. Includes tunnels that would avoid impacts on the floodplain and aboveground water resources and aerial structures that would minimize impacts on floodplains, streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 45.9 ac (18.59 ha) direct and 2,526 ac (1,022.2 ha) indirect. Nonwetland Waters: 16,773 linear ft (5,122.4 linear m). Species: 56 special-status plant and 50 special-status wildlife species. Of the Altamont Pass network alternatives, this network alternative along with two other network alternatives would have the potential to impact the most special-status wildlife species. This alternative could potentially result in impacts on biological resources in San Francisco Bay as a result of the Dumbarton crossing. Potentially significant impacts on special-status plant and wildlife species, wetlands, and waters. This network alternative would be along existing transportation corridors, with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management , such as the Don Edwards San Francisco Bay National Wildlife Refuge. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	San Bruno (Potentially Active) – At Grade Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) - At Grade Silver Creek (Potentially Active) - At Grade Hayward (Active) - Above Grade Mission (Potentially Active) - At Grade

Table 7.2-1
Altamont Pass: San Francisco and San Jose Termini (Base Case for Altamont Pass)

Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 32 public parks, recreation lands, wildlife and waterfowl refuges that are 0-150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated because much of the network alternative is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

[i] Generally, vibration is not a significant impact. However, sensitive and specific areas, such as historical structures and special habitats, could be affected.

[ii] The farmland resources study area is defined as 25 ft (7.6 m) on each side of the alignment. When the alignment is adjacent to an existing rail corridor, the study area extends 50 ft (15 m) from the rail right-of-way on the side the alignment would run. The study area for impacts of stations is the station area footprint.

[iii] The cultural resources and paleontological resources study area is defined as the area within 500 ft (152 m) on each side of the alignment centerline for new routes, 100 ft (30 m) from centerline along existing transportation facilities, and 500 ft (152 m) around station locations.

[iv] The hydrology and water resources study area is defined as 25 ft (7.6 m) on each side of the alignment for two tracks and as 50 ft (15 m) on each side of centerline for four tracks. The study area for indirect impacts is 50 ft (15 m) on each side of the alignment for two tracks and as 100 ft (30 m) on each side of centerline for four tracks. The study area for direct impacts of stations is the station area footprint, and the study area for indirect impact for stations is 50 ft (15 m) from the outside edge of the station footprint area.

[v] The biological resources and wetlands study area for direct impacts is defined as 50 ft (15 m) on each side of the alignment in urban areas and 0.25 mi (0.41 km) in rural areas. The study area for indirect impacts is 1,000 ft (305 m) in urban areas and 0.25 mi (0.41 km) in rural areas on each side of the alignment. The study area for direct impacts of stations is the station area, and the study area for indirect impacts for stations is 1,000 ft (305 m) in urban areas and 0.25 mi (0.41 km) in rural areas from the outside edge of the station footprint area.

[4] The 4(f) and 6(f) resources study area is defined as 900 ft (274 m) on each side of the alignment centerline.

B. OAKLAND AND SAN JOSE TERMINI

This network alternative is shown in Figure 7.2-2 and described in Table 7.2-2. The segments used for this representative alternative are Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose via I-880)[5], East Bay Connections (Dumbarton/Niles XN and Dumbarton/Niles XS), UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-2
Altamont Pass: Oakland and San Jose Termini

Physical/Operational Characteristics	
Network Alternative Description	From Oakland to San Jose, this network alternative would use the Niles/I-880 Alignment. The Altamont Pass would use the UPRR Alignment through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment. Station location options considered for this alternative are West Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	182.16 mi (293.17 km)
Cost (dollars)	$10.0 billion
Express Travel Times (minutes)	Oakland–LA=2:23; Oakland–Sac=0:53; Oakland–Fresno=1:04; SJ–LA=2:19; SJ–Sac=0:49; SJ–Fresno=1:01; Livermore–LA=2:06; LA–Tracy=1:59; Oakland–Tracy=0:29; SJ–Tracy=0:25.
Ridership	This network alternative would directly serve downtown San Jose and Oakland, with a station serving the Oakland International Airport (Coliseum/BART), the I-580 and I-880 corridors, and the Central Valley and would have high ridership and revenue potential. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 88 million passengers and $2.88 billion per year by 2030. Ridership for this network alternative would be about the same as the Altamont “Base Case” network alternative.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing passenger rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,085 million
Operational Issues	Average Speed SF–LA=168.8 mph (281.2kph); SF–Sac=129.5 mph (215.8 kph); SF–Fresno=148.0 mph (246.7 kph); SJ–LA=178.7 mph (297.9 kph);SJ–Sac=144.1 mph (240.2 kph);SJ–Fresno=165 mph (275 kph); Livermore–LA=182.9 mph (304.8 kph); Tracy–LA=183.4 mph (305.7 kph); SF–Tracy=107.1 mph (178.5 kph); SJ–Tracy=120.7 (201.2 kph). Maximum Speed SF–LA=210 mph (350 kph); SF–Sac=198 mph (330 kph); SF–Fresno=210 mph (350 kph);

[5] Does not include Niles Junction to Niles Wye S (“Niles/I-880 5A”) segment.

Table 7.2-2
Altamont Pass: Oakland and San Jose Termini

	SJ–LA=210 mph (350 kph);SJ–Sac=198 mph (330 kph);SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); SF–Tracy=169.2 mph (282 kph); SJ–Tracy=180 mph (300 kph). This network alternative would require the system to split in two separate directions to serve both San Jose and Oakland, given a constant number of trains. This decreases the frequency of service from southern California to these stations by a factor of two, as compared to network alternatives using the Pacheco Pass alignment alternatives. Based on forecasted travel demand, two-thirds of the trains would be directed to Oakland and one-third of the trains would be directed to San Jose. HST operations would need to be coordinated and integrated with ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	The Niles/I-880 corridor alignment alternatives would bring direct HST service up the East Bay to Oakland with potential stations in West Oakland at Oakland International Airport (Coliseum/BART), in the East and South Bay with stations in Union City (BART) and San Jose (Diridon), in the Tri-Valley with a station in Pleasanton (I-680/Bernal Road), in downtown Tracy, and in the Central Valley with stations in Modesto and Merced. This network alternative would increase connectivity and accessibility to Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, the I-580 Corridor and Tri-Valley area, and the Central Valley. This network alternative would provide a safer, more reliable, energy efficient intercity mode along the East Bay while improving the safety, reliability, and performance of the regional commuter service. This network alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Niles/I-880 alignment alternative between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S alignment alternative through the Central Valley. This network alternative would not provide direct HST service to San Francisco, SFO, the San Francisco Peninsula/Caltrain Corridor, and South Santa Clara County.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. Medium potential of vibration impacts for the overall alternative. High potential of vibration impacts from Oakland to Niles Junction. Medium potential of vibration impacts, from Niles Junction/San Jose to downtown Tracy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It exhibits a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the East Bay between Oakland and San Jose and low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.

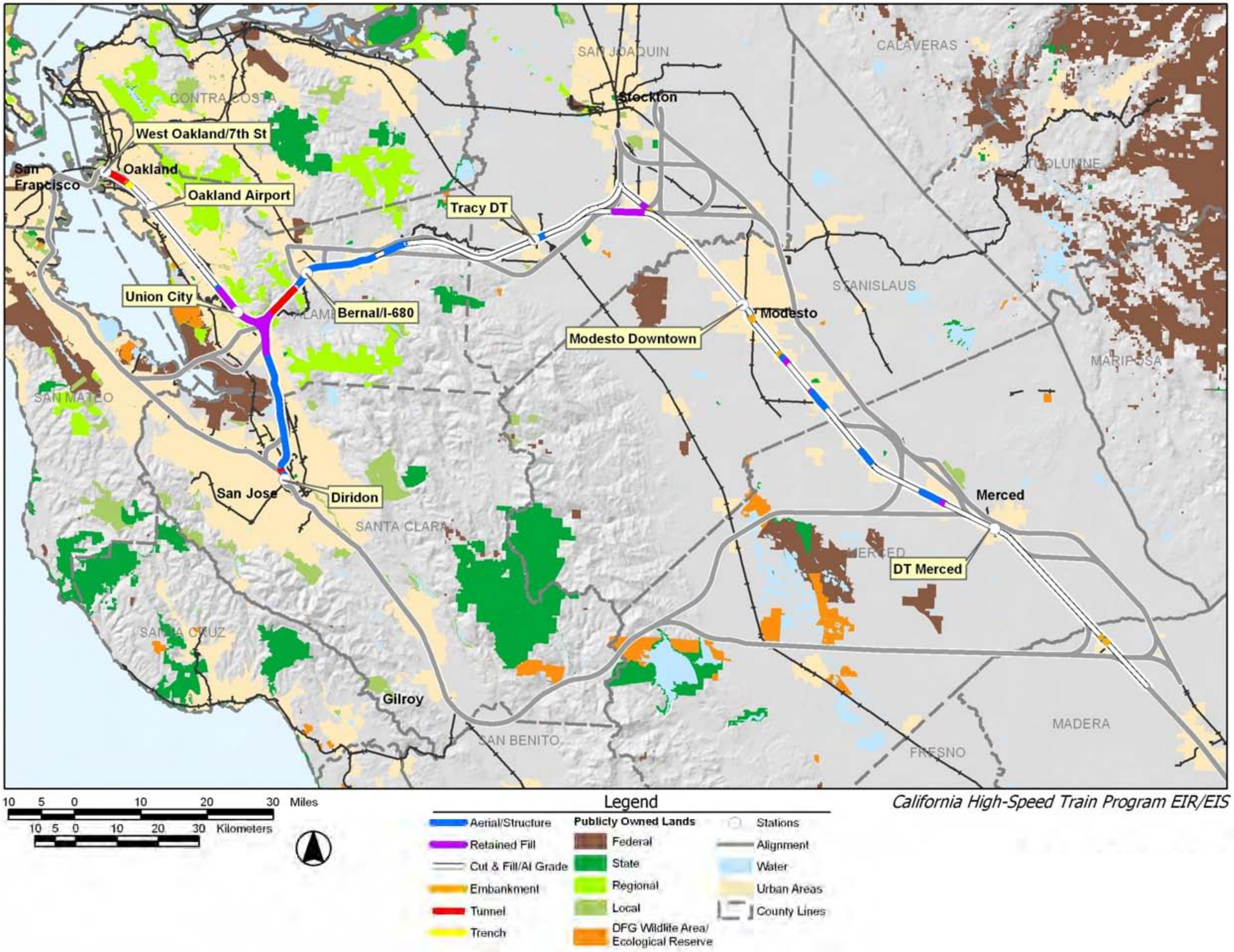


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Figure 7.2-2
Network Alternatives
Altamont Pass
Oakland and San Jose Termini

Table 7.2-2
Altamont Pass: Oakland and San Jose Termini

Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Oakland to Niles Junction =low; (2) Niles Junction to San Jose =medium; (3) UPRR =medium; (4) Tracy Downtown =low; and (5) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 761.9 ac (308.33 ha). Impact up to 426.8 ac (172.71 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative would have moderate impacts to farmland within the Altamont Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 128 known cultural resources. Historic properties and buildings dating from the 1900s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. Overall, this network alternative was identified as having a high sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 218.6 ac (88.48 ha) direct/ 720.4 ac (291.56 ha) indirect Streams: 17,660 linear ft (5,382.7 linear m) direct/ 76,905 linear ft (23,440.49 linear m) indirect Lakes/Waterbodies: 2.3 ac (0.93 ha) direct/ 7.6 ac (3.08 ha) indirect Of the Altamont Pass network alternatives, this network alternative along with four other network alternatives was identified to have the least area of impact on lakes and would not result in impacts on San Francisco Bay. Potentially affect Guadalupe River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 12.3 ac (4.97 ha) direct/ 805 ac (325.7 ha) indirect Non-Wetland Waters: 14,032 linear ft (4,277.0 linear m) Species: 40 special-status plant and 44 special-status wildlife species Potentially significant impacts to special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.

Table 7.2-2
Altamont Pass: Oakland and San Jose Termini

Fault Crossings	Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 29 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

C. SAN FRANCISCO, OAKLAND, AND SAN JOSE TERMINI

This network alternative is shown in Figure 7.2-3 and described in Table 7.2-3. The segments used for this representative alternative are Caltrain Corridor (SF to Dumbarton), Dumbarton (High Bridge)[6], Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose via I-880)[7], East Bay Connections (Dumbarton/Niles XS & Dumbarton/Niles XN), UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-3
Altamont Pass: San Francisco, Oakland, and San Jose Termini

Physical/Operational Characteristics	
Network Alternative Description	From Oakland to San Jose, this network alternative would use the Niles/I-880 Alignment. From San Francisco to Redwood City, this network alternative would use the existing Caltrain rail right-of-way. This network alternative would cross the San Francisco Bay in the Dumbarton corridor. The Altamont Pass would use the UPRR Alignment through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment. Station location options considered for this alternative are Transbay Transit Center, Millbrae/SFO, Redwood City (Caltrain), West Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	241.16 mi (388.12 km)
Cost (dollars)	$15.1 billion[8]
Express Travel Times (minutes)	SF–LA=2:36; Oakland–LA=2:23; SJ–LA=2:19; SF–Sac=1:06; Oakland–Sac=0:53; SJ–Sac=0:49; SF–Fresno=1:18; Oakland–Fresno=1:04; SJ–Fresno=1:01; Livermore–LA=2:06; Tracy–LA=1:59; SF–Tracy=0:42; Oakland–Tracy=0:29; SJ–Tracy=0:25
Ridership	This network alternative would directly serve downtown San Francisco and San Francisco International Airport (SFO), Oakland and the Oakland International Airport (Coliseum/BART), San Jose and the I-580 and I-880 corridors, and the Central Valley. The ridership and revenue is less for this network alternative than other Altamont network alternatives because of the reduced frequency of service to major markets (some trains serving Oakland, some San Francisco, and some San Jose). Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 81.1 million passengers and $2.63 billion per year by 2030. Additional frequency of service to San Francisco, San Jose, and Oakland (along with higher operational costs) would be needed to increase ridership for this network alternative. Ridership for this network alternative is forecast to be about 7.7% less than the Altamont "Base Case" network alternative.

[6] Does not include "Dumbarton Wye South to Caltrain" segment.

[7] Does not include Niles Junction to Niles Wye S ("Niles/I-880 5A") segment.

[8] Includes terminal at 4th and King. Does not include segment cost from 4th Street to Transbay Transit Center or station cost for the Transbay Transit Center.

Table 7.2-3
Altamont Pass: San Francisco, Oakland, and San Jose Termini

Constructability	Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required. Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail and automobile traffic service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,098 million
Operational Issues	Average Speed SF–LA=168.8 mph (281.2 kph); Oakland–LA=176.3 mph (293.8 kph); SJ–LA=178.7 mph (297.9 kph); SF–Sac=129.5 mph (215.8 kph); Oakland–Sac=140.1 mph (233.5 kph); SJ–Sac=144.1 mph (240.2 kph); SF–Fresno=148 mph (246.7 kph); Oakland–Fresno=162.9_ mph (271.6 kph); SJ–Fresno=165 mph (275 kph); Livermore–LA=182.9 mph (304.8 kph); Tracy–LA=183.4 mph (305.7 kph); SF–Tracy=107.1 mph (178.5 kph); Oakland–Tracy=116.6 mph (194.3 kph); SJ–Tracy=120.7 mph (201.2 kph) Maximum Speed SF–LA=210 mph (350 kph); Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=198 mph (330 kph); Oakland–Sac=198 mph (330 kph); SJ–Sac=198 mph (330 kph); SF–Fresno=210 mph (350 kph); Oakland–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); SF–Tracy=169.2 mph (282 kph); Oakland–Tracy=178.2 mph (297 kph); SJ–Tracy=180 mph (300 kph) HST operations would need to be coordinated and integrated with Caltrain service on the SF Peninsula and ACE service in the I-580 corridor. Using the Altamont Pass would require the system to split in three different directions at Newark/Fremont to simultaneously serve San Jose, San Francisco, and Oakland in addition to the line split in the Central Valley to serve both Sacramento and the Bay Area. This would mean that some trains from Los Angeles or Sacramento would go to San Francisco and some to Oakland, while others would go to San Jose.[9] The variety of service types (express, semi-express, suburban express, regional, and local) and the comparatively short distances (relative to international high-speed train services in operation) between the three potential Bay Area terminus stations contribute to the significant inefficiency of serving all three of these stations. Based on forecasted travel demand, one-third of the trains were directed to each terminus, which is equivalent to two-thirds of the trains serving San Francisco and Oakland, with one-third of the trains serving San Jose.

[9] Separate trains are required because the trainsets cannot be easily split to send some vehicles to each destination. Although some passenger train services operate in this manner, the time required to physically separate a trainset into smaller units and prepare them for individual operation (e.g., ensuring separation of passengers, separating vehicles, initiating additional onboard personnel, switching power supply connections, completing system initiation checks after power switch, providing appropriate power vehicles) would be prohibitive, and the process would be highly undesirable for the passengers involved. In addition, the trainsets would be sealed for aerodynamic and passenger comfort purposes, further constraining the ability to physically split the trainsets, unless the trainsets were preconfigured in specific subsets prior to the start of service. Thus, it is assumed that the high-speed trainsets would not be physically separated during the operational period.

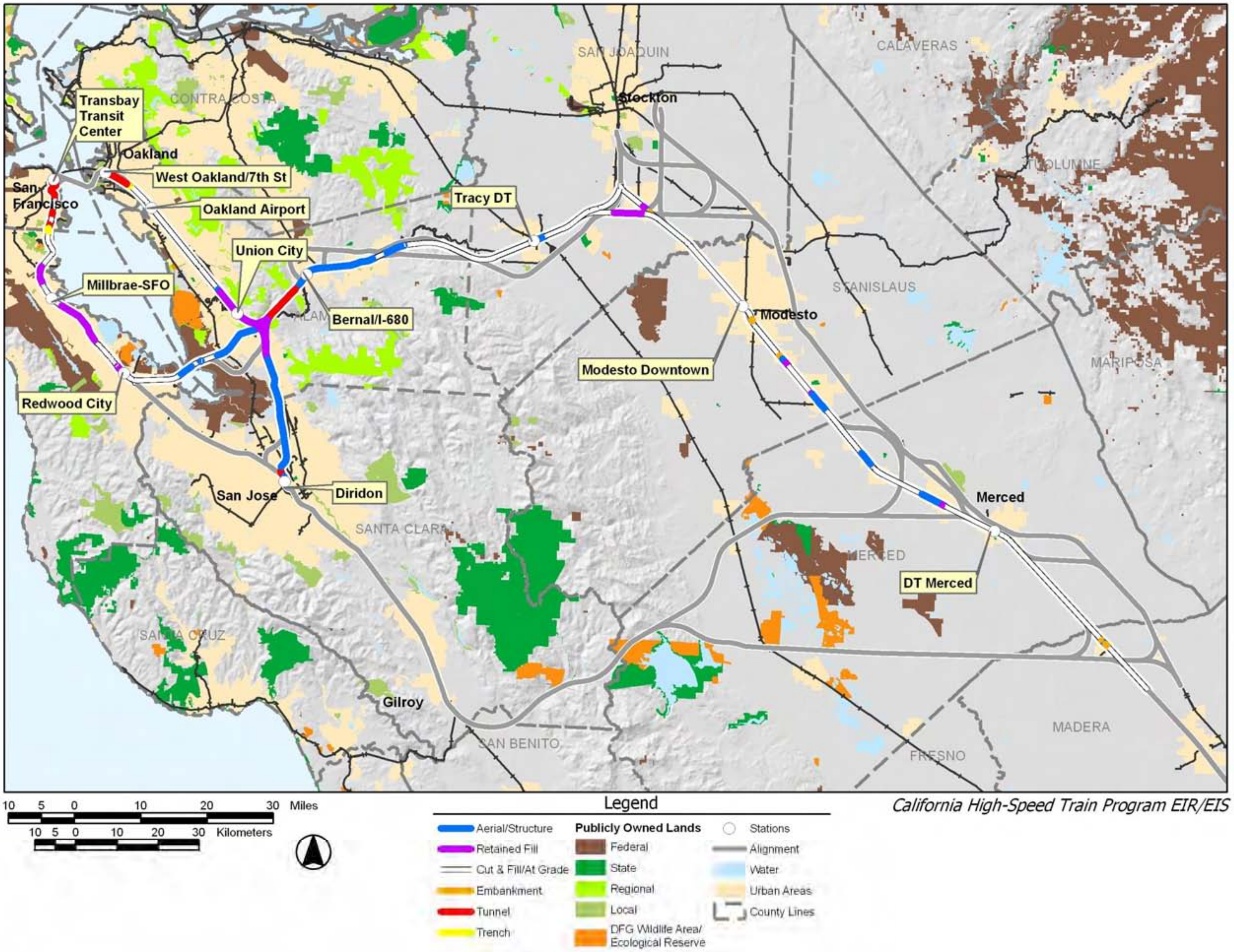

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Figure 7.2-3
Network Alternatives
Altamont Pass
San Francisco, Oakland, and San Jose Termini

Table 7.2-3
Altamont Pass: San Francisco, Oakland, and San Jose Termini

Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula from Redwood City to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), a mid-Peninsula station at Redwood City, to the East and South Bay with stations in Oakland, Oakland Airport (Coliseum/BART), Union City (BART) and San Jose (Diridon), to the Tri-Valley with a station in Pleasanton (I-680/Bernal Road), a downtown station in Tracy, and Central Valley stations in Modesto and Merced. This network alternative would increase connectivity and accessibility to San Francisco, the northern Peninsula and SFO, the hub international airport for northern California, Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, the I-580 Corridor and Tri-Valley area, and the Central Valley. This network alternative would provide a safer, more reliable, energy-efficient intercity mode along the northern portion of the San Francisco Peninsula while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Redwood City, Niles/I-880 Alignment between Oakland and Union City, would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley. This network alternative would not provide direct HST service to south Santa Clara County.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative, with a high potential of noise impacts in the Dumbarton Corridor. Medium potential of vibration impacts for the overall alternative. High potential of vibration impacts from Oakland to Niles Junction. Medium potential of vibration impacts, from San Francisco/Niles Junction/San Jose to downtown Tracy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It exhibits a medium to high compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the Caltrain Corridor (north of Redwood City) and the east bay alignment from Oakland to San Jose. It has a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon, Shinn, and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) Oakland to Niles Junction =low; (3) Niles Junction to San Jose =medium; (4) UPRR =medium; (5) Tracy Downtown =low; (6) Dumbarton High Bridge =medium; and (7) UPRR N/S =low. Overall network alternative rating is low to medium.

Table 7.2-3
Altamont Pass: San Francisco, Oakland, and San Jose Termini

Farmlands:[ii] Ac (ha) potentially affected	Farmland: 764.2 ac (309.28 ha) Impact up to 429.1 ac (173.65 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative along with the San Francisco and San Jose Termini would have the greatest potential impact on farmland within the Altamont Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 175 known cultural resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1890s. Archaeological resources in the area of the Dumbarton crossing include prehistoric sites associated with burials, and historic sites from early 1900s industrial activities. Overall, this network alternative was identified as having a high sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 315.3 ac (127.62 ha) direct/ 983.7 ac (398.12 ha) indirect Streams: 19,814 linear ft (6,039.3 linear m) direct/ 82,951 linear ft (25,283.31 linear m) indirect Lakes/Waterbodies: 39.6 ac (16.03 ha) direct/ 154.9 ac (62.68 ha) indirect Of the Altamont Pass network alternatives, this network alternative along with four other network alternatives was identified to have the highest area of impact on lakes and the San Francisco Bay due to the Dumbarton crossing. This network alternative was also identified as having the potential to encounter the most erosive soils. Potentially affect the San Francisco Bay, Guadalupe River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 46.3 ac (18.73 ha) direct/ 2,594 ac (1,049.7 ha) indirect Non-Wetland Waters: 16,932 linear ft (5,160.9 linear m) Species: 57 special-status plant and 50 special-status wildlife species Of the Altamont Pass network alternatives, this network alternative would have the potential to impact the most special-status plant species, wetlands, and waters. Along with two other network alternatives would have the potential to impact the most special-status wildlife species. This alternative could potentially result in impacts on biological resources in San Francisco Bay as a result of the Dumbarton crossing. Potentially significant impacts on special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the Don Edwards San Francisco Bay National Wildlife Refuge. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.

Table 7.2-3
Altamont Pass: San Francisco, Oakland, and San Jose Termini

Fault Crossings	San Bruno (Potentially Active) – At Grade Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Calaveras (Active) – At Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) - At Grade Silver Creek (Potentially Active) - At Grade Hayward (Active) - Above Grade Mission (Potentially Active) - At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 39 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

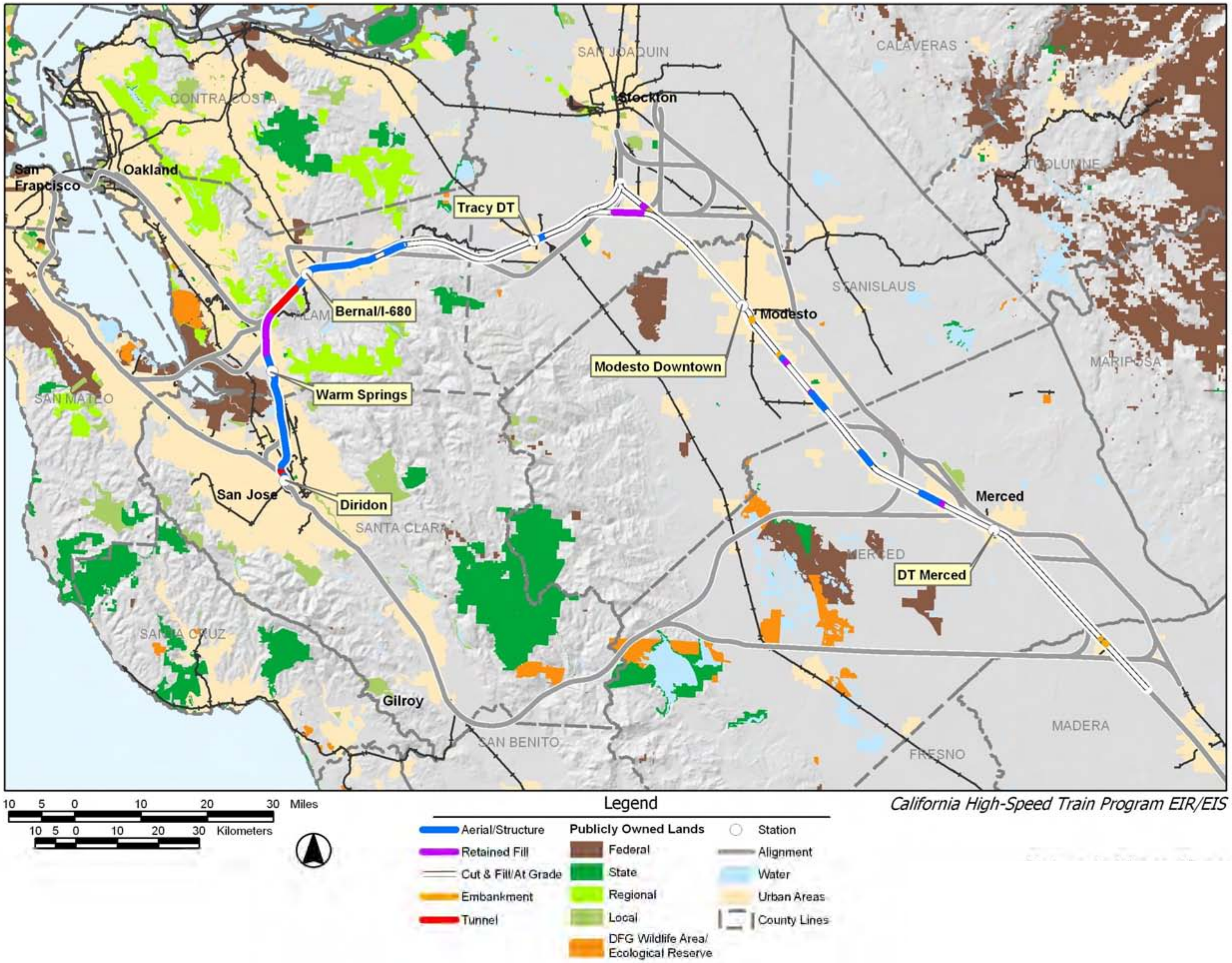
D. SAN JOSE TERMINUS

This network alternative is shown in Figure 7.2-4 and described in Table 7.2-4. The segments used for this representative alternative are Niles/I-880 (Niles Junction to San Jose via I-880)[10], East Bay Connection (Dumbarton/Niles XS), UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-4
Altamont Pass: San Jose Terminus

Physical/Operational Characteristics	
Network Alternative Description	From San Jose, this network alternative would use the Niles/I-880 Alignment between San Jose and Niles. The Altamont Pass would use the UPRR Alignment through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment Station location options considered for this alternative are San Jose (Diridon), Fremont (Warm Springs), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	160.18 mi (257.78 km)
Cost (dollars)	$7.7 billion
Express Travel Times (minutes)	SJ-LA=2:19; SJ-Sac=0:49; SJ Fresno=1:01; Livermore-LA=2:06; Tracy-LA=1:59; SJ-Tracy=0:25
Ridership	This network alternative would directly serve downtown San Jose, the I-880 and I-580 corridors, and the Central Valley. Although this network alternative does not directly serve Oakland or San Francisco, it provides high ridership and revenue because of the high frequency of service provided to San Jose. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 94.6 million passengers and $3.18 billion per year by 2030. Ridership for this network alternative is forecast to be about the 7.7% higher than the Altamont "Base Case" network alternative and with revenue about 11.7% higher.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,076 million
Operational Issues	Average Speed SJ–LA=178.7 mph (297.9 kph); SJ–Sac=144.1 mph (240.2 kph); SJ–Fresno=165 mph (275 kph); Livermore–LA=182.9 mph (304.8 kph); Tracy–LA=183.4 mph (305.7 kph); SJ–Tracy=120.7 mph (201.2 kph) Maximum Speed SJ–LA=210 mph (350 kph); SJ–Sac=198 mph (330 kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); SJ–Tracy=180 mph (300 kph) HST operations would need to be coordinated and integrated with all transportation services at San Jose. HST

[10] Does not include Niles Junction to Niles Wye S ("Niles/I-880 5a") segment.



U.S. Department of Transportation Federal Railroad Administration

Figure 7.2-4
Network Alternatives
Altamont Pass
San Jose Terminus

Table 7.2-4
Altamont Pass: San Jose Terminus

	operations would need to be coordinated and integrated with ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	This network alternative would increase connectivity and accessibility to southern Alameda County, San Jose, the I-580 Corridor and Tri-Valley area, and the Central Valley. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along a portion of the I-880 corridor and the I-580 corridor, with stations in San Jose (Diridon) Freeport (Warm Springs), Pleasanton (I-680/Bernal Road), downtown Tracy, and Central Valley stations in Modesto and Merced. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel to San Jose and reduce existing automobile traffic. The fully grade-separated UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley would improve local traffic flow and reduce air pollution at some existing rail crossings. This network alternative would not provide direct HST service to San Francisco, SFO, the SF Peninsula/Caltrain Corridor, Oakland, Oakland Airport, and south Santa Clara County resulting in considerably less Travel Conditions benefits (travel times, reliability, safety, connectivity, sustainable capacity, and passenger cost) than other network alternatives that directly serve additional stations/markets in the Bay Area.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. Medium potential of vibration impacts for the overall alternative. Medium potential of vibration impacts, from San Jose to downtown Tracy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the east bay from Niles Junction to San Jose and low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Niles Junction to San Jose =medium; (2) UPRR =medium; (3) Tracy Downtown =low; and (4) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 761.9 ac (308.33 ha) Impact up to 426.8 ac (172.71 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative would have moderate impacts to farmland within the Altamont Pass network alternatives.

Table 7.2-4
Altamont Pass: San Jose Terminus

Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 93 known cultural resources. Historic properties and buildings dating from the 1920s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1890s. Overall, this network alternative was identified as having a low sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 211.6 ac (85.62 ha) direct/ 706.1 ac (285.74 ha) indirect Streams: 14,670 linear ft (4,471.3 linear m) direct/ 65,274 linear ft (19,895.48 linear m) indirect Lakes/Waterbodies: 2.3 ac (0.93 ha) direct/ 7.6 ac (3.08 ha) indirect Of the Altamont Pass network alternatives, this network alternative along with four other network alternatives was identified to have the least area of impact on lakes and would not result in impacts on San Francisco Bay. This network alternative was also identified as having the potential to encounter the least amount of erosive soils. Potentially affect Guadalupe River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 12.0 ac (4.84 ha) direct/ 737 ac (298.1 ha) indirect Non-Wetland Waters : 13,577 linear ft (4,138.2 linear m) Species: 39 special-status plant and 43 special-status wildlife species Potentially significant impacts to special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 22 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

E. SAN FRANCISCO TERMINUS

This network alternative is shown in Figure 7.2-5 and described in Table 7.2-5. The segments used for this representative alternative are Caltrain Corridor (SF to Dumbarton), Dumbarton (High Bridge)[11], UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-5
Altamont Pass: San Francisco Terminus

Physical/Operational Characteristics	
Network Alternative Description	From San Francisco to Redwood City, this network alternative would use the existing Caltrain rail right-of-way north of Redwood City and would cross the San Francisco Bay in the Dumbarton Corridor. The Altamont Pass would use the UPRR Alignment through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment. Station location options considered for this alternative are Transbay Transit Center, Millbrae/SFO, Redwood City (Caltrain), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	191.55 mi (308.27 km)
Cost (dollars)	$11.0 billion
Express Travel Times (minutes)	SF-LA=2:36; SF-Sac=1:06; SF-Fresno=1:18; Livermore-LA=2:06; Tracy-LA=1:59; SF-Tracy=0:42
Ridership	This network alternative would directly serve downtown San Francisco and San Francisco International Airport (SFO), Union City, the I-580 corridor, and the Central Valley. Although this network alternative does not directly serve Oakland or San Jose, it provides high ridership and revenue because of the high frequency of service provided to San Francisco. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 93.9 million passengers and $3.13 billion per year by 2030. Ridership for this network alternative is forecast to be about 6.8% higher than the Altamont “Base Case” network alternative and with revenue about 10% higher.
Constructability	Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required. Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,124 million
Operational Issues	Average speed SF-LA=_168.8 mph (281.2 kph); SF-Sac=129.5 mph (215.8 kph); SF-Fresno=148 mph (246.7 kph); Livermore-LA=182.9 mph (304.8 kph); Tracy-LA=183.4 mph (305.7 kph); SF-Tracy=107.1 mph (178.5 kph Maximum speed

[11] Does not include “Dumbarton Wye South to Caltrain” segment.

Table 7.2-5
Altamont Pass: San Francisco Terminus

	SF-LA=210 mph (350 kph); SF-Sac=198 mph (330 kph); SF-Fresno=210 mph (350 kph); Livermore-LA=210 mph (350 kph); Tracy-LA=210 mph (350 kph); SF-Tracy=169.2 mph (282 kph) HST operations would need to be coordinated and integrated with Caltrain service on the SF Peninsula and ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), a mid-Peninsula station at Redwood City, a Tri-Valley in Pleasanton (I-680/Bernal Road) Station, a downtown station in Tracy, and Central Valley stations in Modesto and Merced. This network alternative would increase connectivity and accessibility to San Francisco, the northern Peninsula and SFO, the hub international airport for northern California, southern Alameda County, the I-580 Corridor and Tri-Valley area, and the Central Valley. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the San Francisco Peninsula and in the Tri-Valley while improving the safety, reliability, and performance of the regional commuter service to San Francisco. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Redwood City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley. This network alternative would not provide direct HST service to Oakland, Oakland Airport, San Jose, and south Santa Clara County resulting in considerably less Travel Conditions benefits (travel times, reliability, safety, connectivity, and passenger cost) than other network alternatives that directly serve additional stations/markets in the Bay Area.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative, with a high potential of noise impacts in the Dumbarton Corridor. Medium potential of vibration impacts for the overall alternative. Medium potential of vibration impacts, from San Francisco to downtown Tracy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It exhibits a medium to high compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon, Shinn, and Manteca areas, where additional right-of-way would be required.

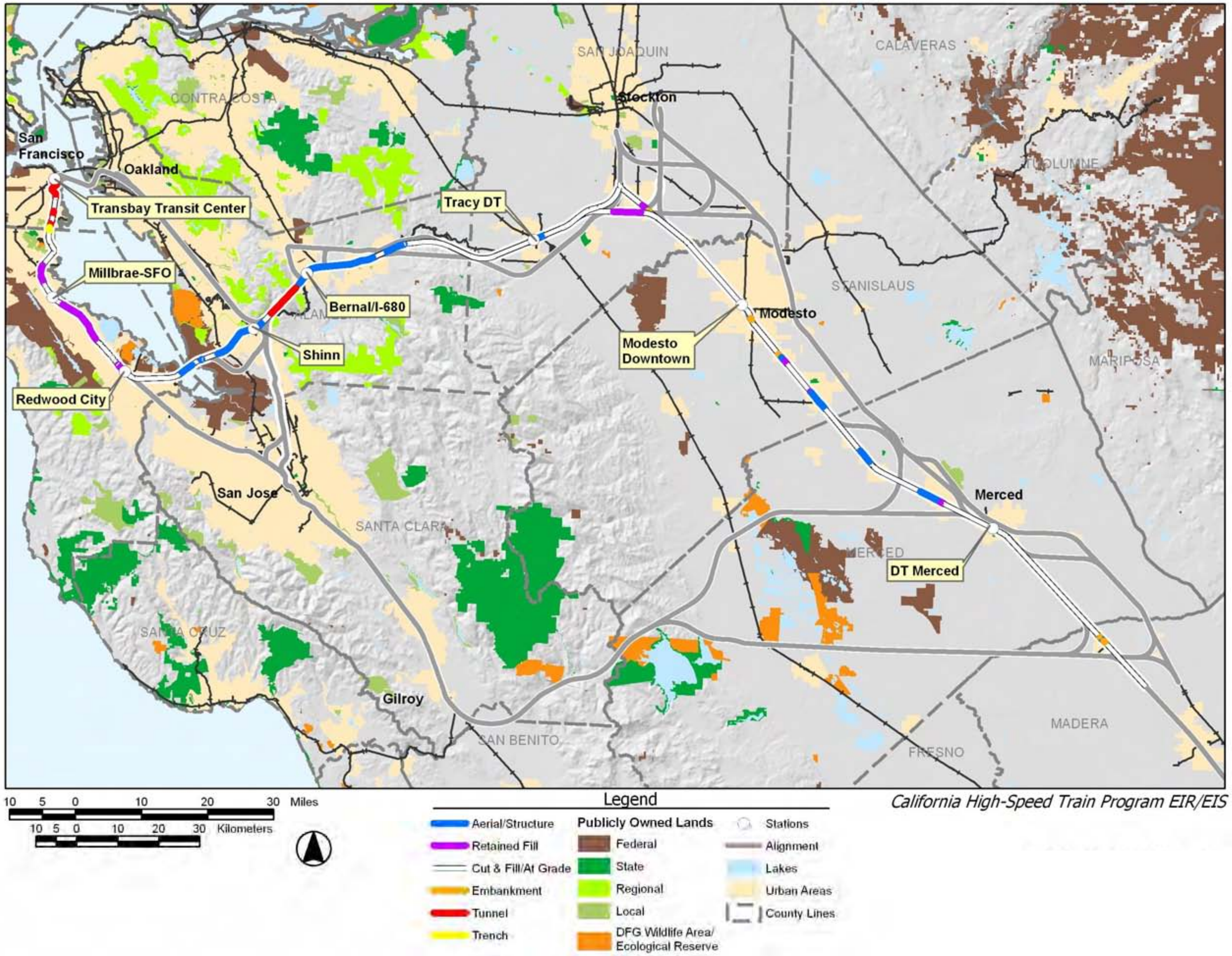


Figure 7.2-5
Network Alternatives
Altamont Pass
San Francisco Terminus

Table 7.2-5
Altamont Pass: San Francisco Terminus

Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) UPRR =medium; (3) Tracy Downtown =low: (4) Dumbarton High Bridge =medium; (5) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 757.8 ac (306.68 ha) Impact up to 422.7 ac (171.05 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative would have moderate impacts to farmland within the Altamont Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 146 known cultural resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1890s. Archaeological resources in the area of the Dumbarton crossing include prehistoric sites associated with burials, and historic sites from early 1900s industrial activities. Overall, this network alternative was identified as having a moderate sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 270.7 ac (109.57 ha) direct/ 817.1 ac (330.68 ha) indirect Streams: 15,995 linear ft (4,875.1 linear m) direct/ 67,867 linear ft (20,685.76 linear m) indirect Lakes/Waterbodies: 39.6 ac (16.03 ha) direct/ 154.9 ac (62.68 ha) indirect Potentially affect the San Francisco Bay, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the South Bay Aqueduct and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 44.4 ac (17.97 ha) direct/ 2,259 ac (914.4 ha) indirect Non-Wetland Waters: 15,947 linear ft (4,860.6 linear m) Species: 56 special-status plant and 49 special-status wildlife species This alternative could potentially result in impacts on biological resources in San Francisco Bay as a result of the Dumbarton crossing. Potentially significant impacts on special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the Don Edwards San Francisco Bay National Wildlife Refuge. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	San Bruno (Potentially Active) – At Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade

Table 7.2-5
Altamont Pass: San Francisco Terminus

	Vernalis (Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) - At Grade Silver Creek (Potentially Active) - At Grade Hayward (Active) - Above Grade Mission (Potentially Active) - At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 24 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

F. OAKLAND TERMINUS

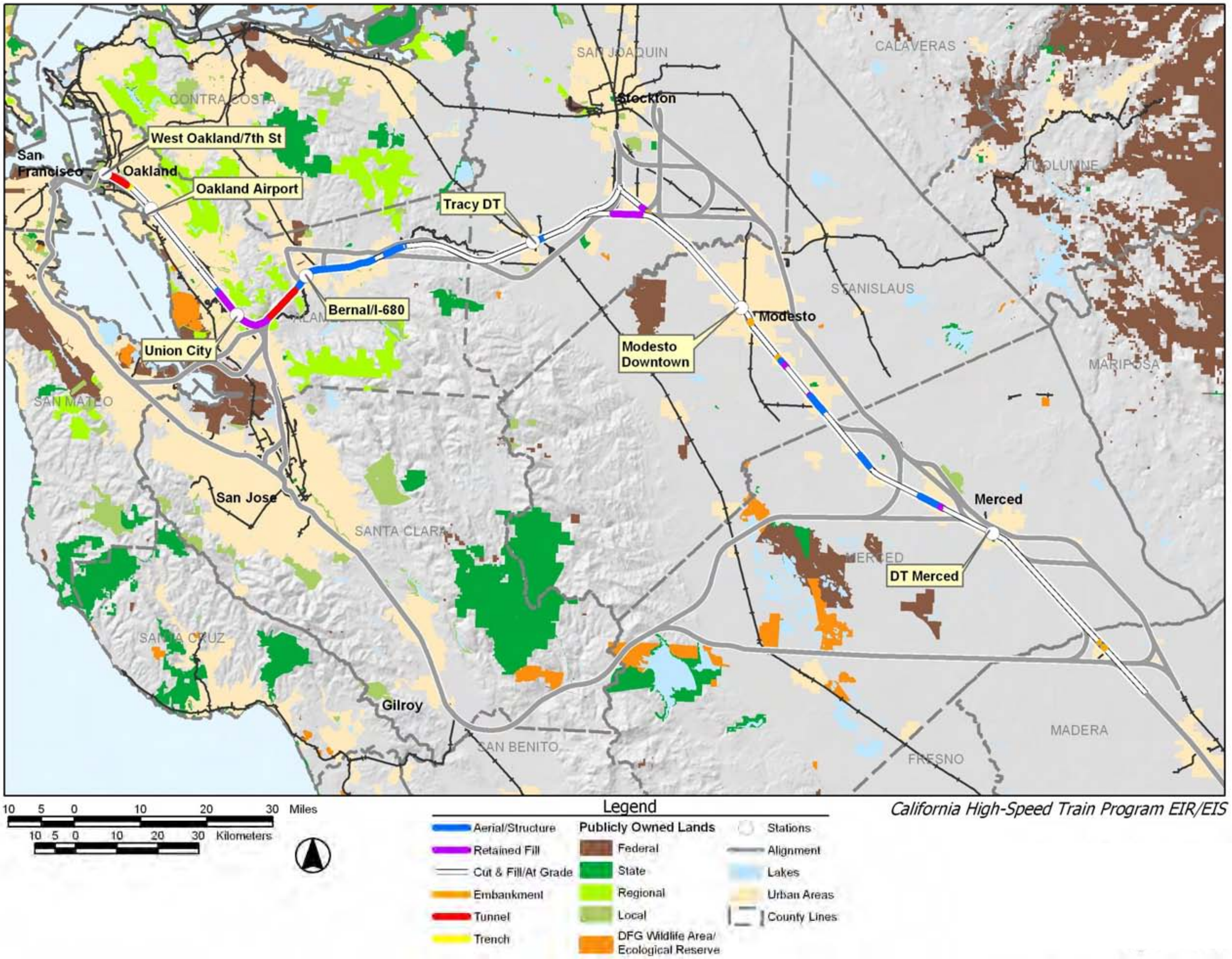
This network alternative is shown in Figure 7.2-6 and described in Table 7.2-6. The segments used for this representative alternative are Niles/I-880 (West Oakland to Niles Junction), East Bay Connection (Dumbarton/Niles XN), UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-6
Altamont Pass: Oakland Terminus

Physical/Operational Characteristics	
Network Alternative Description	From Oakland to Union City, this network alternative would use the Niles/I-800 Alignment north of Niles. The Altamont Pass would use the UPRR Alignment through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment. Station location options considered for this alternative are West Oakland/7th Street, Coliseum/Airport, Union City (BART), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	170.86 mi (274.97 km)
Cost (dollars)	$8.2 billion
Express Travel Times (minutes)	Oakland-LA=2:23; Oakland-Sac=0:53; Oakland-Fresno=1:04; Livermore-LA=2:06; Tracy-LA=1:59; Oakland-Tracy=0:29
Ridership	This network alternative would directly serve downtown Oakland and Oakland International Airport (Coliseum/BART), the I-580 corridor, and the Central Valley. Although this network alternative does not directly serve San Jose or San Francisco, it provides high ridership and revenue because of the high frequency of service provided to Oakland. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 94.4 million passengers and $3.15 billion per year by 2030. Ridership for this network alternative is forecast to be about 7.4% higher than the Altamont "Base Case" network alternative and revenue to be about 10.9% higher.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,093 million
Operational Issues	Average Speed Oakland–LA=176.3 mph (293.8 kph); Oakland–Sac=140.1 mph (233.5 kph); Oakland–Fresno=162.9 mph (271.6 kph); Livermore–LA=182.9 mph (304.8 kph); Tracy–LA=183.4 mph (305.7 kph); Oakland–Tracy=116.6 mph (194.3 kph Maximum Speed Oakland–LA=210 mph (350 kph); Oakland–Sac=198 mph (330 kph); Oakland–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); Oakland–Tracy=178.2 mph (297 kph)

Table 7.2-6
Altamont Pass: Oakland Terminus

	HST operations would need to be coordinated and integrated with ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	The Niles/I-880 Alignment would bring direct HST service up the East Bay to Oakland, with station in West Oakland, the Oakland international Airport (Coliseum/BART), the I-580 corridors with a station in Pleasanton (I-680/Bernal Road), downtown Tracy, and Central Valley stations in Modesto and Merced, This network alternative would increase connectivity and accessibility to Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, the I-580 Corridor and Tri-Valley area, and the Central Valley. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode, while improving the safety, reliability, and performance of the regional commuter service to Oakland. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Niles/I-880 Alignment between Oakland and Union City, UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley would improve local traffic flow and reduce air pollution at existing rail crossings. This network alternative would not provide direct HST service to San Francisco, SFO, the SF Peninsula/Caltrain Corridor, San Jose, and south Santa Clara County resulting in considerably less Travel Conditions benefits (travel times, reliability, safety, connectivity, and passenger cost) than other network alternatives that directly serve additional stations/markets in the Bay Area.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. Medium potential of vibration impacts for the overall alternative. High potential of vibration impacts from Oakland to Niles Junction. Medium potential of vibration impacts, from Niles Junction to downtown Tracy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It has a medium compatibility in the Lathrop, Manteca Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating in the east bay between Niles Junction and Oakland and a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Oakland to Niles Junction =low; (2) UPRR =medium; (3) Tracy Downtown =low; (4) UPRR N/S =low. Overall network alternative rating is low to medium



FLY CALIFORNIA

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Figure 7.2-6
Network Alternatives
Altamont Pass
Oakland Terminus

Table 7.2-6
Altamont Pass: Oakland Terminus

Farmlands:[ii] Ac (ha) potentially affected	Farmland: 755.5 ac (305.73 ha) Impact up to 420.3 ac (170.11 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative along with the Union City Terminus and Oakland, and San Francisco via transbay tube network alternatives would have the Least Potential Impact (LPI) to farmland within the Altamont Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 112 known cultural resources. Historic properties and industrial complexes dating from the 1920s and 1940s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. Overall, this network alternative was identified as having a low sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 181.1 ac (73.29 ha) direct/ 568.2 ac (229.94 ha) indirect Streams: 16,831 linear ft (5,130.0 linear m) direct/ 73,451 linear ft (22,387.96 linear m) indirect Lakes/Waterbodies: 2.3 ac (0.93 ha) direct/ 7.6 ac (3.08 ha) indirect Of the Altamont Pass network alternatives, this network alternative along with four other network alternatives was identified to have the least area of impact on lakes and would not result in impacts on San Francisco Bay. Potentially affect San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the South Bay Aqueduct and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 10.8 ac (4.35 ha) direct/ 539 ac (217.9 ha) indirect Non-Wetland Waters: 13,502 linear ft (4,115.5 linear m) Species: 39 special-status plant and 44 special-status wildlife species Of the Altamont Pass network alternatives, this network alternative along with one other network alternatives was identified to have the least area of impact on wetlands and would not result in impacts on San Francisco Bay. Potentially significant impacts to special-status plant and wildlife species and wetlands and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Hayward (Active) – At Grade - Adjacent and Parallel Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade

Table 7.2-6
Altamont Pass: Oakland Terminus

Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 21 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

G. UNION CITY TERMINUS

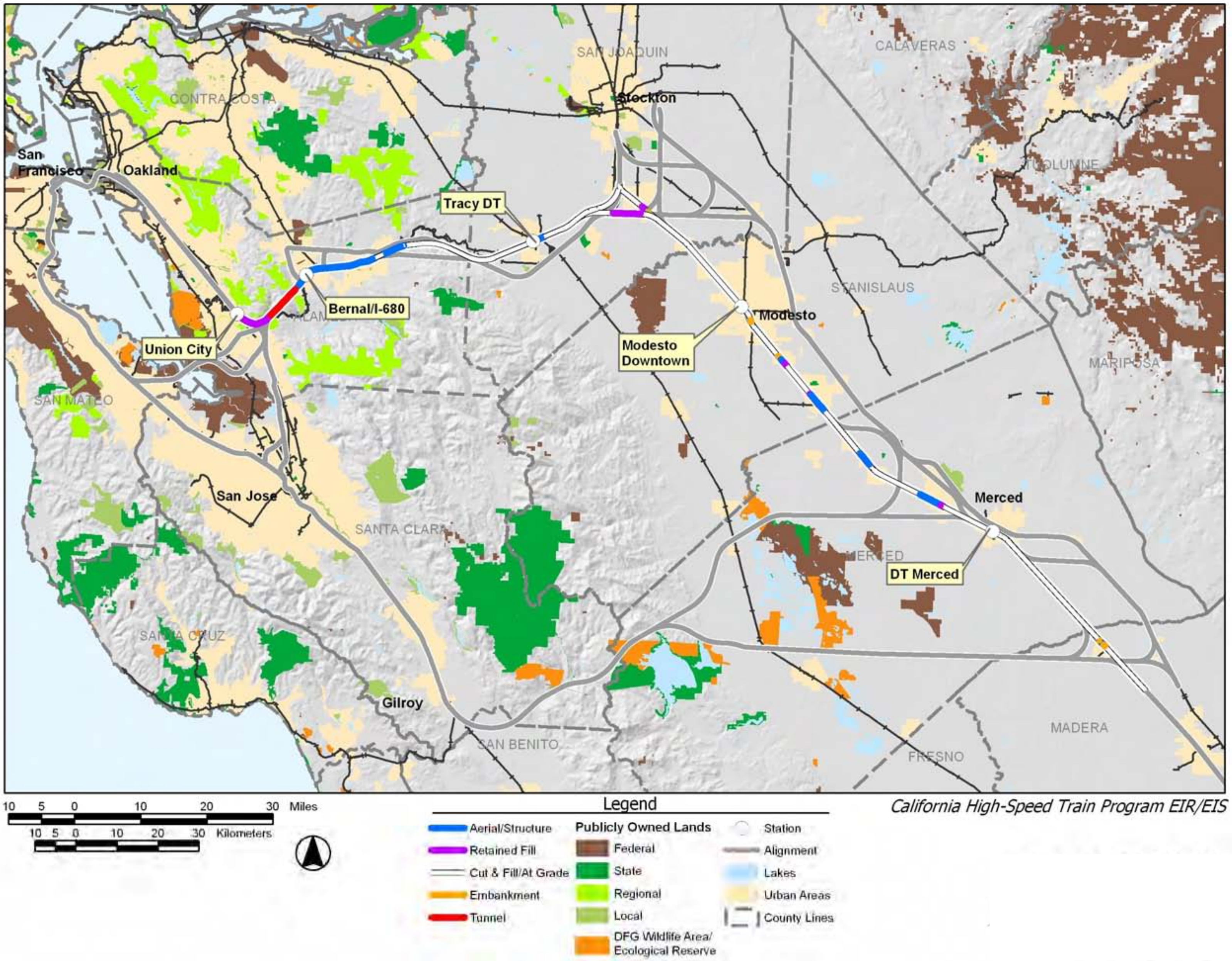
This network alternative is shown in Figure 7.2-7 and described in Table 7.2-7. The segments used for this representative alternative are Niles/I-880 (Union City BART to Niles Junction), East Bay Connection (Dumbarton/Niles XN), UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-7
Altamont Pass: Union City Terminus

Physical/Operational Characteristics	
Network Alternative Description	From Union City, the Altamont Pass Alignment would follow the UPRR through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment. Station location options considered for this alternative are Union City (BART), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	157.93 mi (254.16 km)
Cost (dollars)	$6.0 billion
Express Travel Times (minutes)	Union–LA=2:13; Union–Sac=0:43; Union–Fresno=0:55; Livermore–LA=2:06; Tracy–LA=1:59; Union–Tracy=0:20
Ridership	This network alternative would serve Union City and connect to BART and the I-580 corridor and would have less ridership and revenue potential than network alternatives that provide direct service to additional stations in the Bay Area. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 83.5 million passengers and $2.70 billion per year by 2030. Ridership and revenue for this network alternative is forecast to be about 5% less than the Altamont "Base Case" network alternative.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,073 million
Operational Issues	Average Speed Union-LA=180.2 mph (300.3 kph); Union-Sac=143.8 mph (239.6 kph); Union-Fresno=167 mph (278.28 kph); Livermore-LA=182.9 mph (304.8 kph); Tracy-LA=183.4 mph (305.7 kph); Union-Tracy=106.8 mph (178 kph Maximum Speed Union-LA=210 mph (350 kph); Union-Sac=198 mph (330 kph); Union-Fresno=210 mph (350 kph); Livermore-LA=210 mph (350 kph); Tracy-LA=210 mph (350 kph); Union-Tracy=169.2 mph (282 kph) HST operations would need to be coordinated and integrated with all transportation services at Union City. HST operations would need to be coordinated and integrated with ACE service in the I-580 corridor.

Table 7.2-7
Altamont Pass: Union City Terminus

Potential Environmental Impacts	
Travel Conditions	This network alternative would bring direct HST service to the East Bay, Tri-Valley, and Central Valley areas with an East Bay Station in Union City (BART), a Tri-Valley in Pleasanton (I/680/Bernal Road), a downtown station in Tracy, and Central Valley stations in Modesto and Merced. This network alternative would increase connectivity and accessibility to southern Alameda County, the I-580 Corridor and Tri-Valley area, and the Central Valley. The HST Network alternative would provide a safer, more reliable, energy-efficient intercity mode along the UPRR Alignment while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley would improve local traffic flow and reduce air pollution at some existing rail crossings. This network alternative would not provide direct HST service to San Francisco, SFO, the SF Peninsula/Caltrain Corridor, Oakland, Oakland Airport, San Jose, and south Santa Clara County resulting in considerably less Travel Conditions benefits (travel times, reliability, safety, connectivity, and passenger cost) than other network alternatives that directly serve additional stations/markets in the Bay Area.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. Medium potential of vibration impacts for the overall alternative. High potential of vibration impacts from Union City to Niles Junction. Medium potential of vibration impacts, from Niles Junction to downtown Tracy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating	Segments visual ratings: (1) UPRR =medium; (2) Tracy Downtown =low; and (3) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 755.5 ac (305.73 ha) Impact up to 420.3 ac (170.11 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative along with the Oakland Terminus and Oakland, and San Francisco via transbay tube network alternatives would have the Least Potential Impact to farmland within the Altamont Pass network alternatives.



U.S. Department of Transportation Federal Railroad Administration

Figure 7.2-7
Network Alternatives
Altamont Pass
Union City Terminus

Table 7.2-7
Altamont Pass: Union City Terminus

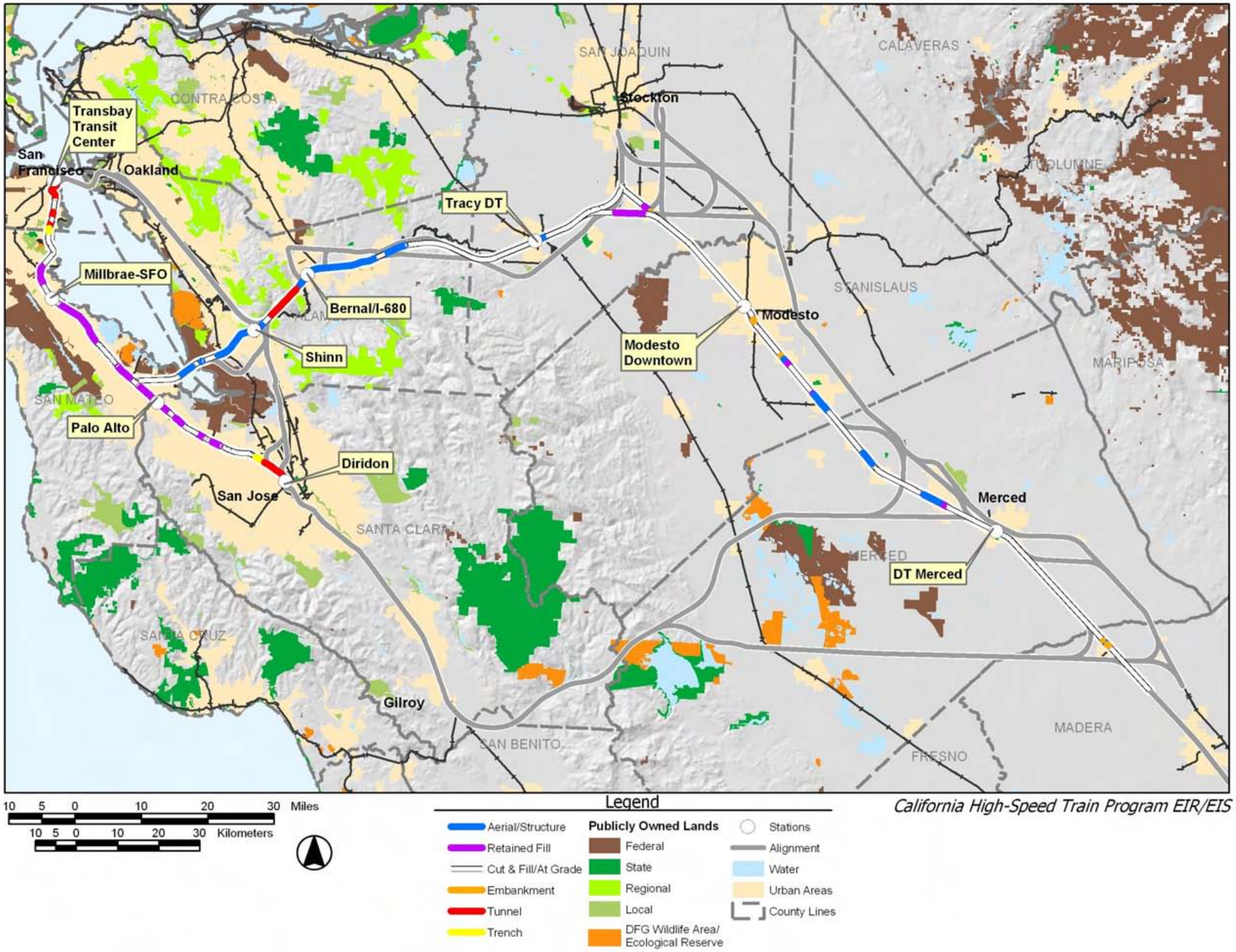
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 88 known cultural resources. Of the Altamont Pass network alternatives, this network alternative was identified to have the least number of known resources. Historic properties and industrial complexes dating from the 1920s and 1940s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. Overall, this network alternative was identified as having a low sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 177.6 ac (71.88 ha) direct/ 561.4 ac (227.20 ha) indirect Streams: 14,432 linear ft (4,398.9 linear m) direct/ 65,198 linear ft (19,872.48 linear m) indirect Lakes/Waterbodies: 2.3 ac (0.93 ha) direct/ 7.6 ac (3.08 ha) indirect Of the Altamont Pass network alternatives, this network alternative was identified to have the least amount of impact on water resources including streams and rivers as well as lakes, floodplains, groundwater, and impaired waters. Potentially affect San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the South Bay Aqueduct and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 10.7 ac (4.31 ha) direct/ 499 ac (202.0 ha) indirect Non-Wetland Waters: 13,113 linear ft (3,996.7 linear m) Species: 38 special-status plant and 36 special-status wildlife species Of the Altamont Pass network alternatives, this network alternative would have the potential to impact the least special-status plant and wildlife species, wetlands, and waters. This network alternative would not result in impacts on San Francisco Bay. Potentially significant impacts to special-status plant and wildlife species and wetlands and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 18 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

H. SAN FRANCISCO AND SAN JOSE – VIA SF PENINSULA

This network alternative is shown in Figure 7.2-8 and described in Table 7.2-8. The segments used for this representative alternative are Caltrain Corridor (SF to Dumbarton), Caltrain (Dumbarton to San Jose), Dumbarton (High Bridge), UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-8
Altamont Pass: San Francisco and San Jose – via San Francisco Peninsula

Physical/Operational Characteristics	
Network Alternative Description	This network alternative would cross the San Francisco Bay in the Dumbarton corridor. From San Francisco to San Jose, this network alternative would use the existing Caltrain Alignment The Altamont Pass Alignment would follow the UPRR through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment. Station location options considered for this alternative are Transbay Transit Center, Millbrae/SFO, Palo Alto (Caltrain), Union City (Shinn), San Jose (Diridon), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	213.30 mi (343.27 km)
Cost (dollars)	$12.6 billion
Express Travel Times (minutes)	SF–LA=2:36; SJ–LA=2:37; SF–Sac=1:06; SJ–Sac=1:03; SF–Fresno=1:18; SJ–Fresno=1:15; Livermore–LA=2:06; Tracy–LA=1:59; SF–Tracy=0:42; SJ–Tracy=0:39
Ridership	This network alternative would directly serve downtown San Francisco and San Francisco International Airport (SFO), San Jose, the I-580 corridor, and the Central Valley resulting in high ridership and revenue. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 90.8 million passengers and $2.74 billion per year by 2030. Ridership for this network alternative is forecast to be 3.2% more than the Altamont "Base Case" network alternative, and revenue is forecast to be 3.6% less than the base case network alternative.
Constructability	Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required. Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,115 million



U.S. Department of Transportation Federal Railroad Administration

Figure 7.2-8
Network Alternatives
Altamont Pass
San Francisco and San Jose—via SF Peninsula

Table 7.2-8
Altamont Pass: San Francisco and San Jose – via San Francisco Peninsula

Operational Issues	Average Speed SF–LA=168.8 mph (281.2 kph); SJ–LA=171.2 mph (285.4 kph); SF–Sac=129.5 mph (215.8 kph); SJ–Sac=144.5 mph (240.8 kph); SF–Fresno=148.0 mph (246.7 kph); SJ–Fresno=161.4 mph (269 kph); Livermore–LA=182.9 mph (304.8 kph); SJ–Tracy=129.7 mph (216.1 kph); SF–Tracy=107.1 (178.5 kph) Maximum Speed SF–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=198 mph 330 kph); SJ–Sac=198_ mph (330 kph); SF–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); SJ–Tracy=171 mph (285_ kph); SF–Tracy=169.2 mph (282 kph); Tracy–LA=210 mph (350 kph) This network alternative would require the system to split in two separate directions to serve both San Jose and San Francisco given a constant number of trains. This decreases the frequency of service from southern California to these stations by a factor of two as compared to network alternatives using the Pacheco Pass alignment options. Based on forecasted travel demand, two-thirds of the trains were directed to San Francisco and one-third of the trains were directed to San Jose. HST operations would need to be coordinated and integrated with Caltrain service on the SF Peninsula and ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), a mid-Peninsula station at Palo Alto, a station in San Jose (Diridon). It would serve the East Bay with a station in Union City (Shinn), the Tri-Valley with a station in Pleasanton (I-680/Bernal Road), a downtown Tracy station, and Central Valley Station in Modesto and Merced. This network alternative would increase connectivity and accessibility to San Francisco, the Peninsula and SFO, the hub international airport for northern California, southern Alameda County, San Jose, the I-580 Corridor and Tri-Valley area, and the Central Valley. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the San Francisco Peninsula, the I-580 Corridor and the Central Valley while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley. This network alternative would not provide direct HST service to Oakland, Oakland Airport, and south Santa Clara County.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative, with a high potential of noise impacts in the Dumbarton Corridor. Medium potential of vibration impacts for the overall alternative. Medium potential of vibration impacts, from San Francisco to Dumbarton and High potential of impacts from Dumbarton to San Jose. Medium potential of impacts from San Jose to downtown Tracy and a low potential in the Central Valley.

Table 7.2-8
Altamont Pass: San Francisco and San Jose – via San Francisco Peninsula

Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It exhibits a medium to high compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the Caltrain Corridor and a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon, Shinn, and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) Caltrain – Dumbarton to San Jose =low; (3) UPRR =medium; (4) Tracy Downtown =low; (4) Dumbarton High Bridge =medium, and (5) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 757.8 ac (306.68 ha) Impact up to 422.7 ac (171.05 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative would have moderate impacts to farmland within the Altamont Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 182 known cultural resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects along with railroad facilities, water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The Santa Clara de Asis Mission in San Jose includes both prehistoric and historic resources. Archaeological resources in the area of the Dumbarton crossing include prehistoric sites associated with burials, and historic sites from early 1900s industrial activities. Overall, this network alternative was identified as having a high sensitivity for cultural resources

Table 7.2-8
Altamont Pass: San Francisco and San Jose – via San Francisco Peninsula

Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas	Floodplains: 317.3 ac (128.40 ha) direct/ 891.3 ac (360.69 ha) indirect Streams: 17,481 linear ft (5,328.2 linear m) direct/ 70,714 linear ft (21,553.71 linear m) indirect Lakes/Waterbodies: 39.6 ac (16.03 ha) direct/ 154.9 ac (62.68 ha) indirect Of the Altamont Pass network alternatives, this network alternative along with four other network alternatives was identified to have the highest area of impact on lakes and the San Francisco Bay due to the Dumbarton crossing. This network alternative was also identified as having the potential to impact the most area of floodplain. Potentially affect San Francisco Bay, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 44.4 ac (17.97 ha) direct/ 2,264 ac (916.1 ha) indirect Non-Wetland Waters: 15,947 linear ft (4,860.6 linear m) Species: 56 special-status plant and 49 special-status wildlife species This alternative could potentially result in impacts on biological resources in San Francisco Bay as a result of the Dumbarton crossing. Potentially significant impacts on special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the Don Edwards San Francisco Bay National Wildlife Refuge. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	San Bruno (Potentially Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) – At Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) - At Grade Silver Creek (Potentially Active) - At Grade Hayward (Active) - Above Grade Mission (Potentially Active) - At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 30 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

I. SAN FRANCISCO, SAN JOSE, AND OAKLAND – WITH NO SF BAY CROSSING

This network alternative is shown in Figure 7.2-9 and described in Table 7.2-9. The segments used for this representative alternative are Caltrain Corridor (SF to Dumbarton), Caltrain (Dumbarton to San Jose), Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose via I-880)[12], East Bay Connectors (Dumbarton/Niles XN & Dumbarton/Niles XS), UPRR (Niles to Altamont), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-9
Altamont Pass: San Francisco, San Jose, and Oakland – with No San Francisco Bay Crossing

Physical/Operational Characteristics	
Network Alternative Description	This Network alternative would not cross the San Francisco Bay. From San Francisco to San Jose, this network alternative would use the existing Caltrain right-of-way and the Niles/I-880 Alignment south of Niles in the East Bay. The Altamont Pass Alignment would follow the UPRR through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment. Station location options considered for this alternative are Transbay Transit Center, Millbrae/SFO, Redwood City (Caltrain), West Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	244.70 mi (393.81 km)
Cost (dollars)	$14.5 billion
Express Travel Times (minutes)	SF–LA=3:17; Oakland–LA=2:23; SJ–LA=2:19; SF–Sac=1:39; Oakland–Sac=0:53; SJ–Sac=0:49; SF–Fresno=1:54; Oakland–Fresno=1:04; SJ–Fresno=1:01; Livermore–LA=2:06; Tracy–LA=1:59; SF–Tracy=1:32; Oakland–Tracy=0:29; SJ–Tracy=0:25
Ridership	This network alternative would directly serve downtown San Francisco and San Francisco International Airport (SFO), the I-880 Corridor in the East Bay, San Jose, the I-580 corridor and the Central Valley. Ridership and revenue for the statewide HST system with this network alternative is forecast at 85.2 million passengers and $2.73 billion per year by 2030. Ridership for this network alternative is forecast to be about 3% less than the Altamont "Base Case" network alternative, with revenue about 4% less.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing commuter rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,123 million
Operational Issues	Average Speed SF–LA=140.2 mph (233.6 kph); Oakland–LA=176.3 mph (293.8 kph); SJ–LA=178.7 mph (297.9 kph); SF–Sac=101.8 mph (169.7 kph); Oakland–Sac=140.1 mph (233.5 kph); SJ–Sac=144.1 mph (240.2 kph); SF–Fresno=112.7 mph (187.9 kph); Oakland–Fresno=162.9 mph (271.6 kph); SJ–Fresno=165 mph (275 kph); Livermore–LA=182.9 mph

[12] Does not include Niles Junction to Niles Wye S ("Niles/I-880 5A") segment.

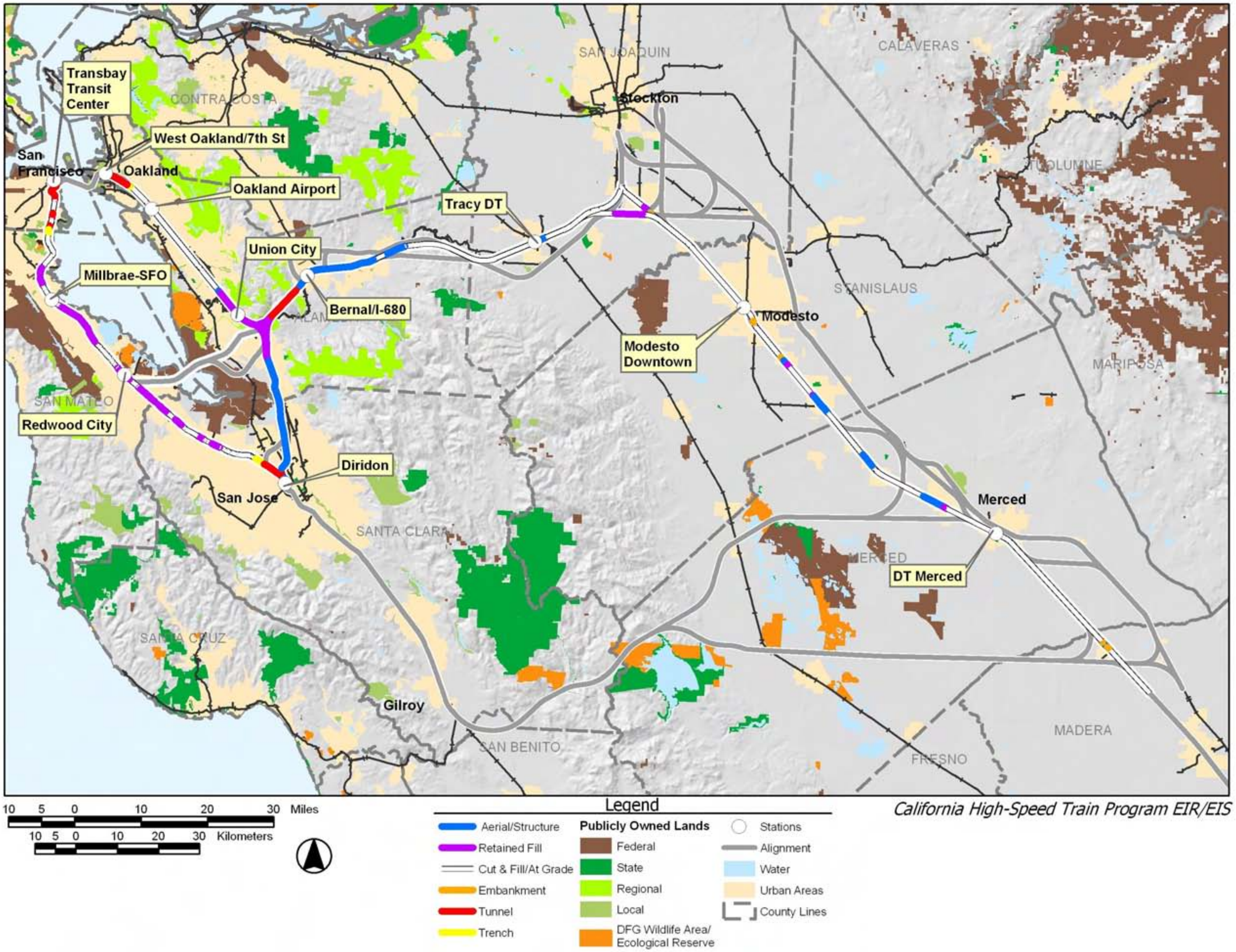


Figure 7.2-9
Network Alternatives
Altamont Pass
San Francisco, San Jose, and Oakland—no SF Bay Crossing

Table 7.2-9
Altamont Pass: San Francisco, San Jose, and Oakland – with No San Francisco Bay Crossing

	(304.8 kph); Tracy–LA=183.4 mph (305.7 kph); SF–Tracy=63 mph (105 kph); Oakland–Tracy=116.6 mph (194.3 kph) 120.7 mph (201.2 kph) Maximum Speed SF–LA=210 mph (350 kph); Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=198 mph (330 kph); Oakland–Sac=198 mph (330 kph); SJ–Sac=198 mph (330 kph); SF–Fresno=210 mph (350 kph); Oakland–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); SF–Tracy=178.2 mph (297kph); Oakland–Tracy=178.2 mph (297 kph); SJ–Tracy=180 mph (300 kph) This network alternative would require the system to split in two separate directions to serve both San Jose and Oakland given a constant number of trains. This decreases the frequency of service from southern California to these stations by a factor of two as compared to network alternatives using the Pacheco Pass alignment options. In addition, travel times to San Francisco are significantly longer than Altamont options using the Dumbarton corridor. Not only do trains travel to San Francisco via San Jose, but the train must be turned in San Jose prior to proceeding north to San Francisco. The turn will take a minimum of 20 minutes. HST operations would need to be coordinated and integrated with Caltrain service in the SF Peninsula and ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), and a mid-Peninsula station in Redwood City. The Alternative would serve Oakland, Oakland Airport, Downtown San Jose (Diridon Station), the Tri Valley with a station in Pleasanton (I-680/Bernal Road), Downtown Tracey, and Central Valley stations in Modesto and Merced. This network alternative would increase connectivity and accessibility to San Francisco, the Peninsula and SFO, the hub international airport for northern California, Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, the I-580 Corridor and Tri-Valley area, and the Central Valley. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the San Francisco Peninsula, the East Bay, and the Tri Valley while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor, Niles/I-880 Alignment between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits is the UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley. This network alternative does not provide direct service to south Santa Clara County.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative, with a high potential of noise impacts in the Dumbarton Corridor. Medium potential of vibration impacts for the overall alternative. High potential of vibration impacts from Oakland to Niles Junction. Medium potential of vibration impacts, from San Francisco/Niles Junction/San Jose to downtown Tracy and a low potential in the Central Valley.

Table 7.2-9
Altamont Pass: San Francisco, San Jose, and Oakland – with No San Francisco Bay Crossing

Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the Caltrain Corridor (north of Redwood City) and the east bay from Oakland to San Jose and a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) Caltrain – Dumbarton to San Jose =low; (3) Oakland to Niles Junction =low; (4) Niles Junction to San Jose =medium; (5) UPRR =medium; (6) Tracy Downtown =low; (7) UPRR N/S =low. The overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 761.9 ac (308.33 ha) Impact up to 426.8 ac (172.71 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative would have moderate impacts to farmland within the Altamont Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 205 known cultural resources. Of the Altamont Pass network alternatives, this network alternative was identified to have the highest number of known resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects along with industrial complexes dating from the 1920s and 1940s, water delivery systems and canals dating from the 1890s, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The Santa Clara de Asis Mission in San Jose includes both prehistoric and historic resources. Overall, this network alternative was identified as having a high sensitivity for cultural resources.

Table 7.2-9
Altamont Pass: San Francisco, San Jose, and Oakland – with No San Francisco Bay Crossing

Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 314.5 ac (127.27 ha) direct/ 895.8 ac (362.55 ha) indirect Streams: 20,273 linear ft (6,179.2 linear m) direct/ 82,171 linear ft (25,045.66 linear m) indirect Lakes/Waterbodies: 2.3 ac (0.93 ha) direct/ 11.0 ac (4.45 ha) indirect Of the Altamont Pass network alternatives, this network alternative was identified to have the highest amount of impact on waters including streams, rivers, and canals. This network alternative would not affect the San Francisco Bay. This network alternative was also identified as having the potential to impact the most impaired waters. Potentially affect Guadalupe River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 12.4 ac (5.01 ha) direct/ 957 ac (387.2 ha) indirect Non-Wetland Waters: 14,622 linear ft (4,115.5 linear m) Species: 56 special-status plant and 50 special-status wildlife species Of the Altamont Pass network alternatives, this network alternative along with two other network alternatives would have the potential to impact the most special-status wildlife species. Potentially significant impacts to special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	San Bruno (Potentially Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) – At Grade Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 39 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

J. OAKLAND AND SAN FRANCISCO – VIA TRANSBAY TUBE

This network alternative is shown in Figure 7.2-10 and described in Table 7.2-10. The segments used for this representative alternative are Trans Bay Crossing – Transbay Transit Center, Niles/I-880 (West Oakland to Niles Junction), East Bay Connector (Dumbarton/Niles XN), UPRR (Niles to Altamont), Tracy UP Connection (Tracy Downtown), and UPRR (Central Valley).

Table 7.2-10
Altamont Pass: Oakland and San Francisco – via Transbay Tube

Physical/Operational Characteristics	
Network Alternative Description	From San Francisco to Oakland, this network alternative would use a new transbay tube between San Francisco and Oakland and would use the Niles/I-880 Alignment north of Shinn. The Altamont Pass Alignment would follow the UPRR through downtown Tracy, and the Central Valley would use the UPRR N/S Alignment. Station location options considered for this alternative are Transbay Transit Center, West Oakland/7[t] Street, Coliseum/Airport, Union City (BART), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	179.64 mi (289.11 km)
Cost (dollars)	$12.9 billion
Express Travel Times (minutes)	SF-LA=2:28; Oakland-LA=2:23; SF-Sac=0:58; Oakland-Sac=0.53; SF-Fresno=1:09; Oakland-Fresno=1:04; Livermore-LA=2:31; Tracy-LA=1:59; SF-Tracy=0:33; Oakland-Tracy=0:29
Ridership	This network alternative would directly serve downtown San Francisco and downtown Oakland, I-580 corridor, and the Central Valley with a single HST line (no split in frequencies) resulting in high ridership and revenue. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 95.9 million passengers and $3.16 billion per year by 2030. Ridership for this network alternative is forecast to be about 9% more than the Altamont "Base Case" network alternative, with revenue about 11% more.
Constructability	Constructing a new transbay tube between Oakland and San Francisco would involve major construction activities in the San Francisco Bay. Special construction methods and mitigations would be required. Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing commuter rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,106 million
Operational Issues	Average speed SF-LA=169.6 mph (282.6 kph); Oakland-LA=176.3 mph (293.8 kph); SF-Sac=137.3 mph (228.8 kph); Oakland-Sac=140.1 mph (233.5 kph); SF-Fresno=156.9 mph (261.5 kph); Oakland-Fresno=162.9 mph (271.6 kph); Livermore-LA=182.9 mph (304.8 kph); Tracy-LA=183.4 mph (305.7 kph); SF-Tracy=114.5 mph (190.9 kph); Oakland-Tracy=116.6 mph (194.3 kph) Maximum speed SF-LA=210 mph (350 kph); Oakland-LA=210 mph (350 kph); SF-Sac=198 mph (330 kph); Oakland-Sac=198 mph (330 kph); SF-Fresno=210 mph (350 kph); Oakland-Fresno=210 mph (350 kph); Livermore-LA=210

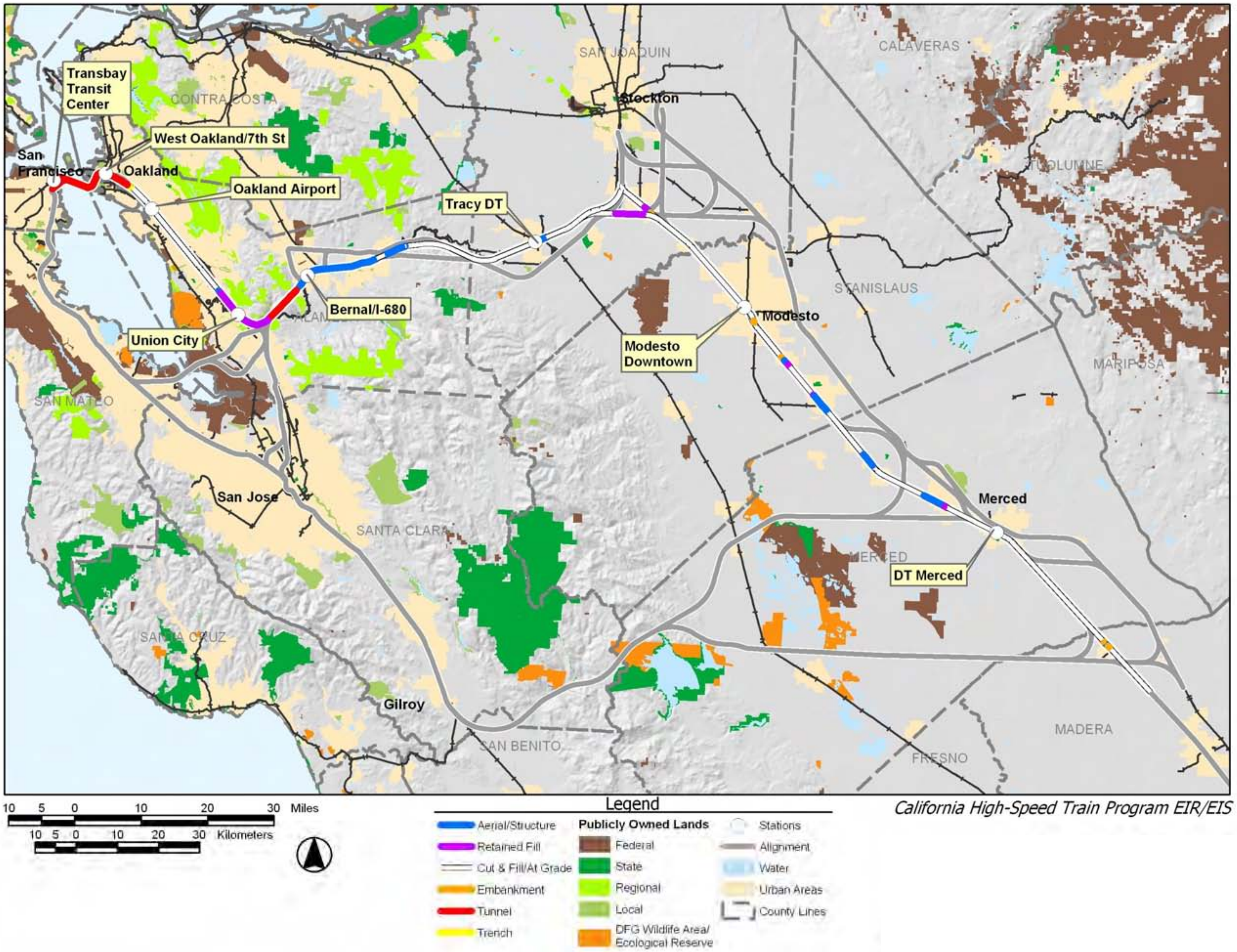


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Figure 7.2-10
Network Alternatives
Altamont Pass
Oakland and San Francisco—via Transbay Tube

Table 7.2-10
Altamont Pass: Oakland and San Francisco – via Transbay Tube

	mph (350 kph); Tracy-LA=210 mph (350 kph); SF-Tracy=178.2 mph (297 kph); Oakland-Tracy=178.2 mph (297 kph) HST operations would need to be coordinated and integrated with ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	This network alternative would bring direct HST service to San Francisco and Oakland with stations at the Transbay Transit Center and West Oakland, to the East Bay with a station at the Oakland International Airport (Coliseum/BART) and Union City (BART), with a Tri Valley station in Pleasanton (I-680/Bernal Road), a downtown Tracy Station, and Central Valley stations in Modesto and Merced. This network alternative would increase connectivity and accessibility to San Francisco, Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, the I-580 Corridor and Tri-Valley area, and the Central Valley. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the I-880 and I-580 corridors while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Niles/I-880 Alignment between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley. This network alternative would not provide direct HST service to SFO, the SF Peninsula/Caltrain Corridor, San Jose, and southern Santa Clara County.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative, with a high potential of noise impacts in the Dumbarton Corridor. Medium potential of vibration impacts for the overall alternative. High potential of vibration impacts from Oakland to Niles Junction. Medium potential of vibration impacts, from San Francisco/Niles Junction to downtown Tracy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the East Bay between Niles Junction and Oakland and a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Oakland to Niles Junction =low; (2) UPRR =medium; (3) Tracy Downtown =low; (4) Trans Bay Crossing =none; and (5) UPRR N/S =low. Overall network alternative rating is low to medium.

Table 7.2-10
Altamont Pass: Oakland and San Francisco – via Transbay Tube

Farmlands:[ii] Ac (ha) potentially affected	Farmland: 755.5 ac (305.73 ha) Impact up to 420.3 ac (170.11 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative along with the Oakland Terminus and Union City Terminus network alternatives would have the Least Potential Impact to farmland within the Altamont Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 114 known cultural resources. Historic properties and industrial complexes dating from the 1920s and 1940s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The area around the Trans Bay crossing likely includes historic artifacts from the Gold Rush period through the 1906 earthquake. Overall, this network alternative was identified as having a low sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 181.1 ac (73.29 ha) direct/ 568.2 ac (229.94 ha) indirect Streams: 16,831 linear ft (5,130.0 linear m) direct/ 73,451 linear ft (22,387.96 linear m) indirect Lakes/Waterbodies: 38.8 ac (15.70 ha) direct/ 243.1 ac (98.38 ha) indirect Potentially affect San Francisco Bay, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the South Bay Aqueduct and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 33.6 ac (13.59 ha) direct/ 1,892 ac (765.8 ha) indirect Non-Wetland Waters: 13,502 linear ft (4,115.5 linear m) Species: 40 special-status plant and 43 special-status wildlife species Of the Altamont Pass network alternatives, this network alternative along with the San Jose, Oakland, and San Francisco – via transbay tube network alternative was identified to have a high impact on wetlands as a result of the Trans Bay crossing. This alternative could also potentially result in significant impacts special-status plant and wildlife species and Bay waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Hayward (Active) – At Grade - Adjacent and Parallel Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade

Table 7.2-10
Altamont Pass: Oakland and San Francisco – via Transbay Tube

Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 22 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

K. SAN JOSE, OAKLAND, AND SAN FRANCISCO – VIA TRANSBAY TUBE

This network alternative is shown in Figure 7.2-11 and described in Table 7.2-11. The segments used for this representative alternative are Trans Bay Crossing – Transbay Transit Center, Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose via I-880)[13], UPRR (Niles to Altamont), East Bay Connections (Dumbarton/Niles XN & Dumbarton/Niles XS), Tracy Downtown (UPRR Connection), and UPRR (Central Valley).

Table 7.2-11
Altamont Pass: San Jose, Oakland, and San Francisco – via Transbay Tube

Physical/Operational Characteristics	
Network Alternative Description	From San Francisco to Oakland this network alternative would use a new transbay tube. The Niles/I-880 Alignment would be used between Oakland and San Jose, with the UPRR Alignment through the Tri-Valley to Tracy, and the UPRR N/S Alignment through the Central Valley. Station location options considered for this alternative are Transbay Transit Center, West Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon), Pleasanton (I-680/Bernal Road), Tracy (Downtown), Modesto (Downtown), and Merced (Downtown).
Length	199.11 mi (320.44 km)
Cost (dollars)	$14.8 billion
Express Travel Times (minutes)	SF–LA=2:31; Oakland–LA=2:23; SJ–LA=2:19; SF–Sac=0:58; Oakland–Sac=0:53; SJ–Sac=0:49; SF–Fresno=1:09; SJ–Fresno=1:01; Livermore–LA=2:06; Tracy–LA=1:59; SF–Tracy=0:33; Oakland–Tracy=0:29; SJ–Tracy=1:09
Ridership	This network alternative would directly serve downtown San Francisco and Oakland, San Jose, the I-580 corridor, and the Central Valley and would have high ridership and revenue. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 89.6 million passengers and $2.88 billion per year by 2030. Ridership for this network alternative is forecast to be nearly 2% more than the Altamont "Base Case" network alternative, with revenue about 1.4% higher.
Constructability	Constructing a transbay tube between Oakland and San Francisco would involve major construction activities in the San Francisco Bay. Special construction methods and mitigations would be required. Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,093 million
Operational Issues	Average Speed SF–LA=169.6 mph (282.6 kph); Oakland–LA=176.3 mph (293.8 kph); SJ–LA=178.7 mph (297.9 kph); SF–Sac=137.3 mph (228.8 kph); Oakland–Sac=140.1 mph (233.5 kph); SJ–Sac=144.1 mph (240.2 kph); SF–Fresno=156.9 mph (261.5 kph); Oakland–Fresno=162.9 mph (271.6 kph); SJ–Fresno=165 mph (275 kph); Livermore–LA=182.9 mph

[13] Does not include Niles Junction to Niles Wye S ("Niles/I-880 5A") segment.

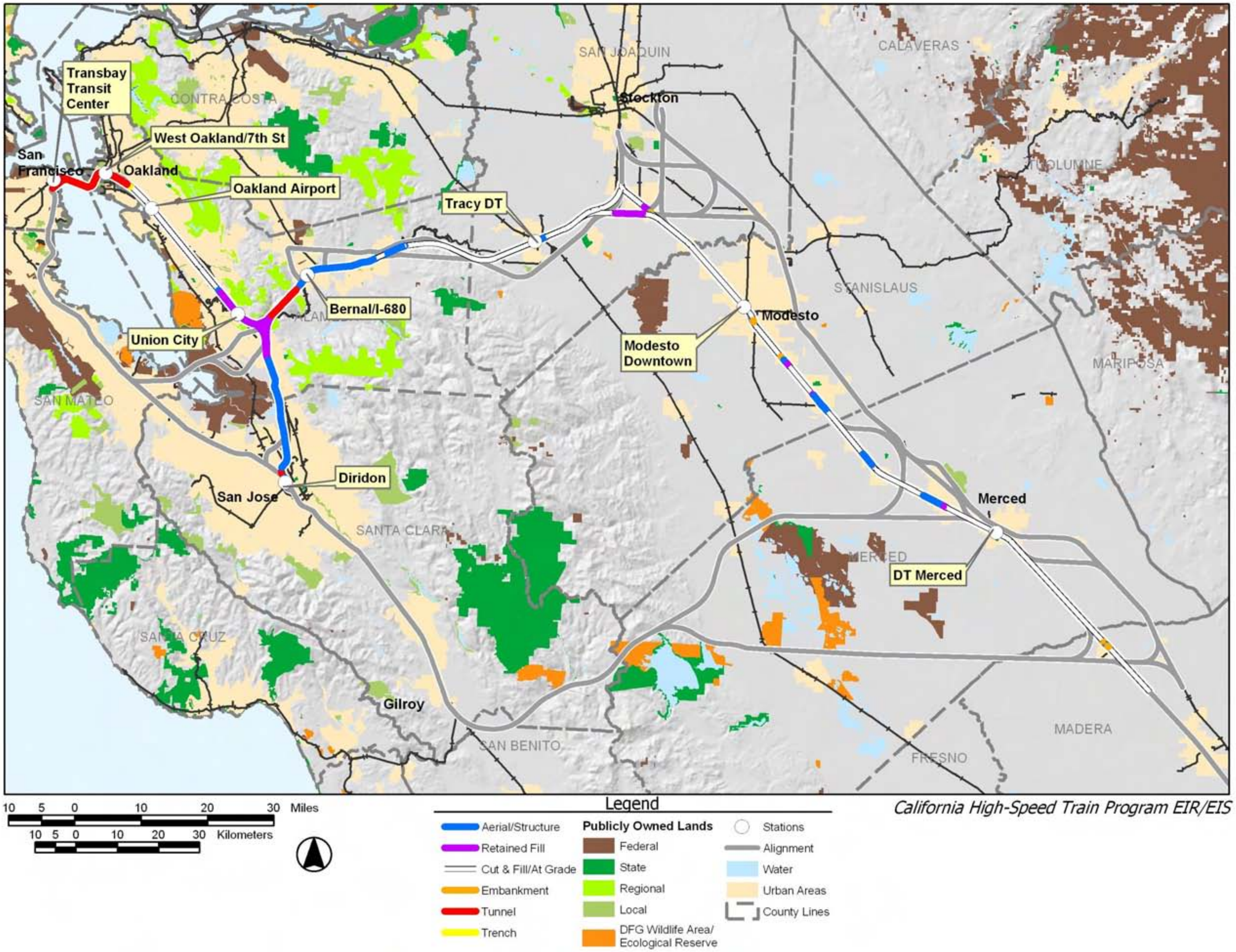

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Figure 7.2-11
Network Alternatives
Altamont Pass
San Jose, Oakland, and San Francisco—via Transbay Tube

Table 7.2-11
Altamont Pass: San Jose, Oakland, and San Francisco – via Transbay Tube

	(304.8 kph); Tracy–LA=183.4 mph (305.7 kph); SF–Tracy=114.5_ mph (190.9 kph); Oakland–Tracy=116.6 mph 194.3 kph); SJ–Tracy=120.7 mph (201.2 kph) Maximum Speed SF–LA=210 mph 350 kph); Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=198 mph (330 kph); Oakland–Sac=198 mph (330 kph); SJ–Sac=198 mph (330 kph); SF–Fresno=210_ mph (350 kph); Oakland–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); SF–Tracy=178.2 mph (297 kph); Oakland–Tracy=178.2 mph (297 kph); SJ–Tracy=180 mph (300 kph) This network alternative would require the system to split in two separate directions to serve both San Jose and San Francisco given a constant number of trains. This decreases the frequency of service from southern California to these stations by a factor of two as compared to network alternatives using the Pacheco Pass alignment options. Based on forecasted travel demand, two-thirds of the trains were directed to San Francisco and one-third of the trains were directed to San Jose. HST operations would need to be coordinated and integrated with ACE service in the I-580 corridor.
Potential Environmental Impacts	
Travel Conditions	This network alternative would directly serve downtown San Francisco and Oakland with stations at the Transbay Transit Center and West Oakland, Union City with a station at Union City (BART), San Jose with a Diridon Station, the I-580 corridor with stations in Pleasanton (I-680/Bernal Road), a downtown Tracy Station, and Central Valley stations in Modesto and Merced. This network alternative would increase connectivity and accessibility to San Francisco, Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, the I-580 Corridor and Tri-Valley area, and the Central Valley. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the I-880 and I-580 corridors and in the Central Valley, while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Niles/I-880 Alignment between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley. This network alternative would not provide direct HST service to SFO, the mid-SF Peninsula area, and south Santa Clara County.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative, with a high potential of noise impacts in the Dumbarton Corridor. Medium potential of vibration impacts for the overall alternative. High potential of vibration impacts from Oakland to Niles Junction. Medium potential of vibration impacts, from San Francisco/Niles Junction/San Jose to downtown Tracy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the East Bay between Oakland and San Jose and a low environmental justice impact rating for the UPRR alignment from Niles

Table 7.2-11
Altamont Pass: San Jose, Oakland, and San Francisco – via Transbay Tube

	Canyon to the Central Valley. Environmental justice impact is rated as medium in the Central Valley except in the Manteca area, where the impact rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Oakland to Niles Junction =low; (2) Niles Junction to San Jose =medium; (3) UPRR =medium; (4) Tracy Downtown =low, (5) Trans Bay Crossing =none, and (6) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 761.9 ac (308.33 ha) Impact up to 426.8 ac (172.71 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy and the UPRR (North/South) segments. Overall, this network alternative would have moderate impacts to farmland within the Altamont Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 119 known cultural resources. Historic properties and industrial complexes dating from the 1920s and 1940s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The area around the Trans Bay crossing likely includes historic artifacts from the Gold Rush period through the 1906 earthquake. Overall, this network alternative was identified as having a moderate sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 218.6 ac (88.48 ha) direct/ 720.4 ac (291.56 ha) indirect Streams: 17,660 linear ft (5,382.7 linear m) direct/ 76,905 linear ft (23,440.49 linear m) indirect Lakes/Waterbodies: 38.8 ac (15.70 ha) direct/ 243.1 ac (98.38 ha) indirect Potentially affect San Francisco Bay, Guadalupe River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.

Table 7.2-11
Altamont Pass: San Jose, Oakland, and San Francisco – via Transbay Tube

Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 35.1 ac (14.21 ha) direct/ 2,158 ac (873.5 ha) indirect Non-Wetland Waters: 14,032 linear ft (4,227.0 linear m) Species: 42 special-status plant and 43 special-status wildlife species This alternative could potentially result in significant impacts on biological resources in San Francisco Bay as a result of the Trans Bay crossing, including wetlands, special-status plant and wildlife species, and Bay waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 30 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

7.2.2 Pacheco Pass Alternatives

A. SAN FRANCISCO AND SAN JOSE TERMINI

This network alternative is shown in Figure 7.2-12 and described in Table 7.2-12. The segments used for this representative alternative are Caltrain Corridor (SF to Dumbarton), Caltrain (Dumbarton to San Jose), Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, BNSF-UPRR.

Table 7.2-12
Pacheco Pass: San Francisco and San Jose Termini (Base Case for Pacheco)

Physical/Operational Characteristics	
Network Alternative Description	From San Francisco to San Jose, this network alternative would use the existing Caltrain rail right-of-way. The Pacheco and Henry Miller (to the UPRR) Alternatives would be used between San Jose and the Central Valley. The BNSF N/S (north of Merced) and UPRR N/S (south of Merced) Alignments would be used in the Central Valley. Station location options considered for this alternative are Transbay Transit Center, Millbrae/SFO, Redwood City, San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Briggsmore (Amtrak).
Length	267.53 mi (430.55 km)
Cost (dollars)	$12.4 billion
Express Travel Times (minutes)	SF–LA=2:38; SJ–LA=2:09; SF–Sac=1:47; SJ–Sac=1:18; SF–Fresno=1:20; SJ–Fresno=0:51; Gilroy–LA=1:57; SF–Gilroy=0:44; SJ–Gilroy=0:15
Ridership	This network alternative would directly serve downtown San Francisco and San Francisco International Airport (SFO), San Jose, southern Santa Clara County, and the Central Valley and would have high ridership and revenue potential. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be 93.9 million passengers and $3.1 billion per year by 2030.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,182 million
Operational Issues	Average Speed SF–LA=164.2 mph (273.6 kph); SJ–LA=179.5 mph (299.2 kph); SF–Sac=152.8 mph (254.7 kph); SJ–Sac=174 mph (290 kph); SF–Fresno=139.5 mph (232.5 kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (305.4 kph); SF–Gilroy=102.3 mph (170.6 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed SF–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=210 mph (350 kph); SJ–Sac=210 mph (350 kph); SF–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Gilroy–LA=210 mph (350 kph); SF–Gilroy=180 mph (300 kph); SJ–Gilroy=180 mph (300 kph)

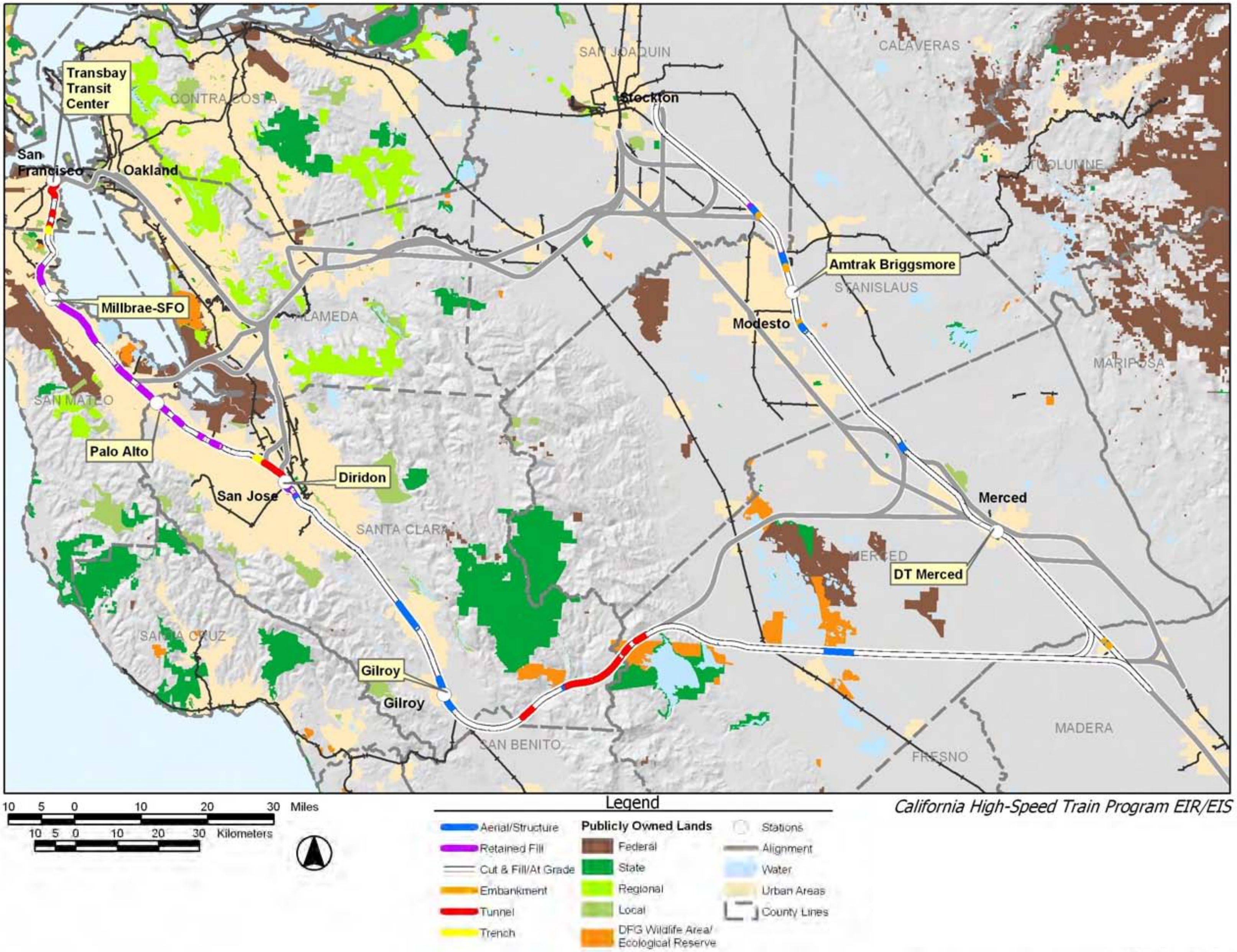

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Figure 7.2-12
Network Alternatives
Pacheco Pass
San Francisco and San Jose Termini

Table 7.2-12
Pacheco Pass: San Francisco and San Jose Termini (Base Case for Pacheco)

	HST operations would need to be coordinated and integrated with Caltrain service.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), and a mid-Peninsula station at either Redwood City. The network alternative would serve Southern Santa Clara County with a Station in Gilroy, and the Central Valley, with station in Merced and Briggsmore. This network alternative would increase connectivity and accessibility to San Francisco, the Peninsula and SFO, the hub international airport for northern California, San Jose, Southern Santa Clara County and the Monterey/Santa Cruz/Salinas area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the San Francisco Peninsula while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Gilroy would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) in the Central Valley. This network alternative would not provide direct HST service to Oakland, Oakland Airport, the East Bay, south Alameda County, and the I-580 corridor.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium potential of vibration impacts for the overall alternative. Medium potential of vibration impacts from San Francisco to Dumbarton. High potential of vibration impacts from Dumbarton to San Jose. Medium potential of vibration impacts, from San Jose to Gilroy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S or BNSF N/S in the Chowchilla area and a medium compatibility along the BNSF N/S Alignment in the Central Valley. Environmental Justice: This network alternative has medium environmental justice impact rating for the Caltrain Corridor between San Francisco and Gilroy and a low impact rating from Gilroy to the Central Valley. The BNSF N/S alignment has a medium impact rating except for low impact ratings in the Briggsmore and Chowchilla areas. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for low property impacts as the alignment either traverses existing transportation right-of-way or through rural land. This network alternative
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) Caltrain – Dumbarton to San Jose =low; (3) Pacheco =medium; (4) Henry Miller to UPRR =low, and (5) BNSF N/S =low. Overall network alternative rating is low to medium.

Table 7.2-12
Pacheco Pass: San Francisco and San Jose Termini (Base Case for Pacheco)

Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,372.3 ac (555.36ha) Impact up to 663.3 ac (268.45 ha) of prime farmland. The majority of potential farmland impacts would occur along the Pacheco, Henry Miller, BNSF (North/South), and UPRR (North/South) segments. Overall, this network alternative along with the San Jose Terminus and San Jose, San Francisco, and Oakland via transbay tube would have the Least Potential Impacts (LPI) to farmland within the Pacheco Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 167 known cultural resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, a sanitary sewer system from 1912, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The Santa Clara de Asis Mission in San Jose includes both prehistoric and historic resources. Overall, this network alternative was identified as having a moderate sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 520.8 ac (210.76 ha) direct/ 1633.2 ac (660.96 ha) indirect Streams: 20,276 linear ft (6,180.1 linear m) direct/ 90,572 linear ft (27,606.42 linear m) indirect Lakes/Waterbodies: 3.8 ac (1.55 ha) direct/ 19.7 ac (7.97 ha) indirect Of the Pacheco Pass network alternatives, this network alternative along with one other network alternative was identified to have the least amount of impact on lakes and would not impact San Francisco Bay. Potentially affect Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 15.6 ac (6.30 ha) direct/ 1,601 ac (648.1 ha) indirect Non-Wetland Waters: 14,395 linear ft (4,387.5 linear m) Species: 58 special-status plant and 53 special-status wildlife species Of the Pacheco Pass network alternatives, this network alternative along with two other network alternatives would have the potential to impact the most special-status wildlife species, but the least area of impact on wetlands. Potentially significant impacts to special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.

Table 7.2-12
Pacheco Pass: San Francisco and San Jose Termini (Base Case for Pacheco)

Fault Crossings	San Bruno (Potentially Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) – At Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 18 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way.

B. OAKLAND AND SAN JOSE TERMINI

This network alternative is shown in Figure 7.2-13 and described in Table 7.2-13. The segments used for this representative alternative are Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose via I-880), Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, BNSF - UPRR.

Table 7.2-13
Pacheco Pass: Oakland and San Jose Termini

Physical/Operational Characteristics	
Network Alternative Description	From Oakland to San Jose, this network alternative would use the Niles/I-880 Alignment. The Pacheco and Henry Miller (to the UPRR) Alternatives would be used between San Jose and the Central Valley. The BNSF N/S (north of Merced) and UPRR N/S (south of Merced) Alignments would be used in the Central Valley. Station location options considered for this alternative are West Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Briggsmore (Amtrak).
Length	256.87 mi (413.40 km)
Cost (dollars)	$11.6 billion
Express Travel Times (minutes)	Oakland-LA=2:30; SJ-LA=2:09; Oakland-Sac=1:38; SJ-Sac=1:18; Oakland-Fresno=1:12; SJ-Fresno=0:51; Gilroy-LA=1:57; Oakland-Gilroy=0:36; SJ-Gilroy=0:15
Ridership	This network alternative would directly serve downtown Oakland and Oakland International Airport (Oakland Coliseum/BART Station) San Jose, southern Santa Clara County, and the Central Valley and would have high ridership and revenue potential. Total ridership is forecast to be about 2% less than the Pacheco "Base Case" forecasts. For the low end forecasts, this would result in about 91.7 million passengers a year by 2030. Revenue for the statewide HST system with this network alternative is $3.08 billion per year by 2030.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing commuter rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,166 million
Operational Issues	Average Speed Oakland–LA=170.7 mph (284.6 kph); SJ–LA=179.5 mph (299.2 kph); Oakland–Sac=163.5 mph (272.6 kph); SJ–Sac=174 mph (290 kph); Oakland–Fresno=150.5 mph (250.8kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (305.4 kph); Oakland–Gilroy=116 mph (193.3 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); Oakland–Sac=210 mph (350 kph); SJ–Sac=210_ mph (350 kph); Oakland–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Gilroy–LA=210 mph (350 kph); Oakland–Gilroy=180 mph (300 kph); SJ–Gilroy=180 mph (300 kph) HST operations would need to be coordinated and integrated with Caltrain service between San Jose and Gilroy.

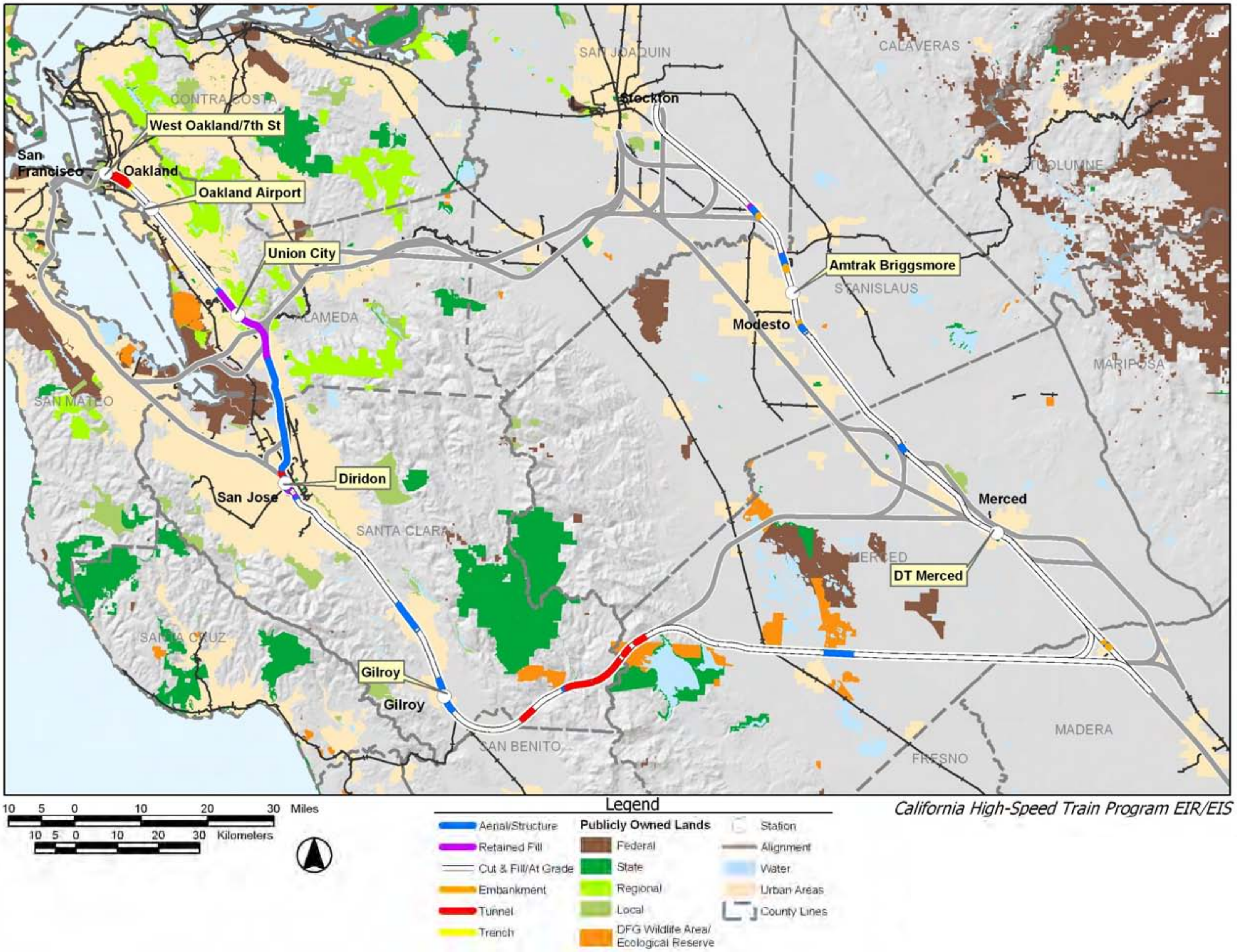

Figure 7.2-13
Network Alternatives
Pacheco Pass
Oakland and San Jose Termini

Table 7.2-13
Pacheco Pass: Oakland and San Jose Termini

Potential Environmental Impacts	
Travel Conditions	The Niles/I-880 corridor Alignment would bring direct HST service up the Oakland, the East Bay, and San Jose with stations in West Oakland, at the Oakland International Airport (Coliseum/BART), Union City (BART) and the Diridon Station in San Jose. The network alternative would serve southern Santa Clara County at Gilroy and the Central Valley with stations in Merced and Briggsmore. This network alternative would increase connectivity and accessibility to Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the East Bay while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Niles/I-880 Alignment between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) in the Central Valley. This network alternative would not provide direct HST service to San Francisco, SFO, the SF Peninsula/Caltrain Corridor, and the I-580 corridor (Tri-Valley and Tracy).
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium to high potential of vibration impacts for the overall alternative. High potential of vibration impacts from Oakland to San Jose. Medium potential of vibration impacts, from San Jose to Gilroy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S or BNSF N/S in the Chowchilla area and a medium compatibility along the BNSF N/S Alignment in the Central Valley. Environmental Justice: This network alternative has medium environmental justice impact rating for the East Bay between Oakland and San Jose, and a medium impact rating for the Caltrain Corridor between San Jose and Gilroy. It has a low impact rating from Gilroy to the Central Valley. The BNSF N/S alignment has a medium impact rating except for low impact ratings in the Briggsmore and Chowchilla areas. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for low property impacts as the alignment either traverses existing transportation right-of-way or through rural land. This network alternative
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings; (1) Oakland to Niles Junction =low; (2) Niles Junction to San Jose =medium: (3) Pacheco =medium; (4) Henry Miller to UPRR =low; and (5) BNSF N/S =low. Overall network alternative rating is low to medium.

Table 7.2-13
Pacheco Pass: Oakland and San Jose Termini

Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,378.7 ac (557.96 ha) Impact up to 669.7 ac (271.04 ha) of prime farmland. The majority of potential farmland impacts would occur along the Pacheco, Henry Miller, BNSF (North/South), and UPRR (North/South) segments. Overall, this network alternative along with the San Francisco, Oakland, and San Jose Termini and San Jose, Oakland, and San Francisco via transbay tube would have the greatest potential impact on farmland within the Pacheco Pass network alternatives. The difference in overall farmland impacts within the Pacheco Pass network alternatives is less than 6.4 ac (2.59 ha).
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 106 known cultural resources. Historic properties and buildings dating from the 1900s and industrial complexes from the 1920s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, a sanitary sewer system, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. Overall, this network alternative was identified as having a low sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 477.5 ac (193.24 ha) direct/ 1638.5 ac (663.09 ha) indirect Streams: 21,788 linear ft (6,640.9 linear m) direct/ 99,406 linear ft (30,298.89 linear m) indirect Lakes/Waterbodies: 4.5 ac (1.81 ha) direct/ 17.6 ac (7.13 ha) indirect Potentially affect Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 17.4 ac (7.04 ha) direct/ 1,825 ac (738.7 ha) indirect Non-Wetland Waters: 14,533 linear ft (4,429.6 linear m) Species: 49 special-status plant and 49 special-status wildlife species This network alternative could potentially result in significant impacts to special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade

Table 7.2-13
Pacheco Pass: Oakland and San Jose Termini

Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 21 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way.

C. SAN FRANCISCO, OAKLAND, AND SAN JOSE TERMINI

This network alternative is shown in Figure 7.2-14 and described in Table 7.2-14. The segments used for this representative alternative are Caltrain Corridor (SF to Dumbarton), Caltrain (Dumbarton to San Jose), Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose via I-880), Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, BNSF - UPRR.

Table 7.2-14
Pacheco Pass: San Francisco, Oakland, and San Jose Termini

Physical/Operational Characteristics	
Network Alternative Description	From San Francisco to San Jose, this network alternative would use the existing Caltrain right-of-way. From Oakland to San Jose, the Niles/I-880 Alignment would be used. The Pacheco and Henry Miller (to the UPRR) Alternatives would be used between San Jose and the Central Valley, and the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) Alignments would be used in the Central Valley. Station location options considered for this alternative are Transbay Transit Center, Millbrae/SFO, Redwood CityWest Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Briggsmore (Amtrak).
Length	309.60 mi (498.26 km)
Cost (dollars)	$16.0 billion
Express Travel Times (minutes)	SF–LA=2:38; Oakland–LA=2:30; SJ–LA=2:09; SF–Sac=1:47; Oakland–Sac=1:38; SJ–Sac=1:18; SF–Fresno=1:20; Oakland–Fresno=1:12; SJ–Fresno=0:51; Gilroy–LA=1:57; SF–Gilroy=0:44; Oakland–Gilroy=0:36; SJ–Gilroy=0:15
Ridership	This network alternative would directly serve downtown San Francisco and San Francisco International Airport (SFO), San Jose and the I-880 corridor, Southern Santa Clara County, and the Central Valley. Total ridership is projected to be about 8% less than the Pacheco "Base Case" forecast or about 86.1 million passengers a year by 2030. Revenue for the statewide HST system with this network alternative is $2.79 billion per year by 2030 (about 10% less than the Pacheco "Base"). Although this option serves additional markets than the Pacheco Base Case Alternative, the drop in system ridership is a result of the splitting of service between the San Francisco Peninsula and the East Bay (with half of the trains serving each side of the Bay). Additional frequency of service to San Francisco and Oakland (along with higher operational costs) would be needed to increase ridership for this network alternative.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing commuter rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,174 million
Operational Issues	Average Speed SF–LA=164.2 mph (273.6 kph); Oakland–LA=170.7 mph (284.6 kph); SJ–LA=179.5 mph (299.2 kph); SF–Sac=152.8 mph (254.7 kph); Oakland–Sac=163.5 mph (272.6 kph); SJ–Sac=174 mph (290 kph); SF–Fresno=139.5 mph (232.5 kph); Oakland–Fresno=150.5 mph (250.8 kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (295.1

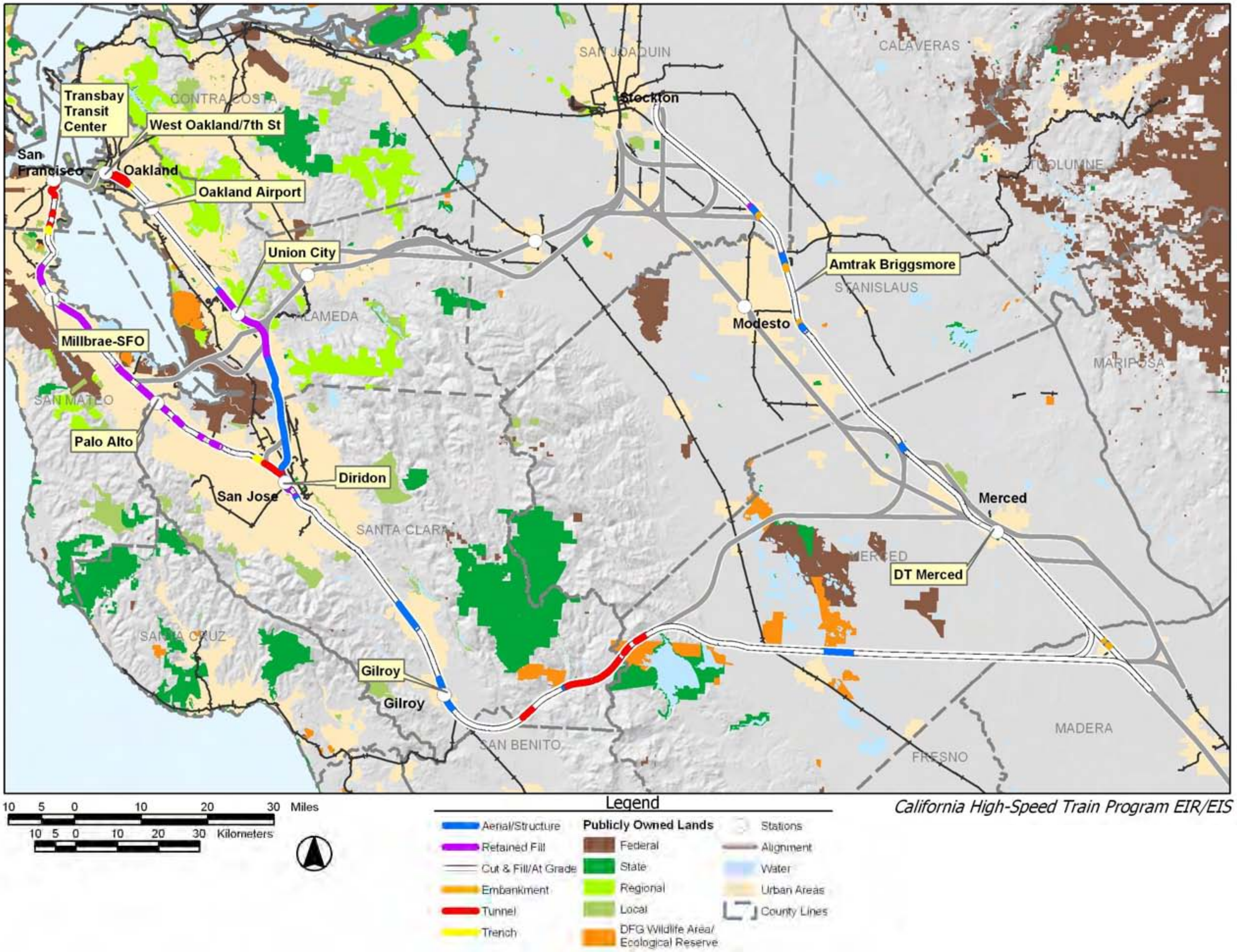

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Figure 7.2-14
Network Alternatives
Pacheco Pass
San Francisco, Oakland, and San Jose Termini

Table 7.2-14
Pacheco Pass: San Francisco, Oakland, and San Jose Termini

	kph); SF–Gilroy=102.3 mph (170.6 kph); Oakland–Gilroy=116 mph (193.3 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed SF–LA=210 mph (350 kph); Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=210 mph (350 kph); Oakland–Sac=210 mph (350 kph); SJ–Sac=210 mph (350 kph); SF–Fresno=210 mph (350 kph); Oakland–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Gilroy–LA=210 mph (350 kph); SF–Gilroy=180mph (300 kph); Oakland–Gilroy=180 mph (300 kph); SJ–Gilroy=180 mph (300 kph) HST operations would need to be coordinated and integrated with Caltrain service. Based on forecasted travel demand, service was divided evenly between the peninsula and east bay market.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), and a mid-Peninsula station at Palo Alto. It would directly serve Oakland and the East Bay with stations at West Oakland/7th Street, the Oakland International Airport (Coliseum/BART), Union City (BART), San Jose (Diridon) and would serve southern Santa Clara County with a station at Gilroy (Caltrain). Service to the Central Valley would be at Merced (Downtown), and the Briggsmore (Amtrak) station. This network alternative would increase connectivity and accessibility to San Francisco, the Peninsula and SFO, the hub international airport for northern California, Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the San Francisco Peninsula while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Gilroy, Niles/I-880 Alignment between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation improvements in the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) in the Central Valley. This network alternative would not provide direct HST service to the I-580 corridor (Tri-Valley and Tracy).
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium to high potential of vibration impacts for the overall alternative. Medium potential of vibration impacts from San Francisco to Dumbarton. High potential of vibration impacts from Dumbarton to San Jose. High potential of vibration impacts from Oakland to San Jose. Medium potential of vibration impacts, from San Jose to Gilroy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S or BNSF N/S in the Chowchilla area and a medium compatibility along the BNSF N/S Alignment in the Central Valley. Environmental Justice: This network alternative has medium environmental justice impact rating for the Caltrain

Table 7.2-14
Pacheco Pass: San Francisco, Oakland, and San Jose Termini

	Corridor between San Francisco and Gilroy, a medium impact rating for the east bay between Oakland and San Jose, and a low impact rating from Gilroy to the Central Valley. The BNSF N/S alignment has a medium impact rating except for low impact ratings in the Briggsmore and Chowchilla areas. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for low property impacts as the alignment either traverses existing transportation right-of-way or through rural land.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) Caltrain – Dumbarton to San Jose =low; (3) Oakland to Niles Junction =low; (4) Niles Junction to San Jose =medium; (5) Pacheco =medium; (6) Henry Miller to UPRR =low; and (7) BNSF N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,378.7 ac (557.96 ha) Impact up to 669.7 ac (271.04 ha) of prime farmland. The majority of potential farmland impacts would occur along the Pacheco, Henry Miller, BNSF (North/South), and UPRR (North/South) segments. Overall, this network alternative along with the Oakland and San Jose Termini and San Jose, Oakland, and San Francisco via transbay tube would have the greatest potential impact on farmland within the Pacheco Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 195 known cultural resources. Of the Pacheco Pass network alternatives, this network alternative was identified to have the highest number of known resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s and industrial complexes from the 1920s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, a sanitary sewer system, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The Santa Clara de Asis Mission in San Jose includes both prehistoric and historic resources. Overall, this network alternative was identified as having a high sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 573.4 ac (232.03 ha) direct/ 1,813.9 ac (734.08 ha) indirect Streams: 24,401 linear ft (7,437.3 linear m) direct/ 104,672 linear ft (31,904.05 linear m) indirect Lakes/Waterbodies: 4.5 ac (1.81 ha) direct/ 21.0 ac (8.50 ha) indirect Of the Pacheco Pass network alternatives, this network alternative was identified to have the highest impact on waters including streams, rivers, and canals as well as floodplains, groundwater, and impaired waters. This network alternative was also identified as having the potential to encounter the most erosive soils. Potentially affect Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.

Table 7.2-14
Pacheco Pass: San Francisco, Oakland, and San Jose Termini

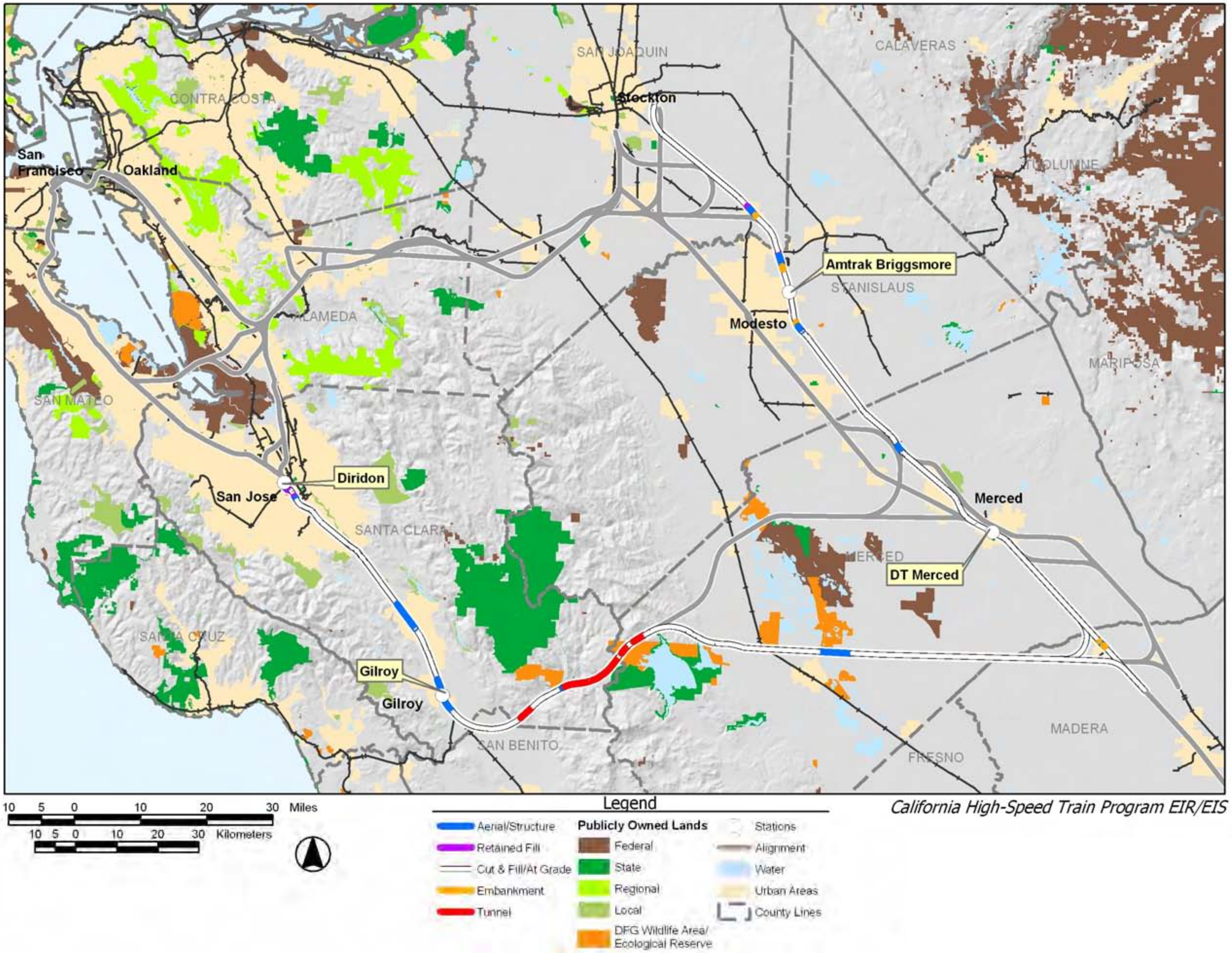
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 17.5 ac (7.07 ha) direct/ 1,977 ac (800.2 ha) indirect Non-Wetland Waters: 15,123 linear ft (4,609.4 linear m) Species: 63 special-status plant and 53 special-status wildlife species Of the Pacheco Pass network alternatives, this network alternative would have the potential to impact the most special-status plant and wildlife species and waters. Potentially significant impacts to special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	San Bruno (Potentially Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) – At Grade Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 31 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way.

D. SAN JOSE TERMINUS

This network alternative is shown in Figure 7.2-15 and described in Table 7.2-15. The segments used for this representative alternative are Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, BNSF - UPRR.

Table 7.2-15
Pacheco Pass: San Jose Terminus

Physical/Operational Characteristics	
Network Alternative Description	From San Jose, this network alternative would use the Pacheco and Henry Miller (to the UPRR) Alignment Alternatives and the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) Alignments would be used in the Central Valley. Station location options considered for this alternative are San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Briggsmore (Amtrak).
Length	213.15 mi (343.04 km)
Cost (dollars)	$8.0 billion
Express Travel Times (minutes)	SJ–LA=2:09; SJ–Sac=1:18; SJ–Fresno=0:51; Gilroy–LA=1:57; SJ–Gilroy=0:15
Ridership	This network alternative would directly serve downtown San Jose and the Central Valley and would have considerably less ridership and revenue potential than other Network Alternatives that directly serve more stations in the Bay Area. Total ridership for this alternative is forecast at about 15% less than the Pacheco “Base Case” alternative, or at about 80.0 million passengers per year. Revenue for the statewide HST system with this network alternative is $2.68 billion per year by 2030 (about 13.6% less than the Pacheco “Base”).
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines. Maintaining operations on the existing passenger rail service and parallel roadways while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,099 million
Operational Issues	Average Speed SJ–LA=179.5 mph (299.2 kph); SJ–Sac=174 mph (290 kph); SJ–Fresno=164.3 mph (273.8 kph);Gilroy–LA=183.2 mph (305.4 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed SJ–LA=210 mph (350 kph); SJ–Sac=210 mph (350 kph); SJ–Fresno=210 mph (350 kph);Gilroy–LA=210 mph (350 kph); SJ–Gilroy=180 mph (300 kph) HST operations would need to be coordinated and integrated with all transportation services at San Jose. HST operations would need to be coordinated and integrated with Caltrain service between San Jose and Gilroy.



U.S. Department of Transportation Federal Railroad Administration

Figure 7.2-15
Network Alternatives
Pacheco Pass
San Jose Terminus

Table 7.2-15
Pacheco Pass: San Jose Terminus

Potential Environmental Impacts	
Travel Conditions	This network alternative would increase connectivity and accessibility San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor between Gilroy and San Jose would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) in the Central Valley. This network alternative would not provide direct HST service to San Francisco, SFO, the SF Peninsula/Caltrain Corridor between San Francisco and San Jose, Oakland, Oakland Airport, the East Bay, south Alameda County, and the I-580 corridor resulting in considerably less Travel Conditions benefits (travel times, reliability, safety, connectivity, sustainable capacity, and passenger cost) than other network alternatives that directly serve additional stations/markets in the Bay Area.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium potential of vibration impacts for the overall alternative. Medium potential of vibration impacts, from San Jose to Gilroy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S or BNSF N/S in the Chowchilla area and a medium compatibility along the BNSF N/S Alignment in the Central Valley. Environmental Justice: This network alternative has medium environmental justice impact rating for the Caltrain Corridor between San Jose and Gilroy, and a low impact rating from Gilroy to the Central Valley. The BNSF N/S alignment has a medium impact rating except for low impact ratings in the Briggsmore and Chowchilla areas. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for low property impacts as the alignment either traverses existing transportation right-of-way or through rural land.
Aesthetics and Visual Resources: General impacts and rating	Segments visual ratings: (1) Pacheco =medium; (2) Henry Miller to UPRR =low; and (3) BNSF N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,372.3 ac (555.36ha) Impact up to 663.3 ac (268.45 ha) of prime farmland. The majority of potential farmland impacts would occur along the Pacheco, Henry Miller, BNSF (North/South), and UPRR (North/South) segments. Overall, this network alternative along with the San Francisco and San Jose Termini and San Jose, San Francisco, and Oakland via transbay tube would have the Least Potential Impacts (LPI) to farmland within the Pacheco Pass network alternatives.

Table 7.2-15
Pacheco Pass: San Jose Terminus

Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 78 known cultural resources. Of the Pacheco Pass network alternatives, this network alternative was identified to have the least number of known resources. Historic resources in small towns of Santa Clara Valley. Historic properties and buildings dating from the 1920s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, a sanitary sewer system, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1890s. Overall, this network alternative was identified as having a low sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas	Floodplains: 424.9 ac (171.97 ha) direct/ 1,457.8 ac (589.97 ha) indirect Streams: 17,663 linear ft (5,383.7 linear m) direct/ 85,306 linear ft (26,001.25 linear m) indirect Lakes/Waterbodies: 3.8 ac (1.55 ha) direct/ 16.3 ac (6.60 ha) indirect Of the Pacheco Pass network alternatives, this network alternative was identified to have the least impact on water resources including streams, rivers, and canals, as well as lakes, floodplains, groundwater, and impaired waters. This network alternative was also identified as having the potential to encounter the least amount of erosive soils. Potentially affect Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 15.5 ac (6.26 ha) direct/ 1,449 ac (586.6 ha) indirect Non-Wetland Waters: 14,395 linear ft (4,387.5 linear m) Species: 46 special-status plant and 38 special-status wildlife species Of the Pacheco Pass network alternatives, this network alternative would have the potential to impact the least special-status plant and wildlife species. This network alternative was also identified to have the least area of impact on wetlands and waters. Potentially significant impacts to special-status plant and wildlife species, wetlands, and waters. Network ALTERNATIVE would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are eight public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way.

E. SAN JOSE, SAN FRANCISCO, AND OAKLAND – VIA TRANSBAY TUBE

This network alternative is shown in Figure 7.2-16 and described in Table 7.2-16. The segments used for this representative alternative are Trans Bay Crossing – Transbay Transit Center, Caltrain Corridor (SF to Dumbarton), Caltrain (Dumbarton to San Jose), Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, BNSF - UPRR.

Table 7.2-16
Pacheco Pass: San Jose, San Francisco, and Oakland – via Transbay Tube

Physical/Operational Characteristics	
Network Alternative Description	From Oakland to San Francisco, this network alternative would use a transbay tube crossing. From San Francisco to San Jose, this network alternative would use the existing Caltrain right-of-way. From San Jose, this network alternative would use the Pacheco and Henry Miller (to the UPRR) Alignment Alternatives and the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) Alignments would be used in the Central Valley. Station location options considered for this alternative are West Oakland, Transbay Transit Center, Millbrae/SFO, Redwood City, San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Briggsmore (Amtrak).
Length	276.31 mi (444.69 km)
Cost (dollars)	$17.0 billion
Express Travel Times (minutes)	SF–LA=2:38; Oakland–LA=2:43; SJ–LA=2:09; SF–Sac=1:47; Oakland–Sac=1 :43; SJ–Sac=1:18; SF–Fresno=1:20; Oakland–Fresno=1 :27; SJ–Fresno=0:51; Gilroy–LA=1:57; SF–Gilroy=0:44; Oakland–Gilroy=0 :50; SJ–Gilroy=0:15
Ridership	This network alternative would directly serve Oakland, downtown San Francisco and San Francisco International Airport (SFO), San Jose, the Caltrain Corridor and the Central Valley and would have high ridership and revenue potential. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be about 2% higher than the Pacheco “Base Case” alternative, or at about 95.8 million passengers a year by 2030. Revenue would be about $3.16 billion a year by 2030.
Constructability	Constructing a new transbay tube between San Francisco and Oakland would involve major construction activities in the San Francisco Bay and special construction methods and mitigations would be required. Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing commuter rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	1,196 million
Operational Issues	Average Speed SF–LA=164.2 mph (273.6 kph); Oakland–LA=156.8 mph (261.3 kph); SJ–LA=179.5 mph (299.2 kph);SF–Sac=152.8 mph (254.7 kph); Oakland–Sac=147 mph (244.9 kph); SJ–Sac=174 mph (290 kph); SF–Fresno=139.5 mph (232.5 kph); Oakland–Fresno=132.9 mph (221.5 kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (305.4 kph); SF–Gilroy=102.3 mph (170.6 kph); Oakland–Gilroy=98 mph (163.38 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed

Table 7.2-16
Pacheco Pass: San Jose, San Francisco, and Oakland – via Transbay Tube

	SF–LA=210 mph (350 kph); Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph);SF–Sac=210 mph (350 kph); Oakland–Sac=210 mph (350 kph); SJ–Sac=210 mph (350 kph); SF–Fresno=210 mph (350 kph); Oakland–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Gilroy–LA=210 mph (350 kph); SF–Gilroy=180 mph (300 kph); Oakland–Gilroy=180 mph (300 kph); SJ–Gilroy=180 mph (300 kph) HST operations would need to be coordinated and integrated with Caltrain service.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco. The transbay tube would provide direct service to Oakland, with a station in West Oakland. The Caltrain Corridor would serve the San Francisco International Airport with a station at (Millbrae), and a mid-Peninsula station at Palo Alto. HST service to San Jose would be at the Diridon Station. The Gilroy Station would service Southern Santa Clara County, and the Central Valley would be served by stations in Merced and Briggsmore. This network alternative would increase connectivity and accessibility to Oakland, San Francisco, the Peninsula and SFO, the hub international airport for northern California, San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/Salinas area, and the Central Valley. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the San Francisco Peninsula while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Gilroy would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) segments in the Central Valley. This network alternative would not provide direct HST service to Oakland Airport, south Alameda County, and the I-580 corridor.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium to high potential of vibration impacts for the overall alternative. Medium potential of vibration impacts from San Francisco to Dumbarton. High potential of vibration impacts from Dumbarton to San Jose. Medium potential of vibration impacts, from San Jose to Gilroy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S or BNSF N/S in the Chowchilla area and a medium compatibility along the BNSF N/S Alignment in the Central Valley. Environmental Justice: This network alternative has medium environmental impact justice rating for the Caltrain Corridor between San Francisco and Gilroy and a low impact rating from Gilroy to the Central Valley. The BNSF N/S alignment has a medium impact rating except for low impact ratings in the Briggsmore and Chowchilla areas. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way.

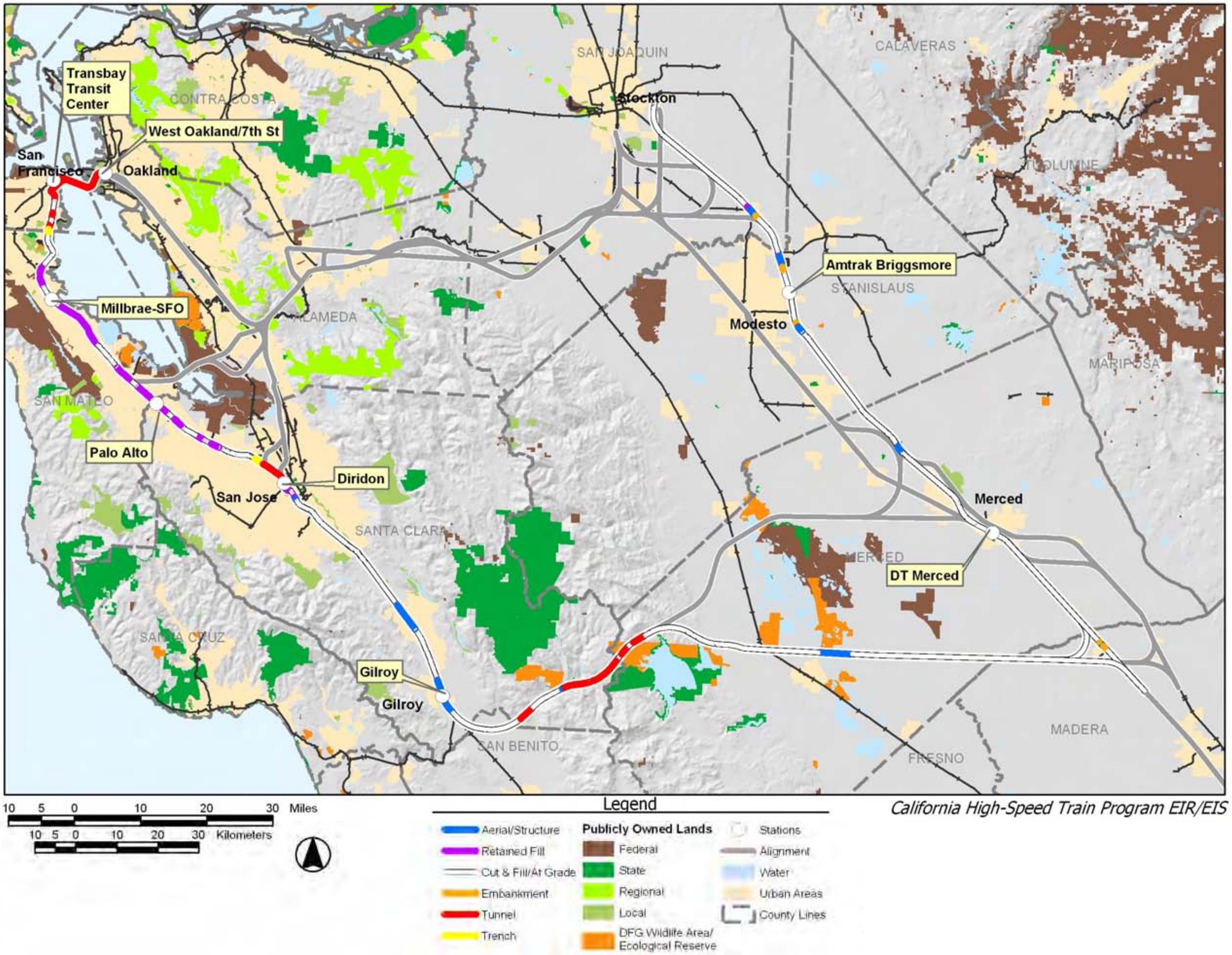


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Figure 7.2-16
Network Alternatives
Pacheco Pass
San Jose, San Francisco, and Oakland—via Transbay Tube

Table 7.2-16
Pacheco Pass: San Jose, San Francisco, and Oakland – via Transbay Tube

	Property: This network alternative has the potential for low property impacts as the alignment either traverses existing transportation right-of-way or through rural land.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =lo; (2) Caltrain – Dumbarton to San Jose =low; (3) Pacheco =medium; (4) Henry Miller to UPRR =low; (5) Trans Bay Crossing =none; and (6) BNSF N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,372.3 ac (555.36ha) Impact up to 663.3 ac (268.45 ha) of prime farmland. The majority of potential farmland impacts would occur along the Pacheco, Henry Miller, BNSF (North/South), and UPRR (North/South) segments. Overall, this network alternative along with the San Francisco and San Jose Termini and San Jose Terminus a would have the Least Potential Impacts (LPI) to farmland within the Pacheco Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 108 known cultural resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, a sanitary sewer system, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The area around the Trans Bay crossing likely includes historic artifacts from the Gold Rush period through the 1906 earthquake. The Santa Clara de Asis Mission in San Jose includes both prehistoric and historic resources. Overall, this network alternative was identified as having a moderate sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 520.8 ac (210.76 ha) direct/ 1,633.2 ac (660.96 ha) indirect Streams: 20,276 linear ft (6,180.1 linear m) direct/ 90,572 linear ft (27,606.42 linear m) indirect Lakes/Waterbodies: 40.3 ac (16.32 ha) direct/ 255.2 ac (103.27 ha) indirect Potentially affect San Francisco Bay, Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.

Table 7.2-16
Pacheco Pass: San Jose, San Francisco, and Oakland – via Transbay Tube

Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 38.4 ac (15.54 ha) direct/ 2,955 ac (1,195.9 ha) indirect Non-Wetland Waters: 14,395 linear ft (4,387.5 linear m) Species: 59 special-status plant and 53 special-status wildlife species Of the Pacheco Pass network alternatives, this network alternative along with two other network alternatives would have the potential to impact the most special-status wildlife species, and a substantial amount of wetlands as a result of the Trans Bay crossing. This alternative could potentially result in impacts on biological resources in San Francisco Bay, including potentially significant impacts to special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	San Bruno (Potentially Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) – At Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 19 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way.

F. SAN JOSE, OAKLAND, AND SAN FRANCISCO – VIA TRANSBAY TUBE

This network alternative is shown in Figure 7.2-17 and described in Table 7.2-17. The segments used for this representative alternative are Trans Bay Crossing – Transbay Transit Center, Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose), Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, BNSF - UPRR.

Table 7.2-17
Pacheco Pass: San Jose, Oakland, and San Francisco– via Transbay Tube

Physical/Operational Characteristics	
Network Alternative Description	This network alternative would require a new transbay tube from San Francisco to Oakland. From Oakland to San Jose, this network alternative would use the Niles/I-880 Alignment. From San Jose, this network alternative would use the Pacheco and Henry Miller (to the UPRR) Alignment Alternatives and the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) Alignments in the Central Valley. Station location options considered for this alternative are Transbay Transit Center, West Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Briggsmore (Amtrak).
Length	265.66 mi (427.54 km)
Cost (dollars)	$16.3 billion
Express Travel Times (minutes)	SF–LA=2:35; Oakland–LA=2:30; SJ–LA=2:09; SF–Sac=1:52; Oakland–Sac=1:38; SJ–Sac=1:18; SF–Fresno=1:17; Oakland–Sac=1:12; SJ–Sac=0:51; Gilroy–LA=1:57; SF–Gilroy=040; Oakland–Gilroy=0:36; SJ–Gilroy=0:15
Ridership	This network alternative would directly serve downtown San Francisco, downtown Oakland and Oakland International Airport, Union City and San Jose, Southern Santa Clara County, and the Central Valley and would have high ridership and revenue potential. Total ridership and revenue for the statewide HST system with this network alternative is forecast to be about 1.6% less than the Pacheco "Base Case" alternative, or at 92.4 million passengers per year by 2030. Revenue is estimated at $3.05 billion per year by 2030.
Constructability	Constructing a new transbay tube between Oakland and San Francisco would involve major construction activities in the San Francisco Bay and special construction methods and mitigations would be required. Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing commuter rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,179 million
Operational Issues	Average Speed SF–LA=164.6 mph (274.4 kph); Oakland–LA=170.7 mph (284.6 kph); SJ–LA=179.5 mph (299.2 kph);SF–Sac=158 mph (263.3 kph); Oakland–Sac=163.5 mph (272.6 kph); SJ–Sac=174 mph (290 kph); Oakland–Fresno=150.5 mph (250.8 kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (305.4 kph); SF–Gilroy=114.4 mph (190.7 kph); Oakland–Gilroy=116 mph (193.3 kph); SJ–Gilroy=114.6 mph (191 kph)

Table 7.2-17
Pacheco Pass: San Jose, Oakland, and San Francisco– via Transbay Tube

	Maximum Speed SF–LA=210 mph (350 kph); Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph);SF–Sac=210 mph (350 kph); Oakland–Sac=210 mph (350 kph); SJ–Sac=210 mph (350 kph); SF–Fresno=210 mph (350 kph); Oakland–Sac=210 mph (350 kph); SJ–Sac=210 mph (350 kph); Gilroy–LA=210 mph (350 kph); SF–Gilroy=180 mph (300 kph); Oakland–Gilroy=180 mph (300 kph); SJ–Gilroy=180 mph (300 kph) HST operations would need to be coordinated and integrated with Caltrain service between San Jose and Gilroy.
Potential Environmental Impacts	
Travel Conditions	The Niles/I-880 Alignment would bring direct HST service up the East Bay and the transbay tube would provide direct service to downtown San Francisco. It would directly serve Oakland and the East Bay with stations at West Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon) and would serve southern Santa Clara County with a station at Gilroy (Caltrain). Service to the Central Valley would be at Merced (Downtown), and Briggsmore (Amtrak) stations. This network alternative would increase connectivity and accessibility to San Francisco, Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the East Bay while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor between Gilroy and San Jose, Niles/I-880 Alignment between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the BNSF N/S (north of Merced) and UPRR N/S (south of Merced) segments in the Central Valley. This network alternative would not provide direct service to SFO, the mid-SF Peninsula, and the I-580 corridor (the Tri-Valley, and Tracy).
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium to high potential of vibration impacts for the overall alternative. Medium potential of vibration impacts from San Francisco to Dumbarton. High potential of vibration impacts from Oakland to San Jose. Medium potential of vibration impacts, from San Jose to Gilroy and a low potential in the Central Valley.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S or BNSF N/S in the Chowchilla area and a medium compatibility along the BNSF N/S Alignment in the Central Valley. Environmental Justice: This network alternative has medium environmental impact justice rating for the East Bay between Oakland and San Jose and for the Caltrain Corridor between San Jose and Gilroy, and a low impact rating from Gilroy to the Central Valley. The BNSF N/S alignment has a medium impact rating except for low impact ratings in the Briggsmore and Chowchilla areas.

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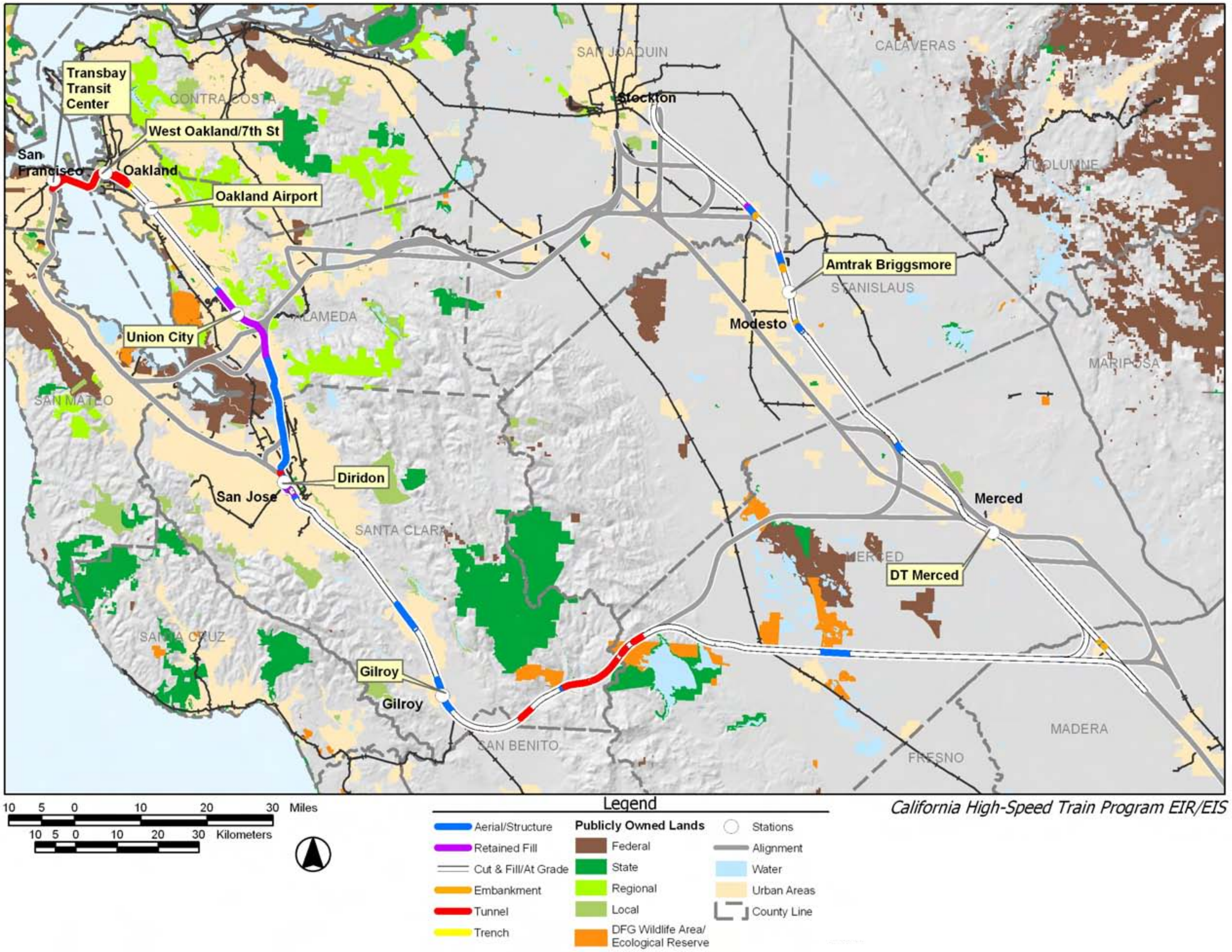

U.S. Department of Transportation Federal Railroad Administration

Figure 7.2-17
Network Alternatives
Pacheco Pass
San Jose, Oakland, and San Francisco—via Transbay Tube

Table 7.2-17
Pacheco Pass: San Jose, Oakland, and San Francisco– via Transbay Tube

	Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for low property impacts as the alignment either traverses existing transportation right-of-way or through rural land.
Aesthetics and Visual Resources: General impacts and rating	Segments visual ratings: (1) Oakland to Niles Junction =low; (2) Niles Junction to San Jose =medium; (3) Pacheco =medium; (4) Henry Miller to UPRR =low; (5) Trans Bay Crossing =none; and (6) BNSF N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,378.7 ac (557.96 ha) Impact up to 669.7 ac (271.04 ha) of prime farmland. The majority of potential farmland impacts would occur along the Pacheco, Henry Miller, BNSF (North/South), and UPRR (North/South) segments. Overall, this network alternative along with the Oakland and San Jose Termini and San Francisco, Oakland, and San Jose Termini would have the greatest potential impact on farmland within the Pacheco Pass network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 111 known cultural resources. Historic properties and industrial complexes dating from the 1920s and 1940s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, a sanitary sewer system, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The area around the Trans Bay crossing likely includes historic artifacts from the Gold Rush period through the 1906 earthquake. Overall, this network alternative was identified as having a low sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 477.5 ac (193.24 ha) direct/ 1,685.1 ac (681.98 ha) indirect Streams: 30,278 linear ft (9,228.9 linear m) direct/ 137,768 linear ft (41,991.56 linear m) indirect Lakes/Waterbodies: 41.0 ac (16.58 ha) direct/ 253.1 ac (102.43 ha) indirect Of the Pacheco Pass network alternatives, this network alternative was identified to have the highest amount of impact on lakes and the San Francisco Bay due to the Trans Bay crossing. Potentially affect San Francisco Bay, Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.

Table 7.2-17
Pacheco Pass: San Jose, Oakland, and San Francisco– via Transbay Tube

Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 40.2 ac (16.28 ha) direct/ 3,179 ac (1,286.5 ha) indirect Non-Wetland Waters: 14,553 linear ft (4,429.6 linear m) Species: 50 special-status plant and 49 special-status wildlife species Of the Pacheco Pass network alternatives, this network alternative along with one other network alternative would have the potential to impact the least special-status wildlife species. This network alternative along with two other network alternatives would have the potential to impact the most area of impact on wetlands. This alternative could potentially result in impacts on biological resources in San Francisco Bay as a result of the Trans Bay crossing. Potentially significant impacts to special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 22 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way.

7.2.3 Pacheco Pass with Altamont Pass (local service)

A. SAN FRANCISCO AND SAN JOSE TERMINI

This network alternative is shown in Figure 7.2-18 and described in Table 7.2-18. The segments used for this representative alternative are Caltrain Corridor (SF to Dumbarton), Caltrain (Dumbarton to San Jose), Dumbarton (High Bridge), UPRR (Niles to Altamont)[14], Tracy Downtown (UPRR Connection)[15], Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, UPRR.

Table 7.2-18
Pacheco Pass with Altamont Pass (Local Service): San Francisco and San Jose Termini

Physical/Operational Characteristics	
Network Alternative Description	From San Francisco to San Jose, this network alternative would use the existing Caltrain rail right-of-way. From San Jose, this network alternative would use the Pacheco and Henry Miller (to the UPRR) Alignment Alternatives and the UPRR N/S Alignment in the Central Valley. From Redwood City, this network alternative would also cross the San Francisco Bay in the Dumbarton Corridor. The Altamont Pass would use the UPRR Alignment through downtown Tracy. Station location options considered for this alternative are Transbay Transit Center, Millbrae/SFO, Palo Alto (Caltrain), San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Modesto (Downtown). Local HST Stations would be at Union City (Shinn), Pleasanton (I-680/Bernal Road), and Tracy (Downtown).
Length	339.16 mi (545.83 km)
Cost (dollars)	$18.3 billion
Express Travel Times (minutes)	Altamont SF–LA=2:45; SJ–LA=2:26; SF–Sac=1:15; SJ–Sac=0:56; SF–Fresno=1:27; SJ–Fresno=1:08; Pleasanton–LA=2:13; Tracy–LA=1:59; SF–Tracy=0:46; SJ–Tracy=0:27 Pacheco SF–LA=2:38; SJ–LA=2:09; SF–Sac=1:47; SJ–Sac=1:18; SF–Fresno=1:20; SJ–Fresno=0:51; Gilroy–LA=1:57; SF–Gilroy=0:44; SJ–Gilroy=0:15
Ridership	This network alternative would directly serve downtown San Francisco and San Francisco International Airport (SFO), San Jose, southern Santa Clara County, Southern Alameda County, the I-580 Corridor and Tri-Valley area and the Central Valley and would have high ridership and revenue potential. Total ridership for the statewide HST system with this network alternative is forecast to be about 3% higher than the Pacheco “Base Case” network alternative, or at 96.2 million passengers per year by 2030. However, revenue is estimated to be about 3.2 percent less than the

[14] Does not include “express tracks” through Pleasanton Station.

[15] Does not include “express tracks” through Tracy Downtown Station.

Table 7.2-18
Pacheco Pass with Altamont Pass (Local Service): San Francisco and San Jose Termini

	Pacheco "Base Case" network alternative at $2.99 billion per year by 2030.
Constructability	Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required. Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing passenger rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,171 million
Operational Issues	Altamont Average Speed SF–LA=165.2_ mph (265.8 kph); SJ–LA=176.5 mph (284 kph);SF–Sac=121.3 mph (195.2 kph);SJ–Sac=135.3 mph (218.3 kph); SF–Fresno=137.3 mph (221.4 kph); SJ–Fresno=153.6 mph (247.8 kph); Pleasanton–LA=181.3 mph (292.3 kph); Tracy–LA=183.4 mph (305.7 kph); SF–Tracy=100.6 mph (162.3 kph); SJ–Tracy=115.7 mph (186.7 kph) Maximum Speed SF–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=198 mph (330 kph); SJ–Sac=198 mph (330 kph); SF–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); SF–Tracy=169.2 mph (282 kph); SJ–Tracy=180 mph (300 kph) Pacheco Average Speed SF–LA=164.2 mph (273.6 kph); SJ–LA=179.5 mph (299.2 kph) ;SF–Sac=152.8 mph (254.7 kph); SJ–Sac=174_ mph (290 kph); SF–Fresno=139.5 mph (232.5 kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (305.4 kph); SF–Gilroy=102.3 mph (170.6 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed SF–LA=210 mph (350 kph); SJ–LA=210 mph 350 kph) ;SF–Sac=210 mph (350 kph); SJ–Sac=210 mph (350 kph); SF–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Gilroy–LA=210 mph (350 kph); SF–Gilroy=180mph (300 kph); SJ–Gilroy=180 mph (300 kph) HST operations would need to be coordinated and integrated with Caltrain service and ACE service. Using both the Pacheco and Altamont alignment alternatives to serve the Bay Area provides greater capacity, operating flexibility, and reliability (in terms of redundancy). To serve the additional markets, more train operations would be necessary.

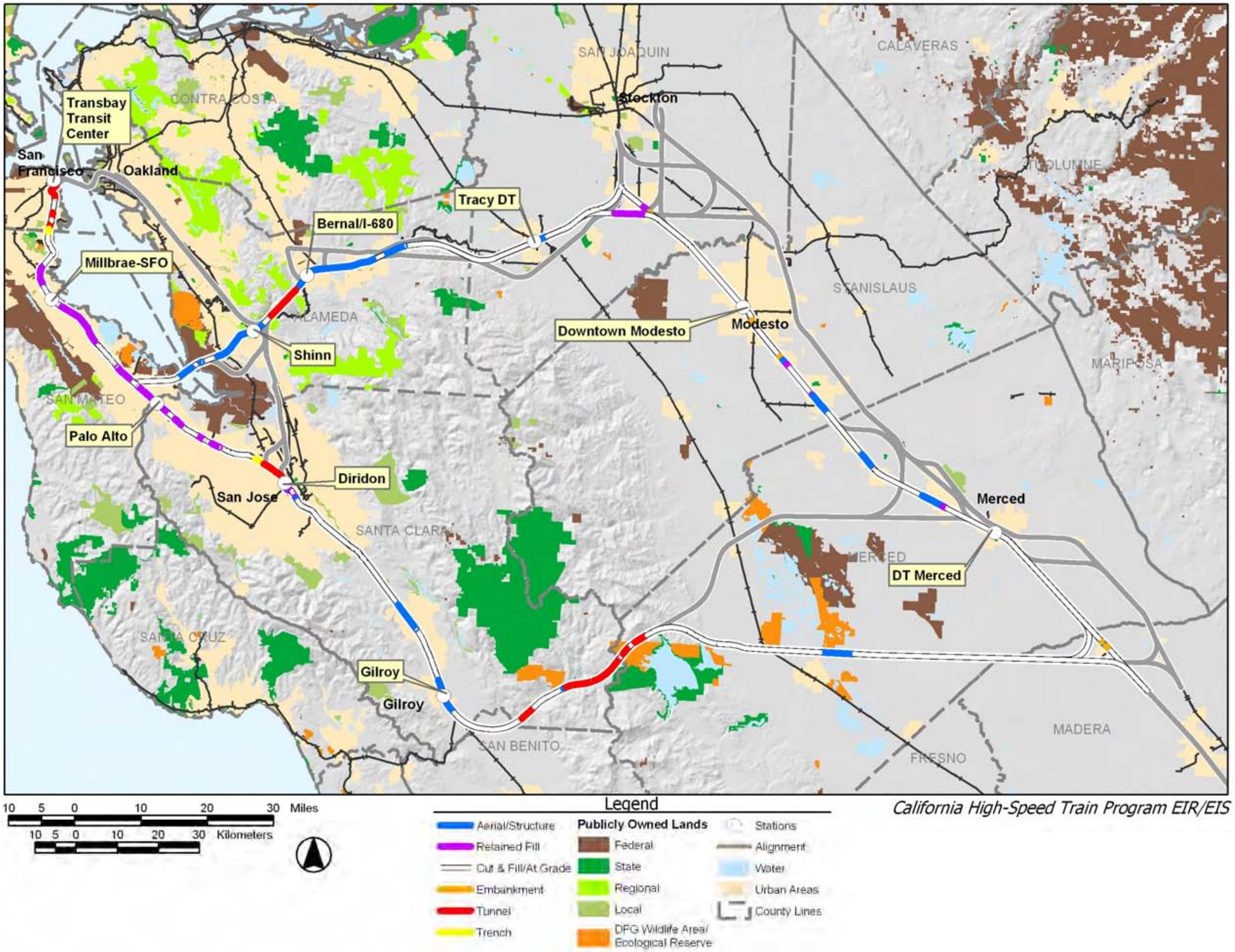

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Figure 7.2-18
Network Alternatives
Pacheco Pass with Altamont Pass (Local Service)
San Francisco and San Jose Termini

Table 7.2-18
Pacheco Pass with Altamont Pass (Local Service): San Francisco and San Jose Termini

Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), a mid-Peninsula station at Palo Alto, and a San Jose Station (Diridon). HST service would be provided to Southern Santa Clara County at a Gilroy Station, with service to the Central Valley at Merced and Modesto. The Altamont Pass would use the UPRR Alignment with stations in Union City (Shinn), Pleasanton (I-680/Bernal), and downtown Tracy. This network alternative would increase connectivity and accessibility to San Francisco, the Peninsula and SFO, the hub international airport for northern California, southern Alameda County, San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area, the I-580 Corridor and Tri-Valley area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the San Francisco Peninsula while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Gilroy would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment segments through the Central Valley. This network alternative would not provide direct HST service to Oakland, and Oakland Airport.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts and the Dumbarton (High Bridge) which has a high potential of noise impacts. Medium to high potential of vibration impacts for the overall alternative. Medium potential of vibration impacts from San Francisco to Dumbarton. High potential of vibration impacts from Dumbarton to San Jose. Medium potential of vibration impacts, from San Jose to Gilroy and San Jose to Tracy. The Central Valley has a low potential for vibration impacts.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S in the Chowchilla area. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It exhibits a medium to high compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the Caltrain Corridor between San Francisco and Gilroy and low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley. It has a low impact rating between Gilroy and the Central Valley, and a medium impact rating in the Central Valley except in the Manteca area, where the rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.

Table 7.2-18
Pacheco Pass with Altamont Pass (Local Service): San Francisco and San Jose Termini

Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) Caltrain – Dumbarton to San Jose =low; (3) Pacheco =medium: (4) Henry Miller to UPRR =low: (5) UPRR =medium; (6) Tracy Downtown =low: (7) Dumbarton High Bridge =medium; and (8) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,380.0 ac (558.49 ha) Impact up to 760.4 ac (307.73 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy, Pacheco, Henry Miller and UPRR (North/South) segments. Overall, this network alternative would have the Least Potential Impact (LPI) to farmland within the Pacheco Pass with Altamont (local service) network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 198 known cultural resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. The area around San Jose has a high density of cultural resources. Archaeological resources in the area of the Dumbarton crossing include prehistoric sites associated with burials, and historic sites from early 1900s industrial activities. Overall, this network alternative was identified as having a high sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 547.1 ac (221.39 ha) direct/ 3,410.6 ac (1,380.28 ha) indirect Streams: 27,130 linear ft (8,269.2 linear m) direct/ 125,490 linear ft (38,249.22 linear m) indirect Lakes/Waterbodies: 41.9 ac (16.97 ha) direct/ 164.9 ac (66.72 ha) indirect Of the Pacheco Pass with Altamont Pass (local service) network alternatives, this network alternative was identified to have the highest impact on lakes and the San Francisco Bay as a result of the Dumbarton crossing. Potentially affect San Francisco Bay, Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.

Table 7.2-18
Pacheco Pass with Altamont Pass (Local Service): San Francisco and San Jose Termini

Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 56.1 ac (22.72 ha) direct/ 3,499 ac (1,416.0 ha) indirect Non-Wetland Waters: 19,891 linear ft (6,062.9 linear m) Species: 70 special-status plant and 57 special-status wildlife species Of the Pacheco Pass with Altamont Pass (local service) network alternatives, this network alternative would have the potential to impact the most area of wetlands and waters. This alternative could potentially result in impacts on biological resources in San Francisco Bay as a result of the Dumbarton crossing. Potentially significant impacts on special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA and Don Edwards San Francisco Bay National Wildlife Refuge. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	San Bruno (Potentially Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) – At Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) - At Grade Silver Creek (Potentially Active) - At Grade Hayward (Active) - Above Grade Mission (Potentially Active) - At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 35 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

B. OAKLAND AND SAN JOSE TERMINI

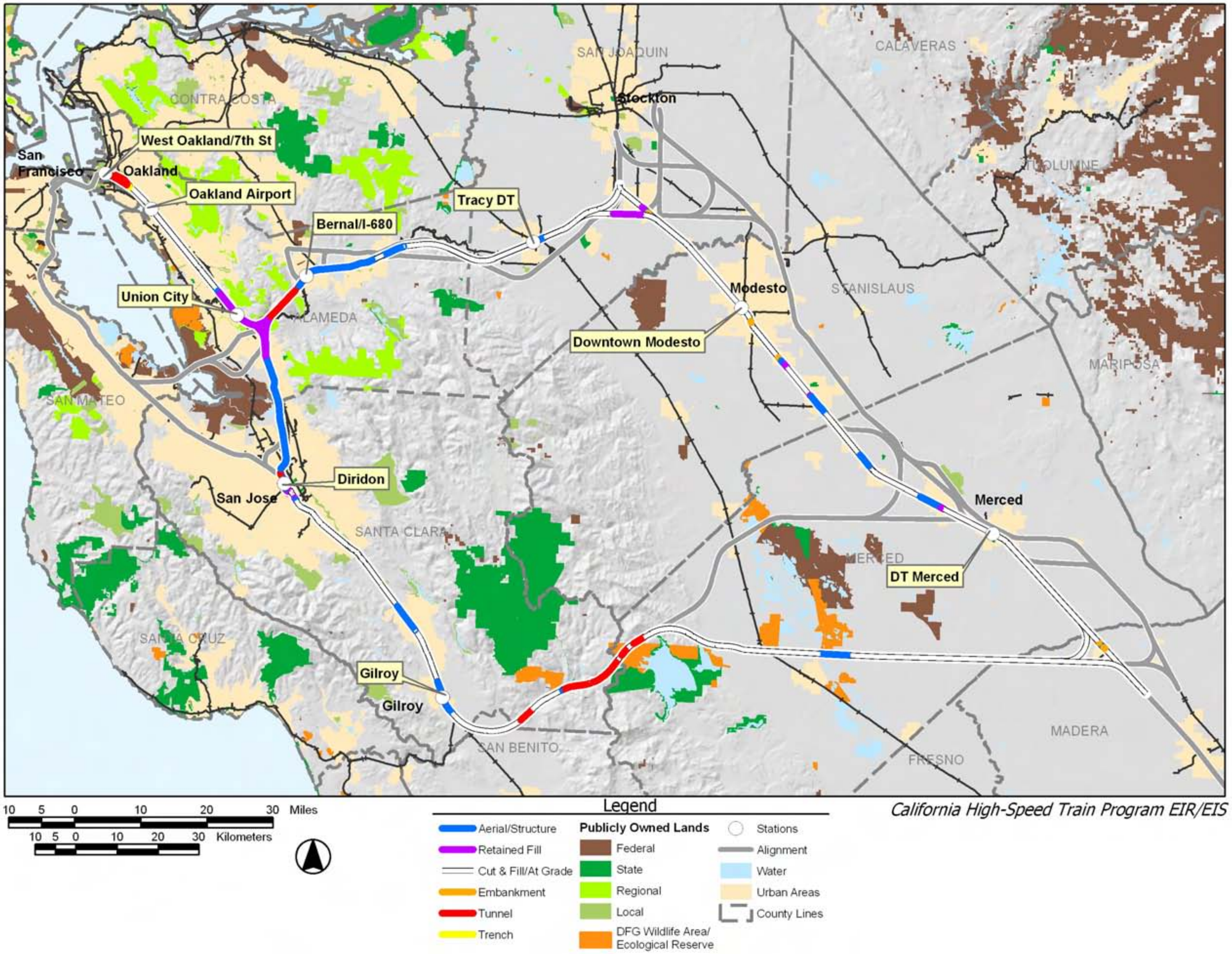
This network alternative is shown in Figure 7.2-19 and described in Table 7.2-19. The segments used for this representative alternative are Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose via I-880), East Bay Connections (Dumbarton/Niles XN & Dumbarton/Niles XS), UPRR (Niles to Altamont)[16], Tracy Downtown (UPRR Connection)[17], Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, UPRR (Central Valley).

Table 7.2-19
Pacheco Pass with Altamont (Local Service): Oakland and San Jose Termini

Physical/Operational Characteristics	
Network Alternative Description	From Oakland to San Jose, this network alternative would use the Niles/I-880 Alignment. From San Jose, this network alternative would use the Pacheco and Henry Miller (to the UPRR) Alignment Alternatives and the UPRR N/S Alignment in the Central Valley. The UPRR Alignment through Downtown Tracy would be used for the Altamont Pass. Station location options considered for this alternative are West Oakland/7th Street, Coliseum/Airport, Union City (BART), San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Modesto (Downtown). Local HST Stations would be at Pleasanton (I-680/Bernal Road), and Tracy (Downtown).
Length	318.45 mi (512.50 km)
Cost (dollars)	$16.0 billion
Express Travel Times (minutes)	Altamont Oakland–LA=2:30; SJ–LA=2:26; Oakland–Sac=1:00; SJ–Sac=0:56; Oakland–Fresno=1:11; SJ–Fresno=1:08; Pleasanton–LA=2:13; Tracy–LA=1:59 Pacheco Oakland–LA=2:30; SJ–LA=2:09; Oakland–Sac=1:38; SJ–Sac=1:18; Oakland–Fresno=1:12; SJ–Fresno=0:51; Gilroy–LA=1:57; Oakland–Gilroy=0:36; SJ–Gilroy=0:15
Ridership	This network alternative would directly serve downtown Oakland and Oakland International Airport (SFO), San Jose, south Santa Clara County, and the Central Valley and would have high ridership and revenue potential. Total ridership for the statewide HST system with this network alternative is forecast to be about 1% less than the Pacheco “Base Case” alternative, or at 92.9 million passengers per year by 2030. Revenue is estimated at $3.07 billion per year by 2030.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing passenger rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.

[16] Does not include “express tracks” through Pleasanton Station.

[17] Does not include “express tracks” through Tracy Downtown Station.



U.S. Department of Transportation Federal Railroad Administration

Figure 7.2-19
Network Alternatives
Pacheco Pass with Altamont (Local Service)
Oakland and San Jose Termini

Table 7.2-19
Pacheco Pass with Altamont (Local Service): Oakland and San Jose Termini

O & M Cost (dollars per year)	$1,140 million
Operational Issues	Altamont Average Speed Oakland–LA=173.6 mph (280.0 kph); SJ–LA=176.1 mph (284.0 kph); Oakland–Sac=132.1 mph (213.0 kph); SJ–Sac=135.3 mph (218.3 kph); Oakland–Fresno=152.4 mph (245.8 kph); SJ–Fresno=153.6 mph (247.8 kph); Pleasanton–LA=181.3 mph (292.3 kph); Tracy–LA=183.4 mph (305.7 kph); Oakland–Tracy=116.6 mph (194.3 kph); SJ–Tracy=120.7 mph (201.2 kph) Maximum Speed Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); Oakland–Sac=198 mph (330 kph); SJ–Sac=198 mph (330 kph); Oakland–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); Oakland–Tracy=178.2 mph (297 kph); SJ–Tracy=180 mph (300 kph); Using both the Pacheco and Altamont alignment alternatives to serve the Bay Area provides greater capacity, operating flexibility, and reliability (in terms of redundancy). In order to serve the additional markets, more train operations would be necessary. HST operations would need to be coordinated and integrated with ACE service. Pacheco Average Speed Oakland–LA=170.7 mph (284.6 kph); SJ–LA=179.5 mph (299.2 kph); Oakland–Sac=163.5 mph (272.6 kph); SJ–Sac=174 mph (290 kph); Oakland–Fresno=150.5 mph (250.8 kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (305.4 kph); Oakland–Gilroy=116 mph (193.3 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); Oakland–Sac=210 mph (350 kph); SJ–Sac=210 mph (350 kph); Oakland–Fresno=210_ mph (350 kph); SJ–Fresno=210 mph (350); Gilroy–LA=210 mph (350 kph); Oakland–Gilroy=180 mph (300 kph); SJ–Gilroy=180 mph (300 kph)
Potential Environmental Impacts	
Travel Conditions	This network alternative would provide direct service to Oakland with a station in West Oakland, to the Oakland International Airport with a Coliseum/BART station, to Southern Alameda County with a station at Union City (BART), to San Jose at the Diridon Station, to Southern Santa Clara County with a Gilroy Station, and to the Central Valley with stations at Merced and Modesto. The Altamont Pass would use the UPRR Alignment with local HST stations at Pleasanton (I-680/Bernal), and downtown Tracy. This network alternative would increase connectivity and accessibility to Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area, the I-580 Corridor and Tri-Valley area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode of travel while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the

Table 7.2-19
Pacheco Pass with Altamont (Local Service): Oakland and San Jose Termini

	capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor between Gilroy and San Jose, Niles/I-880 Alignment between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment segments through the Central Valley. This network alternative would not provide direct HST service to San Francisco, SFO and the SF Peninsula/Caltrain Corridor between San Francisco and San Jose.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium to high potential of vibration impacts for the overall alternative. Medium potential of vibration impacts from San Jose to Niles Junction. High potential of vibration impacts from Oakland to Niles Junction. Medium potential of vibration impacts, from San Jose to Gilroy and Niles Junction to Tracy. The Central Valley has a low potential for vibration impacts.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S in the Chowchilla area. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the East Bay Between Oakland and San Jose, for the Caltrain Corridor between San Jose and Gilroy, and a low impact rating between Gilroy and the Central Valley. It exhibits a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley, and a medium impact rating in the Central Valley, except in the Manteca area, where the rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Oakland to Niles Junction =low; (2) Niles Junction to San Jose =medium; (3) Pacheco =medium; (4) Henry Miller to UPRR =low; (5) UPRR =medium; (6) Tracy Downtown =low; and (7) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,384.1 ac (560.14 ha) Impact up to 764.5 ac (309.39 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy, Pacheco, Henry Miller and UPRR (North/South) segments. Overall, this network alternative along with the San Francisco, Oakland, and San Jose Termini (without Dumbarton Bridge), and San Jose Termini alternatives would have the greatest potential impact on farmland within the Pacheco Pass with Altamont (local service) network alternatives. The difference in overall farmland impacts within the Pacheco Pass with Altamont (local service) network alternatives is about 4 ac (1.62 ha).

Table 7.2-19
Pacheco Pass with Altamont (Local Service): Oakland and San Jose Termini

Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 133 known cultural resources. Historic properties and industrial complexes dating from the 1920s and 1940s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. Overall, this network alternative was identified as having a moderate sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 456.4 ac (184.7 ha) direct/ 1,633.2 ac (660.96 ha) indirect Streams: 27,666 linear ft (8,432.5 linear m) direct/ 132,501 linear ft (40,386.4 linear m) indirect Lakes/Waterbodies: 5.3 ac (2.14 ha) direct/ 18.92 ac (7.66 ha) indirect Potentially affect Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 25.3 ac (10.23 ha) direct/ 2,180 ac (882.4 ha) indirect Non-Wetland Waters: 17,977 linear ft (5,479.3 linear m) Species: 67 special-status plant and 51 special-status wildlife species Potentially significant impacts on special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 36 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

C. SAN FRANCISCO, OAKLAND, AND SAN JOSE TERMINI (WITHOUT DUMBARTON BRIDGE)

This network alternative is shown in Figure 7.2-20 and described in Table 7.2-20. The segments used for this representative alternative are Caltrain (SF – Dumbarton), Caltrain (Dumbarton – San Jose), Niles/I-880 (West Oakland to Niles Junction), Niles/I-880 (Niles Junction to San Jose via I-880), East Bay Connections (Dumbarton/Niles XN & Dumbarton/Niles XS), UPRR (Niles to Altamont)[18], Tracy Downtown (UPRR Connection)[19], Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, UPRR (Central Valley).

Table 7.2-20
Pacheco Pass with Altamont Pass (Local Service): SF, Oak, and SJ Termini (without Dumbarton Bridge)

Physical/Operational Characteristics	
Network Alternative Description	From Oakland to San Jose, this network alternative would use the Niles/I-880 Alignment. From San Francisco to San Jose, this network alternative would use the existing Caltrain right-of-way. From San Jose, this network alternative would use the Pacheco and Henry Miller (to the UPRR) Alignment Alternatives and the UPRR N/S Alignment in the Central Valley. The UPRR Alignment through Downtown Tracy would be used for the Altamont Pass. Station location options considered for this alternative are West Oakland/7th Street, Coliseum/Airport, Union City (BART), Transbay Transit Center, Millbrae/SFO, Palo Alto (Caltrain), San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Modesto (Downtown). Local HST Stations would be at Pleasanton (I-680/Bernal Road), and Tracy (Downtown).
Length	360.90 mi (580.81 km)
Cost (dollars)	$20.4 billion
Express Travel Times (minutes)[20]	Altamont SF–LA=3:26; Oakland–LA=2:30; SJ–LA=2:26; SF–Sac=1:48; Oakland–Sac=1:00; SJ–Sac=0:56; SF–Fresno=2:03; Oakland–Fresno=1:11; SJ–Fresno=1:08 ; Pleasanton–LA=2:13; Tracy–LA=1:59; SF–Tracy=1:36; Oakland–Tracy=0:36; SJ–Tracy=0:27 Pacheco SF–LA=2:38; Oakland–LA=2:30; SJ–LA=2:09;SF–Sac=1:47; Oakland–Sac=1:38; SJ–Sac=1:18; SF–Fresno=1:20; Oakland–Fresno=1:12; SJ–Fresno=0:51; Gilroy–LA=1:57; SF–Gilroy=0:44; Oakland–Gilroy=0:36; SJ–Gilroy=0:15

[18] Does not include “express tracks” through Pleasanton Station.

[19] Does not include “express tracks” through Tracy Downtown Station.

[20] The travel times for any train traveling to or from San Francisco for this alternative must include a turn around time of no less than 20 minutes at the San Jose station.

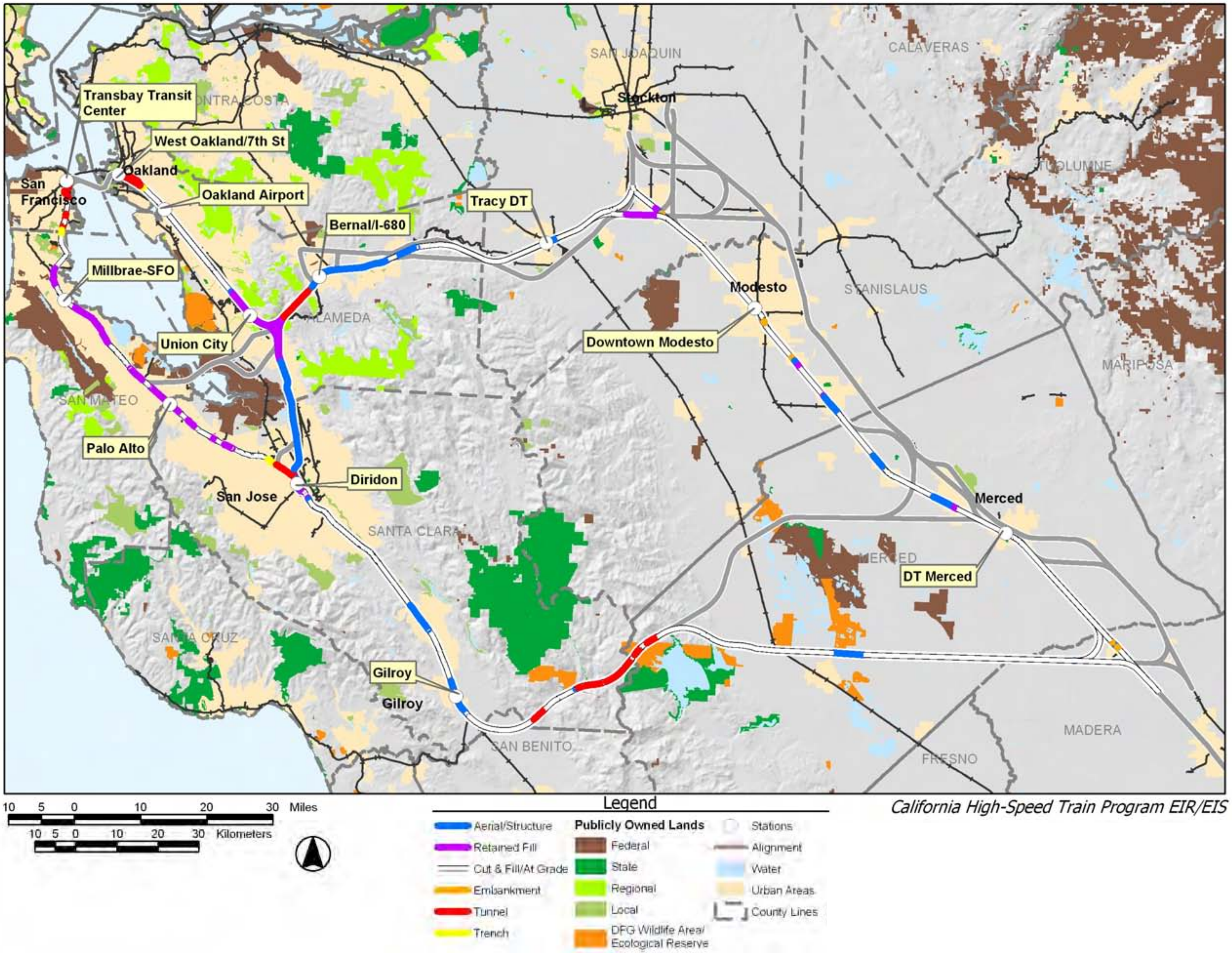


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Figure 7.2-20
Network Alternatives
Pacheco Pass with Altamont (Local Service)
San Francisco, Oakland, and San Jose Termini (without Dumbarton Bridge)

Table 7.2-20
Pacheco Pass with Altamont Pass (Local Service): SF, Oak, and SJ Termini (without Dumbarton Bridge)

Ridership	This network alternative would directly serve downtown Oakland and Oakland International Airport, downtown San Francisco, the San Francisco International Airport, the Peninsula, San Jose, south Santa Clara County and the Central Valley. Total ridership for the statewide HST system with this network alternative is forecast to be about 6.5% less than the Pacheco "Base Case" alternative, or at 87.8 million passengers per year by 2030. Revenue is estimated at $2.9 billion per year by 2030. Although this option serves additional markets than the Pacheco Base Case Alternative, the drop in system ridership is a result of the splitting of service between the San Francisco Peninsula, Oakland, and San Jose. Additional frequency of service (along with higher operational costs) would be needed to increase ridership for this network alternative.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing passenger rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,179 million
Operational Issues	Altamont Average Speed SF–LA=138.6 mph (223.6 kph); Oakland–LA=173.6 mph (280.0 kph); SJ–LA=176.0 mph (284.0 kph); SF–Sac=96.4 mph (155.6 kph); Oakland–Sac=132.1 mph (213.0 kph); SJ–Sac=_135.3 mph (218.3 kph); SF–Fresno=120.4 mph (194.1 kph); Oakland–Fresno=152.4 mph (245.8 kph); SJ–Fresno=153.6 mph (247.8 kph); Pleasanton–LA=181.3 mph (292.3 kph); Tracy–LA=183.4 mph (305.7 kph); SF–Tracy=62.4 mph (100.6 kph); Oakland–Tracy=97.1 mph (156.7 kph); SJ–Tracy=115.7 mph (186.7 kph) Maximum Speed SF–LA=210 mph (350 kph); Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=198 mph (330 kph); Oakland–Sac=198 mph (330 kph); SJ–Sac=198 mph (330 kph); SF–Fresno=210 mph (350 kph); Oakland–Fresno=210 mph (350kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph 350 kph); SF–Tracy=178.2 mph (297 kph); Oakland–Tracy=178.2 mph (297 kph); SJ–Tracy=180 mph (300 kph) Pacheco Average Speed SF–LA=164.2 mph (273.6 kph); Oakland–LA=170.7 mph (284.6 kph); SJ–LA=179.5mph (299.2 kph); SF–Sac=152.8 mph (254.7 kph); Oakland–Sac=163.5 mph (272.6 kph); SJ–Sac=174 mph 290 kph); SF–Fresno=139.5 mph (232.5 kph); Oakland–Fresno=150.5 mph (250.8 kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (305.4_ kph); SF–Gilroy=102.3 mph (170.6 kph); Oakland–Gilroy=116 mph (193.3 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed SF–LA=210 mph (350 kph); Oakland–LA=210 mph (350 kph); SJ–LA=210 mph (350 kph); SF–Sac=210 mph (350 kph); Oakland–Sac=210 mph (350 kph); SJ–Sac=210 mph (350 kph); SF–Fresno=210 mph (350 kph); Oakland–Fresno=210 mph (350 kph); SJ–Fresno=210 mph (350 kph); Gilroy–LA=210 mph (350_ kph); SF–Gilroy=180 mph (300 kph); Oakland–Gilroy=180 mph (300 kph); SJ–Gilroy=180 mph (300 kph)

Table 7.2-20
Pacheco Pass with Altamont Pass (Local Service): SF, Oak, and SJ Termini (without Dumbarton Bridge)

	HST operations would need to be coordinated and integrated with Caltrain service and ACE service. Using both the Pacheco and Altamont alignment alternatives to serve the Bay Area provides greater capacity, operating flexibility, and reliability (in terms of redundancy). In order to serve the additional markets, more train operations would be necessary.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor Alignment would bring direct HST service up the San Francisco Peninsula to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), a mid-Peninsula station at Palo Alto, and a San Jose Station (Diridon). HST service would be provided to Southern Santa Clara County at a Gilroy Station, with service to the Central Valley at Merced and Modesto. The network alternative would provide direct service to Oakland with a station in West Oakland, to the Oakland International Airport with a Coliseum/BART station, and to a Union City (BART) Station. The Altamont Pass would use the UPRR Alignment with local HST stations at Pleasanton (I-680/Bernal), and downtown Tracy. This network alternative would increase connectivity and accessibility to San Francisco, the Peninsula and SFO, the hub international airport for northern California, Oakland, the Oakland International Airport (Coliseum/BART), southern Alameda County, San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area, the I-580 Corridor and Tri-Valley area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode along the East Bay while improving the safety, reliability, and performance of the regional commuter service. particularly along the Altamont Pass Alignment. T The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Gilroy, Niles/I-880 Alignment between Oakland and Union City would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be some grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment segments through the Central Valley.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium to high potential of vibration impacts for the overall alternative. Medium potential of vibration impacts from San Francisco to Dumbarton. High potential of vibration impacts from Dumbarton to San Jose. Medium potential of vibration impacts from San Jose to Niles Junction. High potential of vibration impacts from Oakland to Niles Junction. Medium potential of vibration impacts, from San Jose to Gilroy and Niles Junction to Tracy. The Central Valley has a low potential for vibration impacts.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S in the Chowchilla area. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the East Bay Between Oakland and San Jose and for the Caltrain Corridor between San Francisco and Gilroy. It has a low impact

Table 7.2-20
Pacheco Pass with Altamont Pass (Local Service): SF, Oak, and SJ Termini (without Dumbarton Bridge)

	rating between Gilroy and the Central Valley. It exhibits a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley, and a medium impact rating in the Central Valley, except in the Manteca area, where the rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Caltrain – San Francisco to Dumbarton =low; (2) Caltrain – Dumbarton to San Jose =low; (3) Oakland to Niles Junction =low; (4) Niles Junction to San Jose =medium; (5) Pacheco =medium; (6) Henry Miller to UPRR =low; (7) UPRR =medium; (8) Tracy Downtown =low; and (9) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,384.1 ac (560.14 ha) Impact up to 764.5 ac (309.39 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy, Pacheco, Henry Miller and UPRR (North/South) segments. Overall, this network alternative along with the Oakland and San Jose Termini and San Jose Termini alternatives would have the greatest potential impact on farmland within the Pacheco Pass with Altamont (local service) network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 222 known cultural resources. Of the Pacheco Pass with Altamont (local service) network alternatives, this network alternative was identified to have the highest number of known resources. This network alternative extends through numerous historic districts in San Francisco. Historic properties and buildings dating from the 1900s are within the area of potential effects along with industrial complexes dating from the 1920s an 1940s, water delivery systems and canals dating from the 1890s, railroad facilities, freeway bridges dating from the 1940s, and residential properties dating from the 1880s. Overall, this network alternative was identified as having a high sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 552.2 ac (223.49 ha) direct/ 1,685.1 ac (691.98 ha) indirect Streams: 30,278 linear ft (9,228.9 linear m) direct/ 137,768 linear ft (41,191.56 linear m) indirect Lakes/Waterbodies: 5.3 ac (2.14 ha) direct/ 22.3 ac (9.02 ha) indirect Of the Pacheco Pass with Altamont Pass (local service) network alternatives, this network alternative was identified to have the highest impact on waters including streams, rivers, and canals as well as floodplains, groundwater, and impaired waters. This network alternative was also identified as having the potential to encounter the most erosive soils. Potentially affect Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on

Table 7.2-20
Pacheco Pass with Altamont Pass (Local Service): SF, Oak, and SJ Termini (without Dumbarton Bridge)

	floodplains and streams, creeks, and channels..
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 25.4 ac (10.26 ha) direct/ 2,332 ac (943.9 ha) indirect Non-Wetland Waters: 18,556 linear ft (5,659.1 linear m) Species: 71 special-status plant and 58 special-status wildlife species Of the Pacheco Pass with Altamont Pass (local service) network alternatives, this network alternative would have the potential to impact the most special-status plant and wildlife species. Potentially significant impacts on special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	San Bruno (Potentially Active) – At Grade Buried Trace of Unnamed Fault (Potentially Active) – At Grade Hayward (Active) – At Grade - Adjacent and Parallel Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 46 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

D. SAN JOSE TERMINUS

This network alternative is shown in Figure 7.2-21 and described in Table 7.2-21. The segments used for this representative alternative are Niles/I-880 (Niles Junction to San Jose via I-880)[21], East Bay Connection (Dumbarton/Niles XS), UPRR (Niles to Altamont)[22], Tracy Downtown (UPRR Connection)[23], Pacheco (San Jose to Western Valley), Henry Miller (Western Valley to BNSF/UPRR), Henry Miller UPRR Connection, UPRR (Central Valley).

Table 7.2-21
Pacheco Pass with Altamont Pass (Local Service): San Jose Terminus

Physical/Operational Characteristics	
Network Alternative Description	From San Jose, this network alternative would use the Pacheco and Henry Miller (to the UPRR) Alignment Alternatives and the UPRR N/S Alignment in the Central Valley. The Altamont Pass would use the UPRR Alignment through downtown Tracy. Station location options considered for this alternative are San Jose (Diridon), Gilroy (Caltrain), Merced (Downtown), and Modesto (Downtown). Local HST stations would be at Warm Springs (BART), Pleasanton (I-680/Bernal), and downtown Tracy.
Length	286.04 mi (460.34 km)
Cost (dollars)	$13.5 billion
Express Travel Times (minutes)	Altamont SJ–LA=2:26; SJ–Sac=0:56; SJ–Fresno=1:08; Pleasanton–LA=2:13; Tracy–LA=1:59; SJ–Tracy=0:27 Pacheco SJ–LA=2:09; SJ–Sac=1:18; SJ–Fresno=0:51; Gilroy–LA=1:57; SJ–Gilroy=0:15
Ridership	This network alternative would directly serve downtown San Jose, Southern Santa Clara County, and the Central Valley. Total ridership for the statewide HST system with this network alternative is forecast to be about 4.2% less than the Pacheco “Base Case” alternative, or at 89.8 million passengers per year by 2030. Revenue is estimated at $2.96 billion per year by 2030.
Constructability	Portions of this network alternative are aligned in or along existing passenger rail lines and highways. Maintaining operations on the existing passenger rail service and automobile traffic while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the HST infrastructure could be constructed incrementally to minimize impact to existing operations.
O & M Cost (dollars per year)	$1,130 million

[21] Does not include Niles Junction to Niles Wye S (“Niles/I-880 5A”) segment.

[22] Does not include “express tracks” through Pleasanton Station.

[23] Does not include “express tracks” through Tracy Downtown Station.

Table 7.2-21
Pacheco Pass with Altamont Pass (Local Service): San Jose Terminus

Operational Issues	Altamont Average Speed SJ–LA=176.0 mph (284.0 kph); SJ–Sac=135.3_ mph (218.3 kph); SJ–Fresno=153.6 mph (247.8 kph); Pleasanton–LA=181.3 mph (292.3 kph); Tracy–LA=183.4 mph (305.7 kph); SJ–Tracy=115.7 mph (186.7 kph) Maximum Speed SJ–LA=210 mph (350 kph); SJ–Sac=198 mph (330 kph); SJ–Fresno=210 mph (350 kph); Livermore–LA=210 mph (350 kph); Tracy–LA=210 mph (350 kph); SJ–Tracy=180 mph (300 kph) Pacheco Average Speed SJ–LA=179.5 mph (299.2 kph); SJ–Sac=174 mph (290 kph); SJ–Fresno=164.3 mph (273.8 kph); Gilroy–LA=183.2 mph (305.4 kph); SJ–Gilroy=114.6 mph (191 kph) Maximum Speed SJ–LA=210 mph (350 kph); SJ–Sac=210_ mph (350 kph); SJ–Fresno=210 mph (350 kph); Gilroy–LA=210 mph (350 kph); SJ–Gilroy=180mph (300 kph) Using both the Pacheco and Altamont alignment alternatives to serve the Bay Area provides greater capacity, operating flexibility, and reliability (in terms of redundancy). In order to serve the additional markets, more train operations would be necessary. HST operations would need to be coordinated and integrated with Caltrain service between San Jose and Gilroy, ACE service and all transportation services at San Jose.
Potential Environmental Impacts	
Travel Conditions	This network alternative would provide direct HST service to San Jose (Diridon), Southern Santa Clara county with a station in Gilroy, and the Central Valley with Stations in Merced and Modesto. This network alternative would increase connectivity and accessibility to southern Alameda County, San Jose, Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area, the I-580 Corridor and Tri-Valley area, and the Central Valley. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties. The HST Network Alternative would provide a safer, more reliable, energy-efficient intercity mode in Santa Clara County and the Central Valley while improving the safety, reliability, and performance of the regional commuter service. The HST Network Alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor between Gilroy and San Jose would improve local traffic flow and reduce air pollution at existing rail crossings. There would also be grade separation benefits in the UPRR in the I-580 corridor and UPRR N/S Alignment through the Central Valley. This network alternative would not provide direct HST service to San Francisco, SFO, the SF Peninsula/Caltrain Corridor between San Francisco and San Jose, Oakland, and Oakland Airport.

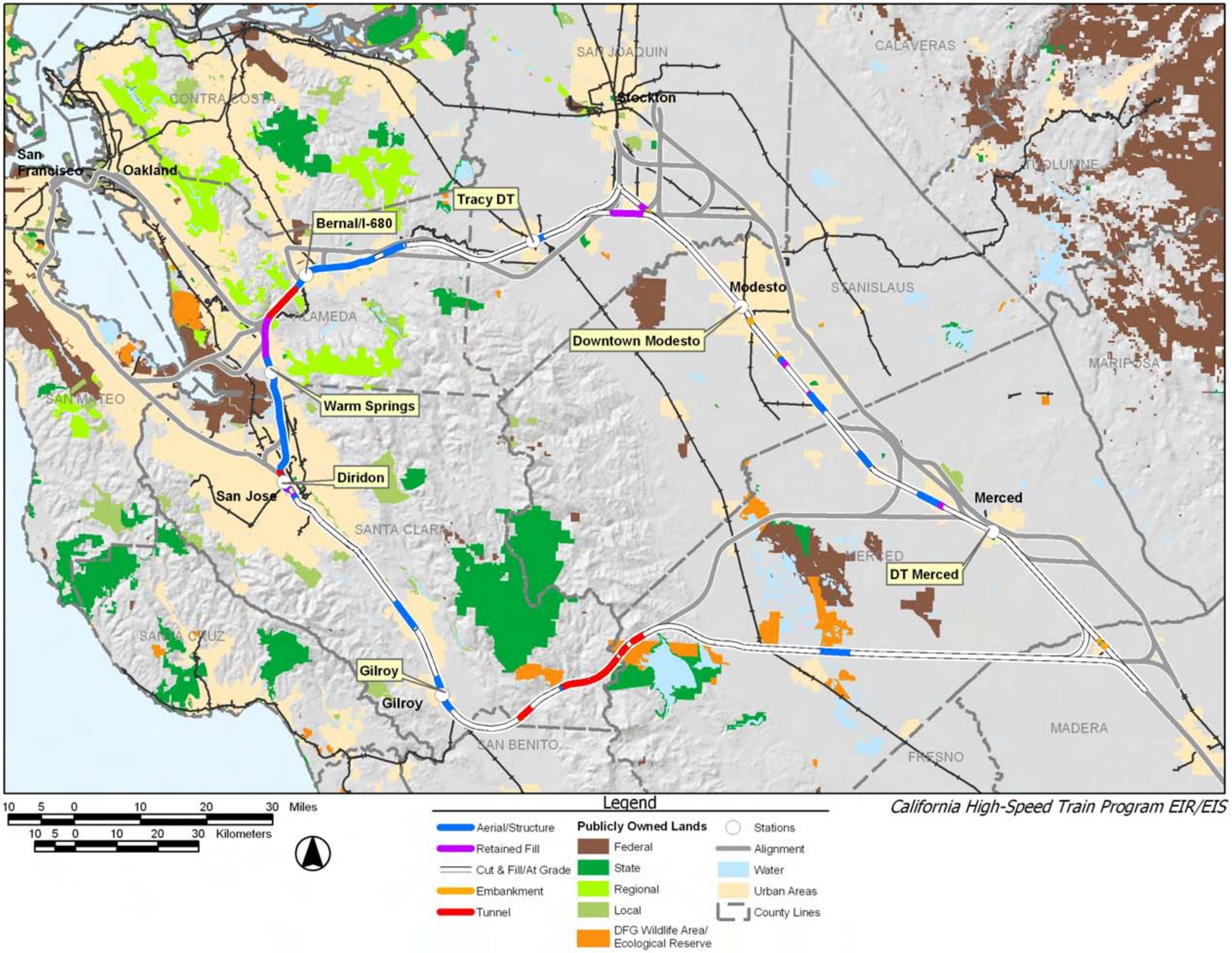

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Figure 7.2-21
Network Alternatives
Pacheco Pass with Altamont (Local Service)
San Jose Terminus

Table 7.2-21
Pacheco Pass with Altamont Pass (Local Service): San Jose Terminus

Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts for the overall alternative. All segments have a medium potential for noise impacts, with the expectation of Henry Miller and Henry Miller UPRR Connection, which have a low potential of noise impacts. Medium to high potential of vibration impacts for the overall alternative. Medium potential of vibration impacts from San Jose to Tracy and from San Jose to Gilroy. The Central Valley has a low potential for vibration impacts.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: Majority of network alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way for most of the alignment. It exhibits low compatibility where it connects to the UPRR N/S in the Chowchilla area. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. It has a medium compatibility in the Lathrop, Manteca, Modesto and Merced areas. Environmental Justice: This network alternative has medium environmental justice impact rating for the East Bay Between Niles Junction and San Jose and for the Caltrain Corridor between San Francisco and Gilroy. It has a low impact rating between Gilroy and the Central Valley. It exhibits a low environmental justice impact rating for the UPRR alignment from Niles Canyon to the Central Valley, and a medium impact rating in the Central Valley, except in the Manteca area, where the rating is low. Community: This network alternative would not affect community cohesion, given that the majority of the alignment is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This network alternative has the potential for high property impacts in the Niles Canyon and Manteca areas, where additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Segments visual ratings: (1) Niles Junction to San Jose =medium; (2) Pacheco =medium; (3) Henry Miller to UPRR =low; (4) UPRR =medium; (5) Tracy Downtown =low; and (6) UPRR N/S =low. Overall network alternative rating is low to medium.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 1,384.1 ac (560.14 ha) Impact up to 764.5 ac (309.39 ha) of prime farmland. The majority of potential farmland impacts would occur along the Tracy, Pacheco, Henry Miller and UPRR (North/South) segments. Overall, this network alternative along with the Oakland and San Jose Termini and San Francisco, Oakland, and San Jose Termini (without Dumbarton Bridge) alternatives would have the greatest potential impact on farmland within the Pacheco Pass with Altamont (local service) network alternatives.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 109 known cultural resources. Of the Pacheco Pass with Altamont (local service) network alternatives, this network alternative was identified to have the least number of known resources. Historic properties and buildings dating from the 1920s are within the area of potential effects along with water delivery systems and canals dating from the 1890s, freeway bridges dating from the 1940s, and residential properties dating from the 1890s. Overall, this network alternative was identified as having a low sensitivity for cultural resources.

Table 7.2-21
Pacheco Pass with Altamont Pass (Local Service): San Jose Terminus

Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 432.2 ac (174.91 ha) direct/ 1,479.1 ac (598.58 ha) indirect Streams: 24,197 linear ft (7,375.2 linear m) direct/ 120,049 linear ft (36,591 linear m) indirect Lakes/Waterbodies: 4.6 ac (1.87 ha) direct/ 17.6 ac (7.13 ha) indirect Of the Pacheco Pass with Altamont Pass (local service) network alternatives, this network alternative was identified to have the least impact on water resources. Potentially affect Guadalupe River, Pajaro River, San Joaquin River, Stanislaus River, Tuolumne River, Merced River, and Chowchilla River as well as the Hetch Hetchy Aqueduct, South Bay Aqueduct, and California Aqueduct among other water resources. Several watercourses would be crossed more than once. Includes tunnels that would avoid impacts on the floodplain and above ground water resources, and aerial structures that would minimize impact on floodplains and streams, creeks, and channels.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 23.7 ac (9.58 ha) direct/ 1,972 ac (798.0 ha) indirect Non-Wetland Waters: 17,521 linear ft (5,340.5 linear m) Species: 54 special-status plant and 50 special-status wildlife species Of the Pacheco Pass with Altamont Pass (local service) network alternatives, this network alternative would have the potential to impact the least special-status plant and wildlife species, wetlands, and waters. Potentially significant impacts on special-status plant and wildlife species, wetlands, and waters. Network alternative would be along existing transportation corridors with some portions in new rail corridors. Potentially result in a barrier to the movement of wildlife in areas where it severs wildlife movement corridors. Conflict with conservation and restoration plans and special management areas, such as the GEA. The placement of the alignment and stations and use of tunnels and aerial structures would minimize impacts on biological resources.
Fault Crossings	Hayward (Active) – At Grade Silver Creek (Potentially Active) – Above Grade Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade Ortigalita (Active) – At Grade Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Vernalis (Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	There are 27 public parks, recreation lands, wildlife and waterfowl refuges that are 0–150 ft (46 m) from center of the network alternative. Few potential direct impacts are anticipated given that much of the network alternatives is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the network alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.

7.3 Alignment Alternatives

The HST Alignment Alternatives are general locations for HST tracks, structures, and systems for the HST system between logical points within study corridors; they are generally configured along or adjacent to existing rail transportation facilities. These HST Alignment Alternatives are described in Chapter 2, analyzed in Chapter 3, and compared and used to create the HST Networks Alternatives.

To facilitate the alignment alternative analysis, the study area was divided into six corridors within the study region:

- San Francisco to San Jose.
- Oakland to San Jose.
- San Jose to Central Valley.
- East Bay to Central Valley.
- San Francisco Bay Crossings.
- Central Valley Alignment.

These corridors connect different parts of the study region and are fundamentally different and distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections). The HST Alignment Alternatives and station location options considered in each corridor of the study region are discussed below. The analyses in Chapter 3 under Affected Environment, Environmental Consequences, and Mitigation Strategies compile and report information about the affected environment and environmental consequences for each alignment alternative and segment as outlined in the tables. The purpose of this chapter is to summarize and compare the physical and operational characteristics and potential environmental consequences associated with the HST Network Alternatives and for the various HST alignment alternatives within the six corridors. The HST Alignment Alternatives and station location options are described below.

A. CALTRAIN (SAN FRANCISCO TO DUMBARTON)

This alignment alternative is shown in Figure 7.3-1 and described in Table 7.3-1.

Table 7.3-1
Caltrain: San Francisco to Dumbarton

Physical/Operational Characteristics	
Alignment Alternative Description	From San Francisco to Dumbarton, this alignment would use the existing Caltrain rail right-of-way. Station location options considered for this alternative are Transbay Transit Center or 4th and King, Millbrae/SFO, Redwood City (Caltrain).
Length	27.70 mi (44.58 km)
Cost (dollars)	$3.08 billion
Express Travel Times	20 minutes SF–Dumbarton (Transbay to Redwood City Station)
Ridership	This alignment would directly serve downtown San Francisco and San Francisco International Airport (SFO).
Constructability	Maintaining operations on the existing commuter rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the infrastructure improvements could be constructed incrementally.
Operational Issues	Average speed =76.6 mph (127.5 kph) Maximum speed =120 mph (200 kph) HST operations would need to be coordinated and integrated with Caltrain service.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor alignment alternative would bring direct HST service up the San Francisco Peninsula from Redwood City to downtown San Francisco with potential stations in downtown San Francisco, at SFO (Millbrae), and a mid-Peninsula station at Redwood City. This alignment alternative would increase connectivity and accessibility to San Francisco, the Peninsula, and SFO, the hub international airport for northern California. This alignment alternative would provide a safer, more reliable, energy-efficient intercity mode along the San Francisco Peninsula while improving the safety, reliability, and performance of the regional commuter service. It would also greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor north of Redwood City would improve local traffic flow and reduce air pollution at existing rail crossings.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts and medium potential of vibration impacts. Dense urban area surrounding land uses. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at existing grade crossings.
Land Use and Planning, Communities and Neighborhoods,	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or

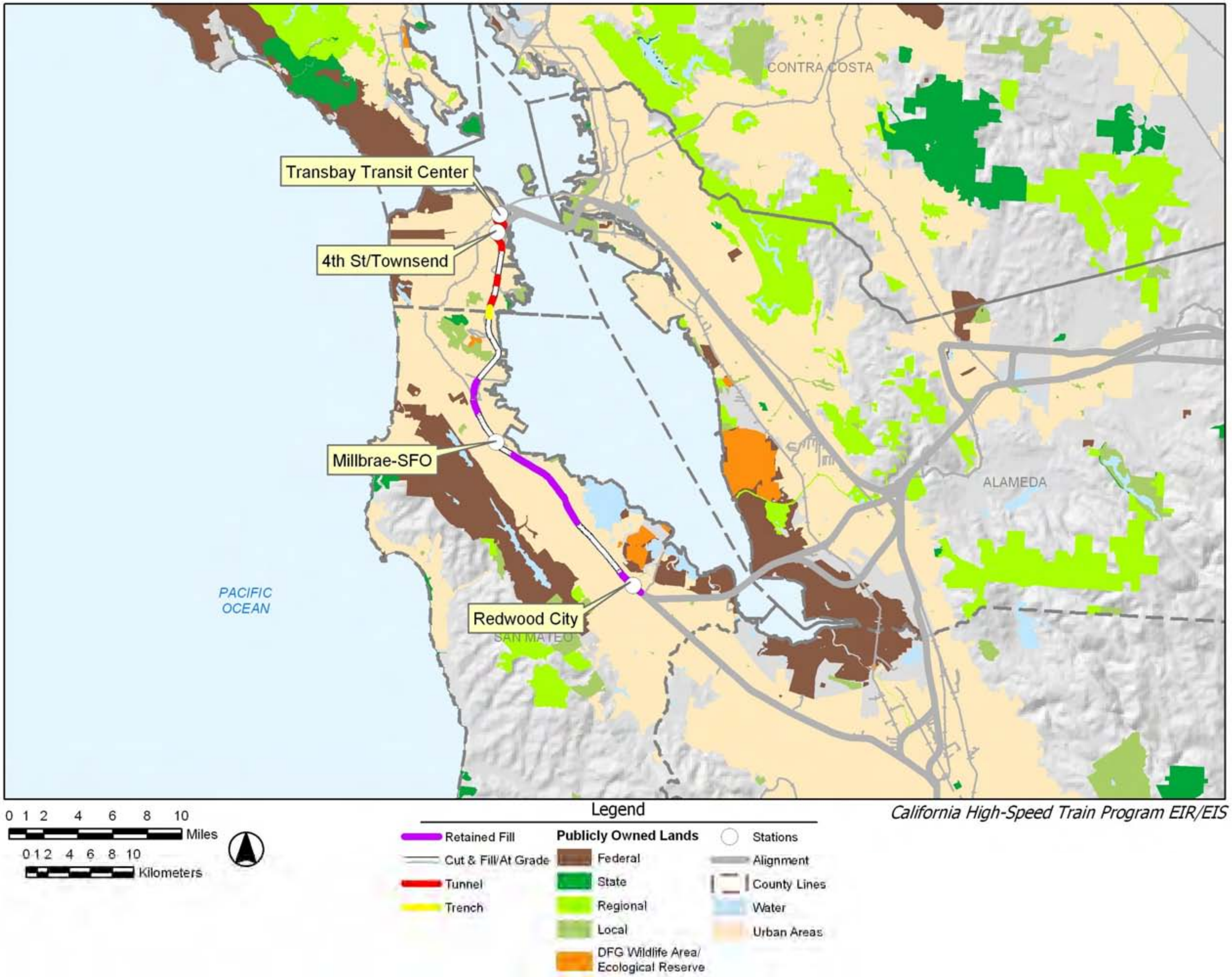

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Figure 7.3-1
HST Alignment Alternatives
Caltrain (San Francisco to Dumbarton)

Table 7.3-1
Caltrain: San Francisco to Dumbarton

Property, and Environmental Justice	immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: This alignment alternative has medium environmental justice impact rating for the Caltrain Corridor north of Dumbarton. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for high property impacts in the 4th and Townsend to Millbrae segment.
Aesthetics and Visual Resources: General impacts and rating.	Includes two additional tracks, pedestrian overcrossings and undercrossing at stations, and a raised Caltrain right-of-way. Overall low visual impact
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 51 known cultural resources. The alignment alternative extends through numerous historic districts between Transbay Terminal and Millbrae/SFO. The alignment alternative also includes a number of historic buildings and archaeological resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 49.3 ac (19.95 ha) direct/ 101.2 ac (40.96 ha) indirect Streams: 1,178 linear ft (359.1 linear m) direct/ 6,617 linear ft (797.7 linear m) indirect Lakes/Waterbodies[5]: 0.0 ac (0.0 ha) direct/ 3.4 ac (1.38 ha) indirect Potentially affect at least 16 named and unnamed water resources, including Oyster Point Channel, San Bruno Channel, San Bruno Canal, Colma Creek, Mills Creek, San Mateo Creek, and Pulgas Creek.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 0.08 ac (0.032 ha) direct/ 147.9 ac (59.85 ha) indirect Non-Wetland Waters: 590 linear ft (179.8 linear m) Species: 19 special-status plant and 29 special-status wildlife species This alignment alternative would have potential to directly and indirectly impact wetlands and non-wetland waters. Alignment alternative would have the potential to impact both special-status plant and wildlife species. Potential species impacts include San Mateo thorn-mint, Contra Costa goldfields, California clapper rail, and California least tern. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.
Fault Crossings	San Bruno (Potentially Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative include (1) Herman Street Park. (2) Washington Park, (3) Trinta Park, and (4) San Mateo County Fairgrounds. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.

B. CALTRAIN (DUMBARTON TO SAN JOSE)

This alignment alternative is shown in Figure 7.3-2 and described in Table 7.3-2.

Table 7.3-2
Caltrain: Dumbarton to San Jose

Physical/Operational Characteristics	
Alignment Alternative Description	From Dumbarton to San Jose, this alignment alternative would use the existing Caltrain rail right-of-way. Station location options considered for this alternative are Palo Alto (Caltrain), and San Jose (Diridon).
Length	21.38 mi (34.40 km)
Cost (dollars)	$1.61 billion
Express Travel Times	13.5 minutes Dumbarton–San Jose (Redwood City–San Jose)
Ridership	This alignment alternative would provide direct HST service on the SF Peninsula/Caltrain Corridor between San Jose and Redwood City.
Constructability	Maintaining operations on the existing commuter rail service while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the infrastructure improvements could be constructed incrementally.
Operational Issues	Average speed =92 mph (153.3 kph) Maximum speed =120 mph (200 kph) HST operations would need to be coordinated and integrated with Caltrain service.
Potential Environmental Impacts	
Travel Conditions	The Caltrain corridor alignment alternative would bring direct HST service to the Southern Peninsula with potential stations in Palo Alto, and a Station in downtown San Jose (Diridon). This alignment alternative would increase connectivity and accessibility to San Jose and the Peninsula. The HST system would provide a safer, more reliable, energy-efficient intercity mode along the Peninsula while improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic. The fully grade-separated Caltrain corridor south of Dumbarton would improve local traffic flow and reduce air pollution at existing rail crossings.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts. High potential of vibration impacts. Dense urban area surrounding land uses. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at existing grade crossings.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: This alignment alternative has medium environmental justice impact rating for the Caltrain

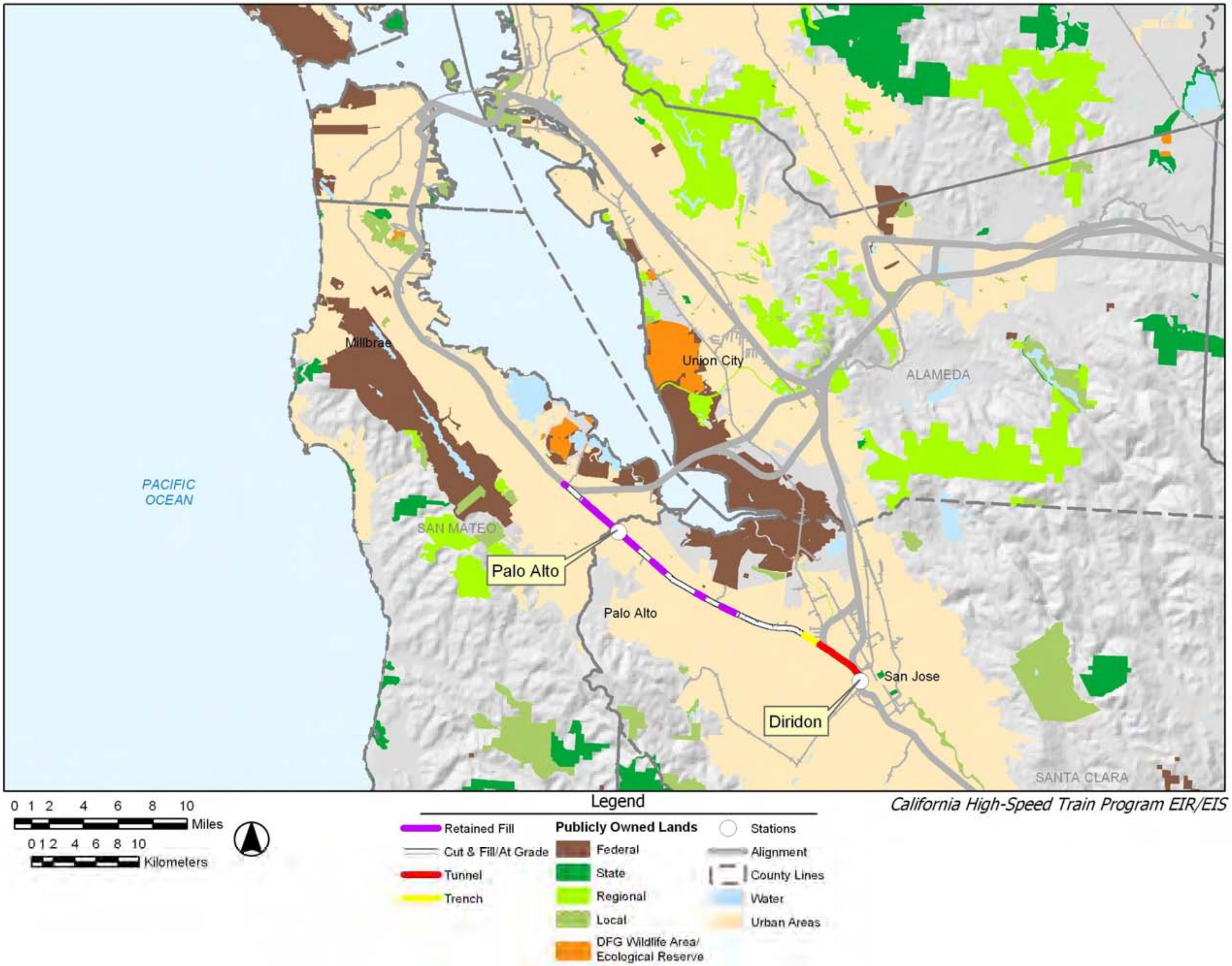

Figure 7.3-2
HST Alignment Alternatives
Caltrain (Dumbarton to San Jose)

Table 7.3-2
Caltrain: Dumbarton to San Jose

	Corridor south of Dumbarton to San Jose. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for low property impacts.
Aesthetics and Visual Resources: General impacts and rating.	Includes two additional tracks, pedestrian overcrossings and undercrossings at stations, a raised Caltrain right-of-way, a new two-track bridge next to historic San Francisquito Creek truss bridge, and elevated facilities at the Diridon San Jose station. Overall low visual impact
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 34 known cultural resources. The area around San Jose has a high density of cultural resources. The Santa Clara de Asis Mission in San Jose includes both prehistoric and historic resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 46.5 ac (18.82 ha) direct/ 74.2 ac (30.03 ha) indirect Streams: 1,435 linear ft (437.4 linear m) direct/ 2, 649 linear ft (807.4 linear m) indirect Lakes/Waterbodies[5]: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha) indirect Potentially affect at least nine named and unnamed water resources, including San Francisquito Creek, Matadero Creek, Barron Creek, Permanente Creek, Stevens Creek, Calabasas Creek, and Saratoga Creek.
Biological Resources Including Wetlands: Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 0.0 ac (0.0 ha) direct/ 4.1 ac (1.66 ha) indirect Non-Wetland Waters: 672 linear ft (204.8 linear m) Species: 5 special-status plant and 9 special-status wildlife species This alignment alternative would have potential to directly impact non-wetland waters and indirectly impact wetlands. Alignment alternative would have the potential to impact both special-status plant and wildlife species. Potential species impacts include Contra Costa goldfields, San Francisco garter snake, California tiger salamander, and California red-legged frog. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.
Fault Crossings	Buried Trace of Unnamed Fault (Potentially Active) – At Grade
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative include (1) Holbrook Palmer Park, (2) El Camino Park, (3) Peers Park, (4) Bowden Park, (5) Rengstorff Park, (6) Bracher Park, and (7) San Francisco Bay Trail. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.

C. NILES/I-880 ALIGNMENT ALTERNATIVES (OAKLAND TO NILES JUNCTION)

All information presented is for the area from Oakland to Niles Junction. These alternatives are shown in Figure 7.3-3 and described in Table 7.3-3.

Table 7.3-3
Niles/I-880: Oakland to Niles Junction

	West Oakland to Niles Junction	12th Street/City Center to Niles Junction
Physical/Operational Characteristics		
Alignment Alternative Description	From the West Oakland station site, this is the alignment alternative currently used by the Capitol intercity rail service. From Oakland, this alignment alternative would travel south along the Union Pacific Railroad (UPRR) Hayward Line. Station location options considered in this segment include West Oakland, Oakland International Airport (Coliseum BART) Station, and Union City.	From the 12th Street/City Center downtown Oakland station site, this alignment alternative would travel south following the UPRR Hayward rail line. Station location options considered in this segment include 12th Street/City Center, Oakland International Airport (Coliseum/BART) Station, and Union City.
Length	27.74 mi (44.64 km)	26.73 mi (43.02 km)
Cost (dollars)	$2.34 billion	$2.25 billion
Travel Time	12 min (West Oakland-Union City)	11 min (12th Street-Union City)
Ridership	This alignment would directly serve Oakland and Oakland International Airport.	Sensitivity analysis for the Altamont Pass forecast this alternative to have somewhat higher ridership and revenue potential (2.7% more ridership and 1.5% more revenue) than the network alternative to West Oakland. In contrast, for the Pacheco Pass this alternative resulted in somewhat lower ridership and revenue potential (0.6% ridership and 2.5% revenue).
Constructability	Maintaining operations on the existing rail services while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the infrastructure improvements could be constructed incrementally.	Maintaining operations on the existing rail services while constructing grade separations, tunnels, elevated sections, and stations would involve major construction issues/challenges. However, the infrastructure improvements could be constructed incrementally.
Operational Issues	Average speed =103.5 mph (172.5 kph) Maximum speed =172.2 mph (287 kph) Potential for shared tracks with Capitol Rail Service. Potential conflict with UPRR freight access and operations.	Average speed = 107.7 mph (179.5 kph) Maximum speed =172.2 mph (287 kph) Potential for shared tracks with Capitol Rail Service. Potential conflict with UPRR freight access and operations.

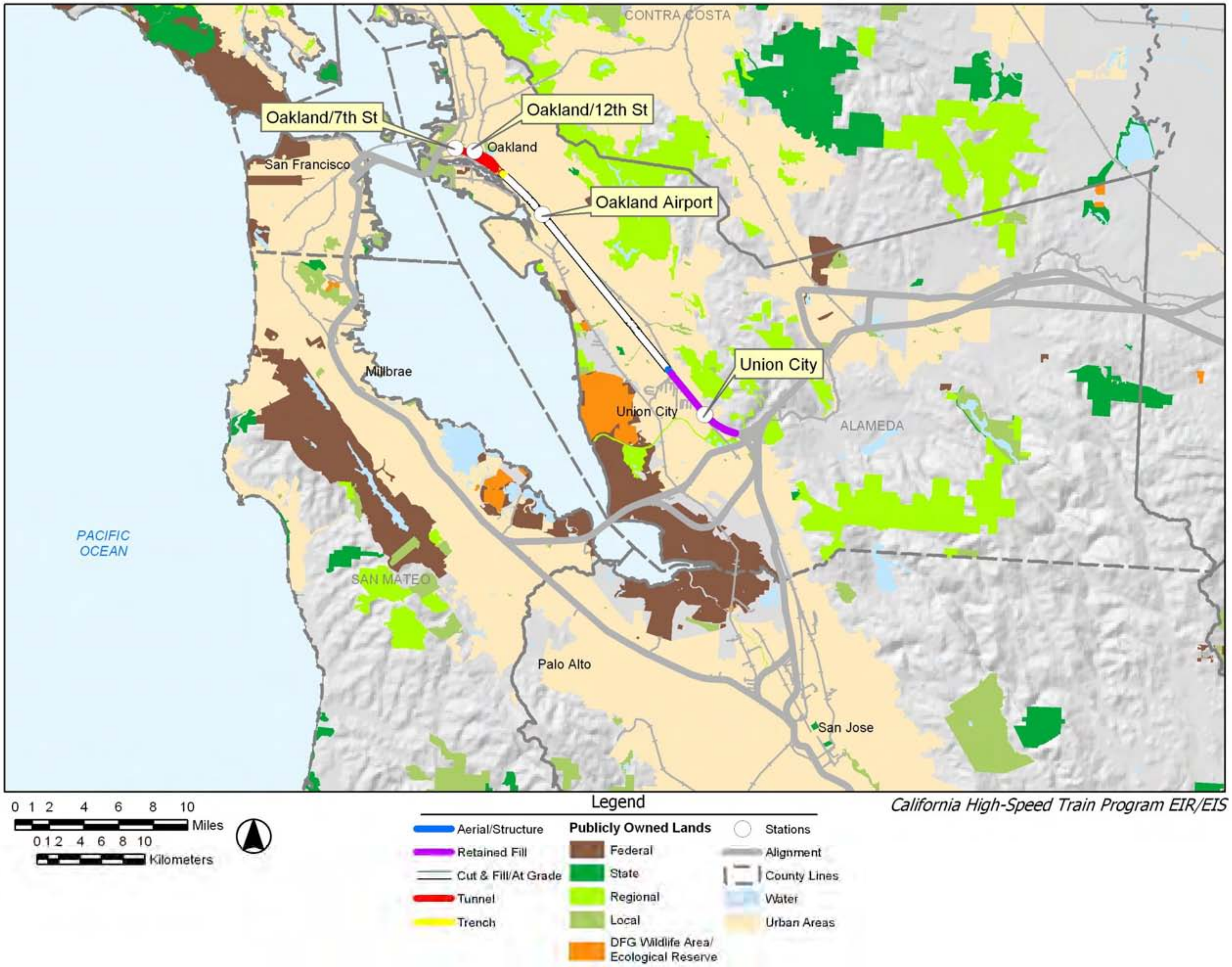

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Figure 7.3-3
HST Alignment Alternatives
Niles/I-880 (Oakland to Niles Junction)

Table 7.3-3
Niles/I-880: Oakland to Niles Junction

	West Oakland to Niles Junction	12th Street/City Center to Niles Junction
Potential Environmental Impacts		
Travel Conditions	The Oakland to Niles Junction alignments would bring direct HST service up the East Bay to Oakland with a potential station in West Oakland, at Oakland International Airport (OAK) (Oakland Coliseum), and a potential southern Alameda County station at either Union City or Fremont (Warm Springs). These alignments would increase connectivity and accessibility to Oakland, the East Bay, and Oakland International Airport. The HST system would provide a safer, more reliable, energy-efficient intercity mode directly to the East Bay while improving the safety, reliability and performance of the existing Capitol intercity service (Sacramento to San Jose via I-80) through grade separation improvements between Oakland and Niles Junction. This alignment alternative would increase the capacity for intercity travel in the East Bay and reduce highway congestion.	The Oakland to Niles Junction alignments would bring direct HST service up the East Bay to Oakland with potential stations in Downtown Oakland, at Oakland International Airport (Coliseum/BART), and a potential southern Alameda County station at either Union City or Fremont (Auto Mall Parkway). These alignments would increase connectivity and accessibility to Oakland, the East Bay, and Oakland International Airport. The HST system would provide a safer, more reliable, energy-efficient intercity mode directly to the East Bay while improving the safety, reliability and performance of the existing Capitol intercity service (Sacramento to San Jose via I-80) through grade separation improvements between Oakland and Union City. This alignment alternative would increase the capacity for intercity travel in the East Bay and reduce highway congestion.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts. High potential of vibration impacts. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at existing grade crossings.	Medium potential of noise impacts. High potential of vibration impacts. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at existing grade crossings.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or

Table 7.3-3
Niles/I-880: Oakland to Niles Junction

	West Oakland to Niles Junction	12th Street/City Center to Niles Junction
	adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for low property impacts.	immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for low property impacts.
Aesthetics and Visual Resources: General impacts and rating.	Includes highway grade separations and an elevated alignment. Overall low visual impact	
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 24 known cultural resources. The majority of resources are located within the city of Oakland and include the Old Oakland Historic District. Resources include buildings and industrial complexes dating from the 1920s and 1940s and residential properties dating from the 1880s to the 1940s.	32 known cultural resources. This alignment alternative has the highest density of cultural resources within this corridor. The majority of resources are located within the city of Oakland and include buildings and residential properties dating from the 1880s to the 1920s.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 4.3 ac (1.74 ha) direct/ 9.5 ac (3.84 ha) indirect Streams: 1,035 linear ft (315.5 m) direct/ 8,828 linear ft (2,690.8 linear m) indirect Lakes/Waterbodies: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha) indirect Potentially affect at least 13 named and unnamed water resources, including Arroyo Viejo, Lion Creek, San Leandro Creek, San Lorenzo Creek, and Alameda Creek. Includes tunnels that would avoid impacts on the floodplain, and aerial structures that would minimize impact on the floodplain and streams, creeks, and channels.	Floodplains: 4.3 ac (1.74 ha) direct/ 9.5 ac (3.84 ha) indirect Streams: 1,035 linear ft (315.5 m) direct/ 8,828 linear ft (2,690.8 linear m) indirect Lakes/Waterbodies: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha) indirect Potentially affect 8 named and unnamed water resources, including Mission Creek, Alameda Creek, the Lagoon/Elizabeth Lake, Penitencia Creek, and Mud Slough/Coyote Creek. Includes tunnels that would avoid impacts on the floodplain, and aerial structures that would minimize impact on the floodplain and streams, creeks, and channels.

Table 7.3-3
Niles/I-880: Oakland to Niles Junction

	West Oakland to Niles Junction	12th Street/City Center to Niles Junction
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 0.11 ac (0.04 ha) direct/ 52.1 ac (21.07 ha) indirect Non-Wetland Waters: 455 linear ft (138.7 linear m) Species: 5 special-status plant and 23 special-status wildlife species This alignment alternative would have potential to indirectly impact the most wetlands. Alignment alternative would have the potential to impact the least plant species. Potential species impacts include Presidio clarkia, brown pelican, California clapper rail, California least tern, and salt marsh harvest mouse. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.	Wetlands[v]: 0.11 ac (0.04 ha) direct/ 30.2 ac (12.21 ha) indirect Non-Wetland Waters: 455 linear ft (138.7 linear m) Species: 6 special-status plant and 23 special-status wildlife species This alignment alternative would have potential to indirectly impact the least wetlands. Alignment alternative would have the potential to impact the most plant species. Potential species impacts include Presidio clarkia, brown pelican, California clapper rail, California least tern, and salt marsh harvest mouse. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.
Fault Crossings	Hayward (Active) – At Grade - Adjacent and Parallel	
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of Alignment Alternative include (1) Coliseum Gardens Park, (2) Stonehurst Recreation Area Park, (3) Charles F. Kennedy Park, (4) Quarry Lakes Regional Park, (5) Rancho Arroyo Park, and (6) San Francisco Bay Trail. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.	Public parks, recreation lands, wildlife and waterfowl refuges within 0–50 ft from center of alignment alternative include Madison Park, (2) Coliseum Gardens Park, (3) Stonehurst Recreation Area Park, (4) Charles F. Kennedy Park, (5) Quarry Lakes Regional Park, (6) Rancho Arroyo Park, and (7) San Francisco Bay Trail. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.

D. NILES/I-880 ALIGNMENT ALTERNATIVES (NILES JUNCTION TO SAN JOSE)

All information presented is for the area from Niles Junction to San Jose. This alignment alternative is shown in Figure 7.3-4 and described in Table 7.3-4.

Table 7.3-4
Niles/I-880: Niles Junction to San Jose

	Niles Junction to San Jose via Trimble	Niles Junction to San Jose via I-880
Physical/Operational Characteristics		
Alignment Alternative Description	From Niles Junction, this alignment alternative would travel south along the Union Pacific Railroad (UPRR) Hayward Line to the UPRR Milpitas Line (through Fremont), transition to the I-880 median, and then transition to Trimble road to San Jose. Station options considered in this segment include Fremont (Warm Springs) and San Jose Diridon.	From Niles Junction, this alignment alternative would travel south along the Union Pacific Railroad (UPRR) Hayward Line to the UPRR Milpitas Line (through Fremont), and then transition to the I-880 median to San Jose. Station options considered in this segment include Fremont (Warm Springs) and San Jose Diridon.
Length	17.04 mi (27.43 km)	16.22 mi (26.10 km)
Cost (dollars)	$2.18 billion	$1.61 billion
Travel Time	15 min (San Jose–Union City)	13 min (San Jose–Union City)
Ridership	Would have slightly less intercity ridership potential as Niles Junction to San Jose via I-880 alternative (as a result of the 2-minute additional travel times).	Would have about slightly more ridership potential as Niles Junction to San Jose via Trimble alternative.
Constructability	Major construction issues associated with constructing columns and footings in the wide median of I-880 (between San Jose and Fremont) and tunneling adjacent to San Jose Airport along Trimble Road.	Major construction issues associated with constructing columns and footings in the wide median of I-880 (between San Jose and Fremont).
Operational Issues	Average speed =87.1 mph (145.2 kph) Maximum speed =134.4 mph (224 kph) Potential for shared tracks with Capitol Rail Service. Potential conflict with UPRR freight access and operations.	Average speed =93.3 mph (155.5 kph) Maximum speed =151.8 mph (253 kph) Potential for shared tracks with Capitol Rail Service. Potential conflict with UPRR freight access and operations.
Potential Environmental Impacts		
Travel Conditions	These alignments would increase connectivity and accessibility to the East Bay and San Jose The HST system would provide a safer, more reliable, energy-efficient intercity mode directly to the East Bay. This alignment alternative would increase the capacity for intercity travel in	These alignments would increase connectivity and accessibility to the East Bay, and San Jose. The HST system would provide a safer, more reliable, energy-efficient intercity mode directly to the East Bay. This alignment alternative would greatly increase the

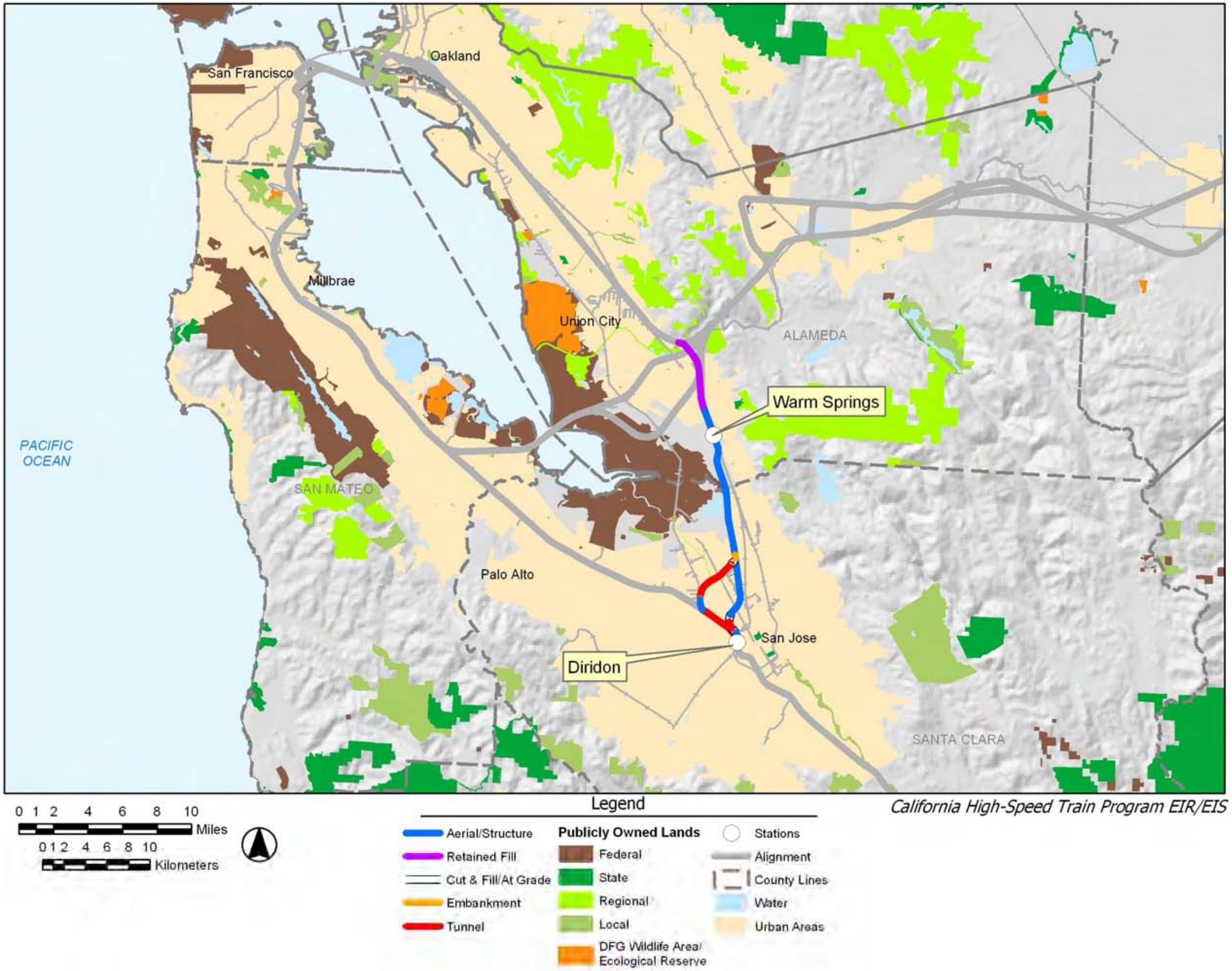

Figure 7.3-4
HST Alignment Alternatives
Niles/I-880 (Niles Junction to San Jose)

Table 7.3-4
Niles/I-880: Niles Junction to San Jose

	Niles Junction to San Jose via Trimble	Niles Junction to San Jose via I-880
	the East Bay and reduce highway congestion.	capacity for intercity travel in the East Bay and reduce highway congestion.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts. Medium potential of vibration impacts.	Medium potential of noise impacts. Medium potential of vibration impacts.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: This alignment alternative has medium environmental justice impact rating for East Bay between Niles Junction and San Jose, using Trimble Road. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for low property impacts.	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: This alignment alternative has medium environmental justice impact rating for East Bay between Niles Junction and San Jose. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for low property impacts.
Aesthetics and Visual Resources: General impacts and rating.	Includes elevated alignment adjacent to residential, along I-880 freeway and at the Diridon San Jose station. Overall medium visual impact	Include elevated alignment adjacent to residential, along I-880, along Montague and Trimble Road, near the historic Santa Clara Depot and Tower, and at the Diridon San Jose station. Overall medium visual impact
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 31 known cultural resources. The majority of resources are located within San Jose, which includes the Santa Clara de Asis Mission. The remains of a Pleistocene mammoth were discovered near the airport in 2005.	There are 4 known cultural resources. There are few archaeological or architectural resources located in the area of San Jose.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 36.4 ac (14.73 ha) direct/ 129.8 ac (52.53 ha) indirect Streams: 1,013 linear ft (308.8 m) direct/ 2,220 linear ft (676.7 linear m) indirect Lakes/Waterbodies: 0.7 ac (0.28 ha) direct/ 1.3 ac (0.53 ha) indirect	Floodplains: 45.5 ac (18.41ha) direct/ 167 ac (67.58 ha) indirect Streams: 1,135 linear ft (345.9 m) direct/ 2,707 linear ft (825.1 linear m) indirect Lakes/Waterbodies: 0.7 ac (0.28 ha) direct/ 1.3 ac (0.53 ha) indirect

Table 7.3-4
Niles/I-880: Niles Junction to San Jose

	Niles Junction to San Jose via Trimble	Niles Junction to San Jose via I-880
	Potentially affect 8 named and unnamed water resources, including Mission Creek, Alameda Creek, the Lagoon/Elizabeth Lake, Penitencia Creek, and Mud Slough/Coyote Creek. Tunnel would extend under the Guadalupe River and Coyote Creek.	Potentially affect 10 named and unnamed water resources, including Mission Creek, Alameda Creek, the Lagoon/Elizabeth Lake, Penitencia Creek, Mud Slough/Coyote Creek, and Guadalupe River. Aerial structure would extend over the Guadalupe River and Coyote Creek.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 1.27 ac (0.51 ha) direct/ 302.3 ac (122.34 ha) indirect Non-Wetland Waters: 958 linear ft (292.0 linear m) Species: 6 special-status plant and 25 special-status wildlife species This alignment alternative would have potential to directly and indirectly impact the least wetlands and non-wetland waters. Alignment alternative would have the potential to impact the most plant species. Potential species impacts include Contra Costa goldfields, vernal pool tadpole shrimp, brown pelican, California clapper rail, California least tern, and salt marsh harvest mouse. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.	Wetlands[v]: 1.80 ac (0.73 ha) direct/ 323.7 ac (131.01 ha) indirect Non-Wetland Waters: 1,080 linear ft (329.2 linear m) Species: 5 special-status plant and 25 special-status wildlife species This alignment alternative would have potential to directly and indirectly impact the most wetlands and non-wetland waters. Alignment alternative would have the potential to impact fewer plant species. Potential species impacts include Contra Costa goldfields, vernal pool tadpole shrimp, brown pelican, California clapper rail, California least tern, and salt marsh harvest mouse. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.
Fault Crossings	Hayward Fault (Active) – At Grade Silver Creek Fault (Potentially Active) – Above Grade	
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative include (1) Fremont Central Park, (2) Grimmer Park. Few potential direct impacts are anticipated given that much of the Alignment Alternative is within or directly adjacent to existing transportation rights-of-way, and no resources exist in areas where the Alignment Alternative is not adjacent to or within this existing right-of-way.	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative include (1) Fremont Central Park, (2) Grimmer Park, (3) Columbus Park, (4) Heritage Rose Garden, and (5) Guadalupe Gardens. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.

E. PACHECO PASS ALTERNATIVE

All information presented is for the area from San Jose Diridon Station to San Luis Reservoir. This segment is shown in Figure 7.3-5 and described in Table 7.3-5.

Table 7.3-5
Pacheco Pass Alternatives: San Jose Diridon Station to San Luis Reservoir

Alignment Alternative Description	From the Diridon Station site in downtown San Jose, this alignment alternative would travel south following the Caltrain alignment to Gilroy. From Gilroy, the alignment alternative would travel east through Pacheco Pass to the Central Valley floor. Station options considered in this segment include Morgan Hill (Caltrain) or Gilroy (Caltrain).
Length	57.48 mi (92.5 km)
Cost (dollars)	$3.74 billion
Travel Time	14.5 min (San Jose–Gilroy)
Ridership	This alignment alternative provides high HST ridership potential to the Bay Area via the Pacheco Pass.
Constructability	Difficult to maintain roadway and existing freight and passenger rail operations during construction of the HST infrastructure.
Operational Issues	Average speed = 118.6 mph (197.6 kph) Maximum speed =178.8 mph (298 kph) Potential for shared tracks with Caltrain commuter rail Service. Potential conflict with UPRR freight access and operations.
Travel Conditions	The Pacheco alignments would bring direct HST service up the Caltrain alignment with a potential station at Gilroy (Caltrain) or Morgan Hill (Caltrain). This alignment alternative would increase connectivity and accessibility to Southern Santa Clara County and Monterey/ Santa Cruz/ Salinas area. The HST system would provide a safer, more reliable, energy-efficient intercity mode directly to Santa Clara County while improving the safety, reliability and performance of the existing Caltrain commuter rail service through grade separation improvements between Gilroy and San Jose. This alignment alternative would greatly increase the capacity for intercity travel in Santa Clara County and reduce highway congestion. The Gilroy station would be the closest HST station for Monterey, Santa Cruz, and San Benito counties.
Noise and Vibration:[i] High, medium, or low potential impacts	Medium potential of noise impacts. Medium potential of vibration impacts. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at existing grade crossings.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way east of Gilroy.

Table 7.3-5
Pacheco Pass Alternatives: San Jose Diridon Station to San Luis Reservoir

Justice	Environmental Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way in the urban areas. Property: This alignment alternative has the potential for low property impacts.
Aesthetics and Visual Resources: General impacts and rating.	Includes elevated facilities at the Diridon San Jose station, elevated facilities south of Diridon station, highway grade separations, expansion of existing railway corridor along Monterey Highway, new transportation corridor between Gilroy and Pacheco Valley, elevated crossing of SR 152 in Pacheco Valley, and cut and fill sections over Pacheco Pass. Overall medium visual impact.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 241 ac (97.5 ha) Impact up to 176 ac (71.2 ha) of prime farmland. High potential for farmland severance south of Gilroy.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 11 known cultural resources. Little development has taken place along this alignment. Resources include buildings, canals, and a bridge as well as potentially historic resources in the Santa Clara Valley, including Morgan Hill and Gilroy.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 103.4 ac (41.85 ha) direct/ 303.5 ac (122.8 ha) indirect Streams: 2,674 linear ft (815.0 m) direct/ 9,215 linear ft (2,808.7 linear m) indirect Lakes/Waterbodies[5]: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha) indirect Potentially affect at least 13 unnamed and named water resources, including Los Gatos Creek, Guadalupe River, Little Llagas Creek, Llagas Creek, Miller Slough, Pajaro River, Pacheco Creek, and Tequisquita Slough. A combination of at-grade permeable track, aerial structure, and tunnels would minimize impacts.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 0.11 ac (0.04 ha) direct/ 43.8 ac (17.73 ha) indirect Non-Wetland Waters: 1,960 linear ft (597.4 linear m) Species: 23 special-status plant and 27 special-status wildlife species This alignment alternative would have potential to indirectly impact a substantial amount of wetlands and non-wetland waters. Alignment alternative would also have the potential to impact plant and wildlife species. Potential species impacts include Tiburon Indian paintbrush, Santa Clara Valley dudleya, Bay checkerspot butterfly, California red-legged frog, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.
Fault Crossings	Silver Creek (Potentially Active) – At Grade Calaveras (Active) – At Grade

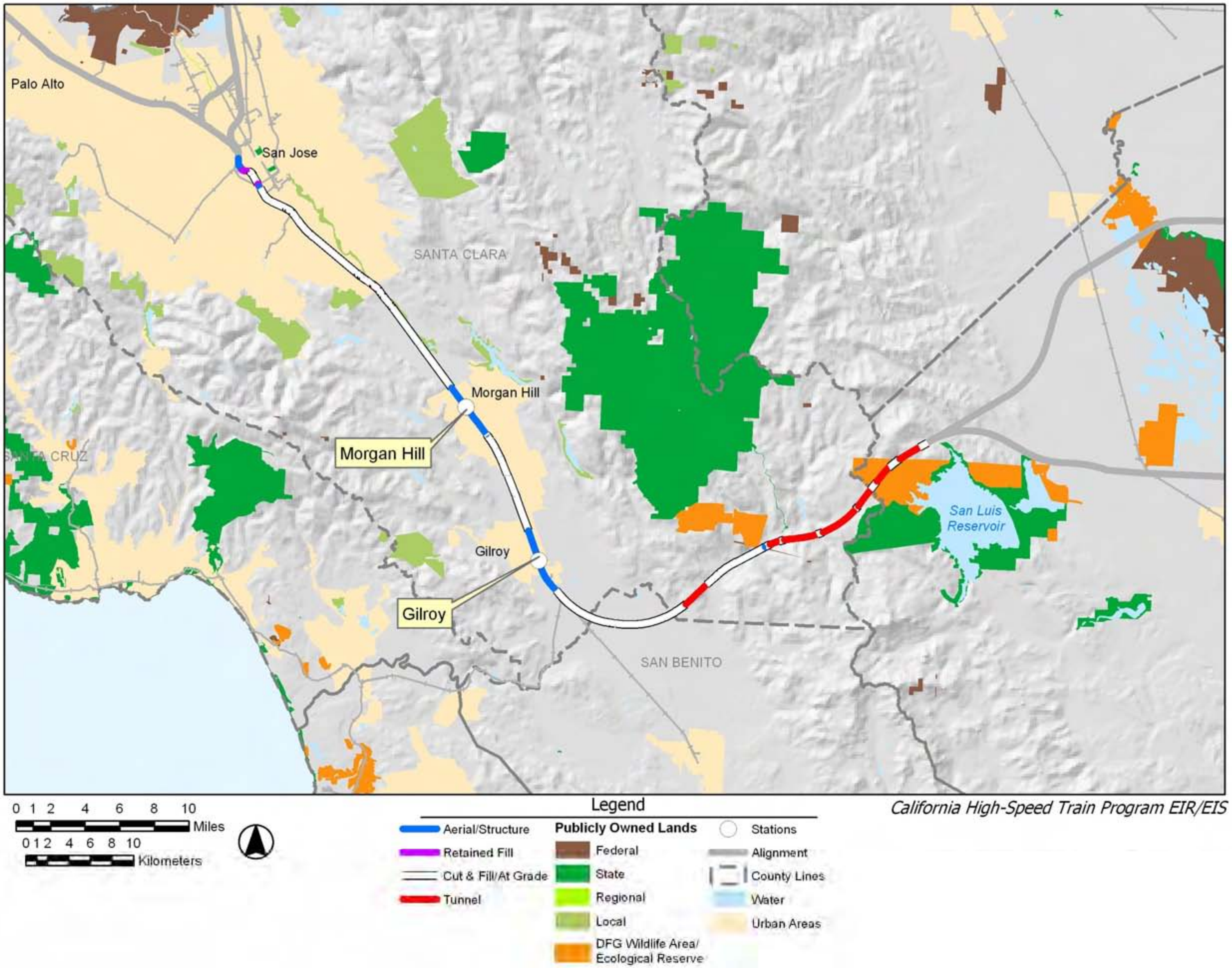

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Figure 7.3-5
HST Alignment Alternatives
Pacheco Pass Alternatives
(San Jose to San Luis Reservoir)

Table 7.3-5
Pacheco Pass Alternatives: San Jose Diridon Station to San Luis Reservoir

Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative include (1) Edenvale Garden Park, (2) Coyote Creek Park, and (3) Upper Cottonwood Wildlife Area. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the alignment alternative is not adjacent to or within this existing right-of-way.

F. PACHECO PASS ALTERNATIVES

All information presented is for the area from San Luis Reservoir to UPRR or BNSF. This segment is shown in Figure 7.3-6 and described in Table 7.3-6.

Table 7.3-6
Pacheco Pass Alternatives: San Luis Reservoir to UPRR or BNSF

	GEA North	Henry Miller (UPRR Connection)	Henry Miller (BNSF Connection)
Alignment Alternative Description	From the Central Valley floor, this alignment alternative would pass through the northern portion of the GEA.	From the Central Valley floor, this alignment alternative would pass north of Santa Nella and would then generally follow Henry Miller Avenue to the UPRR N/S line in the Central Valley.	From the Central Valley floor, this alignment alternative would pass north of Santa Nella and would then generally follow Henry Miller Avenue to the BNSF N/S line in the Central Valley.
Length	60.22 mi (96.92 km)	62.69 mi (100.89 km)	65.06 mi (104.70 km)
Cost (dollars)	$1.41 billion	$1.36 billion	$1.40 billion
Travel Time	Gilroy–Briggsmore=32 min (88.66 mi; 142.7 km) Gilroy–Modesto=33 min (91.04 mi; 146.5 km) Gilroy–Fresno (UPRR)=43 min (128 mi; 206 km) Gilroy–Fresno (BNSF)=44 min (135.4 mi; 217.8 km)	Gilroy–Briggsmore=44 min (133 mi; 214 km) Gilroy–Modesto=45 min (130 mi; 209 km) Gilroy–Fresno=40 min (115 mi; 185 km)	Gilroy–Briggsmore=48 min (150 mi; 241 km) Gilroy–Modesto=49 min (147 mi; 237 km) Gilroy–Fresno=40 min (119 mi; 192 km)
Ridership	Forecast to have slightly less ridership (2.3%) and revenue (1%) than the Henry Miller Road (UPRR Connection) Alternative. Higher ridership between Sacramento and the Bay Area would offset less ridership between the Bay Area and southern California.	This Alternative would have slightly higher ridership potential than the GEA North Alternative.	This Alternative would have slightly less ridership potential than the Henry Miller Alternative (UPRR Connection) as a result of longer travel times between the Bay Area and Sacramento.
Constructability	Would require more grade separations than Henry Miller at the eastern end of the alignment.	Would require aerial segment through sensitive grasslands/wetlands area.	Would require aerial segment through sensitive grasslands/wetlands area.

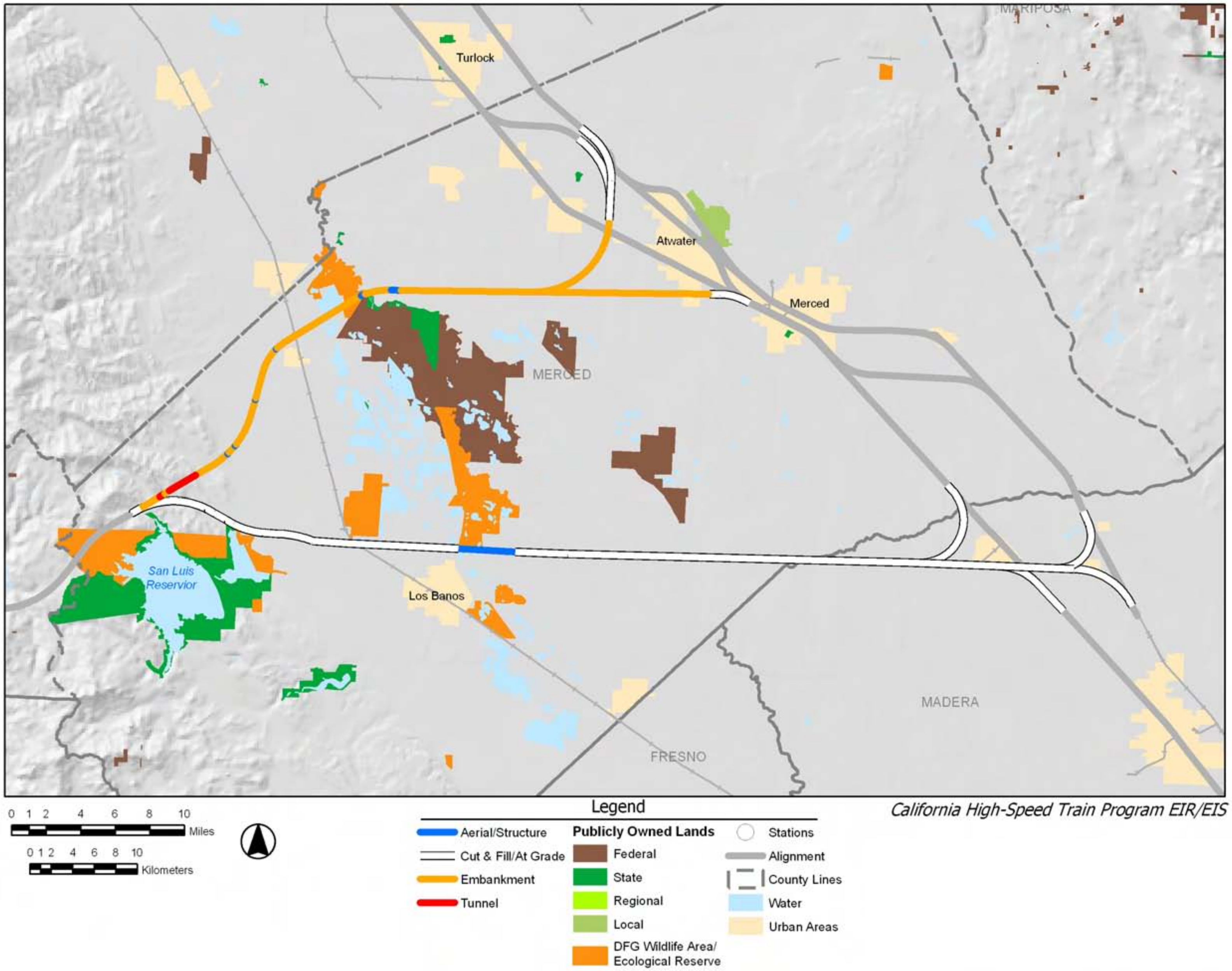

Figure 7.3-6
HST Alignment Alternatives
Pacheco Pass Alternatives
(San Luis Reservoir to UPRR or BNSF)

Table 7.3-6
Pacheco Pass Alternatives: San Luis Reservoir to UPRR or BNSF

	GEA North	Henry Miller (UPRR Connection)	Henry Miller (BNSF Connection)
Operational Issues	Gilroy–Briggsmore Average speed=161.1 mph (268.6 kph) Maximum speed=210 mph (350 kph) Gilroy–Modesto Average speed=161.8 mph (269.6 kph) Maximum speed=210 mph (350 kph) Gilroy–Fresno (UPRR) Average speed=170.8 mph (284.6 kph) Maximum speed=210mph (350 kph) Gilroy–Fresno (BNSF) Average speed=171 mph (285 kph) Maximum speed=210 mph (350 kph)	Gilroy–Briggsmore Average speed=168.6 mph (281 kph) Maximum speed=210 mph (350 kph) Gilroy–Modesto Average speed=170.1 mph (283.5kph) Maximum speed=210 mph (350 kph) Gilroy–Fresno Average speed=166.8 mph (277.9kph) Maximum speed=210 mph (350 kph)	Gilroy–Briggsmore Average speed=168.6 mph (281 kph) Maximum speed=210 mph (350 kph) Gilroy–Modesto Average speed=172.2 mph (287 kph) Maximum speed=210 mph (350 kph) Gilroy–Fresno Average speed=166.9 mph (278.2 kph) Maximum speed=210 mph (350 kph)
Travel Conditions	This alignment alternative would have increased travel times between Los Angeles and San Jose, but would reduce travel times between San Jose and Sacramento.	This alignment alternative would generally parallel an existing roadway corridor (Henry Miller Road) in the Central Valley. It would provide the most direct route between Los Angeles and San Jose.	
Noise and Vibration:[i] High, medium, and low potential impacts	Low potential of noise impacts. Low potential of vibration impacts.. Introduces new potential impacts in partially residential area on what is currently a sparsely used freight line.	Low potential of noise impacts. Low potential of vibration impacts... Trains at conventional speeds. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings. The grade crossing noise reduction (elimination of horn noise and gate noise from existing services) as a result of the grade separations would offset the increase in train frequencies.	
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is incompatible (low rating), given that it is within or immediately adjacent to agricultural land. Environmental Justice: This alignment alternative has high environmental justice impact rating. It traverses lower	Compatibility: Highly compatible with existing Henry Miller Road between Santa Nella and Elgin Avenue. New alignment right-of-way would be incompatible with agricultural uses east of Elgin Avenue. Environmental Justice: This alignment alternative has low environmental justice impact rating. Although the environmental justice percentage thresholds are exceeded east of Gilroy, the environmental justice populations are sparse and distant from the HST line.	

Table 7.3-6
Pacheco Pass Alternatives: San Luis Reservoir to UPRR or BNSF

	GEA North	Henry Miller (UPRR Connection)	Henry Miller (BNSF Connection)
	land use density areas with higher minority and low income populations. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way in the urban areas. Property: This alignment alternative has the potential for low property impacts because it either traverses existing transportation right-of-way or through rural land.	Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way in the urban areas. Property: This alignment alternative has the potential for low property impacts because it either traverses existing transportation right-of-way or through rural land.	
Aesthetics and Visual Resources: General impacts and rating.	Includes new transportation corridor between Pacheco Pass and Gustine, elevated crossing of I-5, wetlands crossings, and new transportation corridor connections to UPRR or BNSF in Chowchilla. Overall medium visual impact.	Includes a trench near the San Joaquin National Cemetery, an elevated crossing of I-5, and wetlands crossings. Overall low visual impact.	
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 271 ac (110 ha) Similar farmland impacts as the Henry Miller (UPRR Connection), but have the greatest impact on prime farmland. Impact up to 137 ac (55.4 ha) of prime farmland. Highest potential for farmland severance.	Farmland: 265 ac (107 ha) Less farmland impacts than either the GEA North or Henry Miller (BNSF Connection). Impact up to 128 ac (52 ha) of prime farmland. Generally follows existing roadway, but potential for farmland severance.	Farmland: 295 ac (119 ha) Would have greatest potential impacts on farmlands. Impact up to 130 ac (52.4 ha) of prime farmland. Generally follows existing roadway, but potential for farmland severance.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 9 known cultural resources. Much of the area along this alignment alternative has seen little development historically. Previously recorded resources include prehistoric archaeological sites and architectural resources.	There are 5 known cultural resources. Much of the area along this alignment alternative has seen little development historically. Previously recorded resources include an archaeological site and architectural resources.	There are 5 known cultural resources. Much of the area along this alignment alternative has seen little development historically. Previously recorded resources include an archaeological site and architectural resources.

Table 7.3-6
Pacheco Pass Alternatives: San Luis Reservoir to UPRR or BNSF

	GEA North	Henry Miller (UPRR Connection)	Henry Miller (BNSF Connection)
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains, and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 53.08 ac (21.48 ha) direct/ 158.3 ac (64.04 ha) indirect Streams: 6,771 linear ft (2,063.8 linear m) direct/ 20,436 linear ft (6,228.9 linear m) indirect Lakes/Waterbodies: 2.3 (0.93 ha) direct/ 8.4 ac (3.40 ha) indirect Potentially affect at least 44 unnamed and named water resources, including (i.e., not limited to) California Aqueduct, Mendota Canal, Garzas Creek, Sullivan Extension, Duck Ponds, Mud Slough, San Joaquin River, Cottonwood Creek, Los Banos Creek, Livingston Canal, and the Merced River.	Floodplains: 126.4 ac 51.15(ha) direct/ 469.5 ac (190.01 ha) indirect Streams: 6,697 linear ft (2,041.2 linear m) direct/ 44,458 linear ft (13,550.8 linear m) indirect Lakes/Waterbodies: 2.5 (1.01 ha) direct/ 10.0 ac (4.05 ha) indirect Potentially affect at least 44 unnamed and named water resources, including Tule Lake, California Aqueduct, San Louis Creek, Mendota Canal, Los Banos Creek, San Louis Wasteway, Mud Slough, Delta Canal, San Joaquin River, Chowchilla River, and Berenda Slough. Primarily at-grade and adjacent to Henry Miller Road and elevated through portion of GEA; constructed with culverts under the track to convey anticipated storm flows and to minimize ponding.	Floodplains: 130.4 ac (52.77 ha) direct/ 487.3 ac (197.21 ha) indirect Streams: 6,266 linear ft (1,909.9 linear m) direct/ 43,420 linear ft (13,234.4 linear m) indirect Lakes/Waterbodies: 2.3 (0.93 ha) direct/ 10.6 ac (4.29 ha) indirect Potentially affect same 44 unnamed and named water resources as Henry Miller (UPRR Connection). Primarily at-grade and adjacent to Henry Miller Road and elevated through portion of GEA; constructed with culverts under the track to convey anticipated storm flows and to minimize ponding.

Table 7.3-6
Pacheco Pass Alternatives: San Luis Reservoir to UPRR or BNSF

<table>
<tr><th></th><th>GEA North</th><th>Henry Miller (UPRR Connection)</th><th>Henry Miller (BNSF Connection)</th></tr>
<tr><td>Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas</td><td>Wetlands[v]: 17.96 ac (7.27 ha) direct/ 1,037.2 ac (419.75 ha) indirect
Non-Wetland Waters: 6,771 linear ft (292.0 linear m)
Species: 22 special-status plant and 34 special-status wildlife species
This alignment alternative would impact the GEA and have potential to directly impact the least non-wetland waters and plant and wildlife species. This alignment alternative would have the potential to impact the most wetlands. Potential species impacts include succulent owl's clover, hairy orcutt grass, valley elderberry longhorn beetle, California tiger salamander, vernal pool tadpole shrimp, least Bell's vireo, riparian (San Joaquin Valley) woodrat, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. This alignment alternative would generally not follow transportation corridors.</td><td>Wetlands[v]: 11.61 ac (4.7 ha) direct/ 1,186.0 ac (479.96 ha) indirect
Non-Wetland Waters: 10,588 linear ft (3,227.2 linear m)
Species: 25 special-status plant and 34 special-status wildlife species
This alignment alternative would impact the GEA and have potential to indirectly impact the most wetlands and impact the most non-wetland waters. Alignment alternative would also have the potential to impact the most plant and wildlife species. Potential species impacts include succulent owl's clover, hairy orcutt grass, Greene's tuctoria, valley elderberry longhorn beetle, vernal pool tadpole shrimp, least Bell's vireo, riparian (San Joaquin Valley) woodrat, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.</td><td>Wetlands[v]: 11.48 ac (4.65 ha) direct/ 1,185.0 ac (479.57 ha) indirect
Non-Wetland Waters: 10,312 linear ft (3,143.1 linear m)
Species: 25 special-status plant and 34 special-status wildlife species
This alignment alternative would impact the GEA and have potential to indirectly impact the most wetlands. Alignment alternative would also have the potential to impact the most plant and wildlife species. Potential species impacts include succulent owl's clover, hairy orcutt grass, Greene's tuctoria, valley elderberry longhorn beetle, vernal pool tadpole shrimp, least Bell's vireo, riparian (San Joaquin Valley) woodrat, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.</td></tr>
<tr><td>Fault Crossings</td><td>Ortigalita (Active) – At Grade Embankment</td><td>Ortigalita (Active) – At Grade</td><td>Ortigalita (Active) – At Grade</td></tr>
<tr><td>Section 4(f) and 6(f) Resources:[4] Number of resources rated high (potential direct effects)</td><td>Public parks, recreation lands, wildlife v waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative include the San Luis National Wildlife Refuge, North Grasslands Wildlife Area, and Great Valley Grasslands State Park. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.</td><td colspan="2">Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative include the Los Banos Wildlife Area. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.</td></tr>
</table>

G. ALTAMONT PASS ALIGNMENT ALTERNATIVES (NILES CANYON TO ALTAMONT PASS)

All information presented is for the area from Niles Canyon to the Altamont Pass. This alternative is shown in Figure 7.3-7 and described in Table 7.3-7.

Table 7.3-7
Altamont Pass Alignment Alternatives: Niles Canyon to Altamont Pass

	I-680/I-580/UPRR	I-580/UPRR	Patterson Pass/UPRR	UPRR
Physical/Operational Characteristics				
Alignment Alternative Description	The I-680/I-580/UPRR alignment alternative would begin at Niles Canyon to Sunol, follow the I-680 Freeway, north and transition to the I-580 Freeway median east to Altamont Pass. Station options considered in this segment include Pleasanton (BART), Livermore (I-580), or Livermore (Greenville/I-580).	The I-580/UPRR alignment alternative would begin at Niles Canyon and would follow UPRR through Pleasanton, travel north to the I-580 and then to Altamont Pass. Station options would be at Pleasanton (I-680/Bernal Rd), or Livermore (I-580), or Livermore (Greenville/I-580).	The Patterson Pass/UPRR alignment alternative would begin at Niles Canyon and would follow the UPRR line to Patters Pass and then to the Central Valley. Station options considered in this segment include Pleasanton (I-680/Bernal Rd), or Livermore (Downtown), or Livermore (Greenville/UPRR).	The UPRR alignment alternative would begin at Niles Canyon and would follow the UPRR line through the Tri-Valley. Station options considered in this segment include Pleasanton (I-680/Bernal Rd), or Livermore (Downtown), or Livermore (Greenville/UPRR).
Length	30.71 mi (49.43 km)	27.32 mi (43.96 km)	25.60 mi (41.19 km)	25.86 mi (41.62 km)
Cost (dollars)	$2.37 billion	$2.0 billion	$1.72 billion	$1.68 billion
Travel Time	22 min	17 min	14 min	14 min
Ridership	Forecast to provide 1.6% less total ridership and 1.4% less total revenue than the UPRR alignment primarily as a result of longer travel times.	Would provide the slightly less ridership potential than alternatives using the UPRR alignment as a result of longer travel times.	Would provide high ridership and revenue potential through the Altamont Pass.	Would provide high ridership and revenue potential through the Altamont Pass.
Constructability	Would require extensive aerial structure along the I-580 and I-680 freeway and rail corridors with major constructability issues. A particularly long and high aerial curve would be	Would require extensive aerial structure along the I-580 freeway and rail corridor. Construction issues through downtown Pleasanton.	Would require extensive earthwork as compared to the UPRR alignment alternative. Construction issues through downtown Livermore and Pleasanton.	Construction issues through downtown Livermore and Pleasanton

Table 7.3-7
Altamont Pass Alignment Alternatives: Niles Canyon to Altamont Pass

	I-680/I-580/UPRR	I-580/UPRR	Patterson Pass/UPRR	UPRR
	required from the I-580 to I-680 alignments.			
Operational Issues	Average speed: 91.1 mph (151.8 kph) Maximum speed: 159 mph (265 kph) HST operations would need to be coordinated and integrated with BART.	Average speed: 97.8 mph (162.9 kph) Maximum speed: 159 mph (265 kph) HST operations would need to be coordinated and integrated with ACE service and UPRR operations.	Average speed: 105.8 mph (176.3 kph) Maximum speed: 171 mph (285 kph) HST operations would need to be coordinated and integrated with ACE service and UPRR operations.	Average speed: 108.3 mph (180.5 kph) Maximum speed: 168 mph (280 kph) HST operations would need to be coordinated and integrated with ACE service and UPRR operations.
Potential Environmental Impacts				
Travel Conditions	This alignment alternative would provide direct HST service to the Tri-Valley area with potential stations at the Pleasanton (BART), Livermore (I-580), or Livermore (Greenville/I-580). This alignment alternative would increase connectivity and accessibility to the I-580 Corridor and Tri-Valley area. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode along the I-580 Corridor while improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and	This alignment alternative would provide direct HST service to the Tri-Valley area with potential stations at Pleasanton (I-680/Bernal Rd), or Livermore (I-580), or Livermore (Greenville/I-580). This alignment alternative would increase connectivity and accessibility to the I-580 Corridor and Tri-Valley area. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode along the I-580 Corridor while improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing	These alignment alternatives would provide generally equivalent service to the I-580/UPRR alignment alternative.	

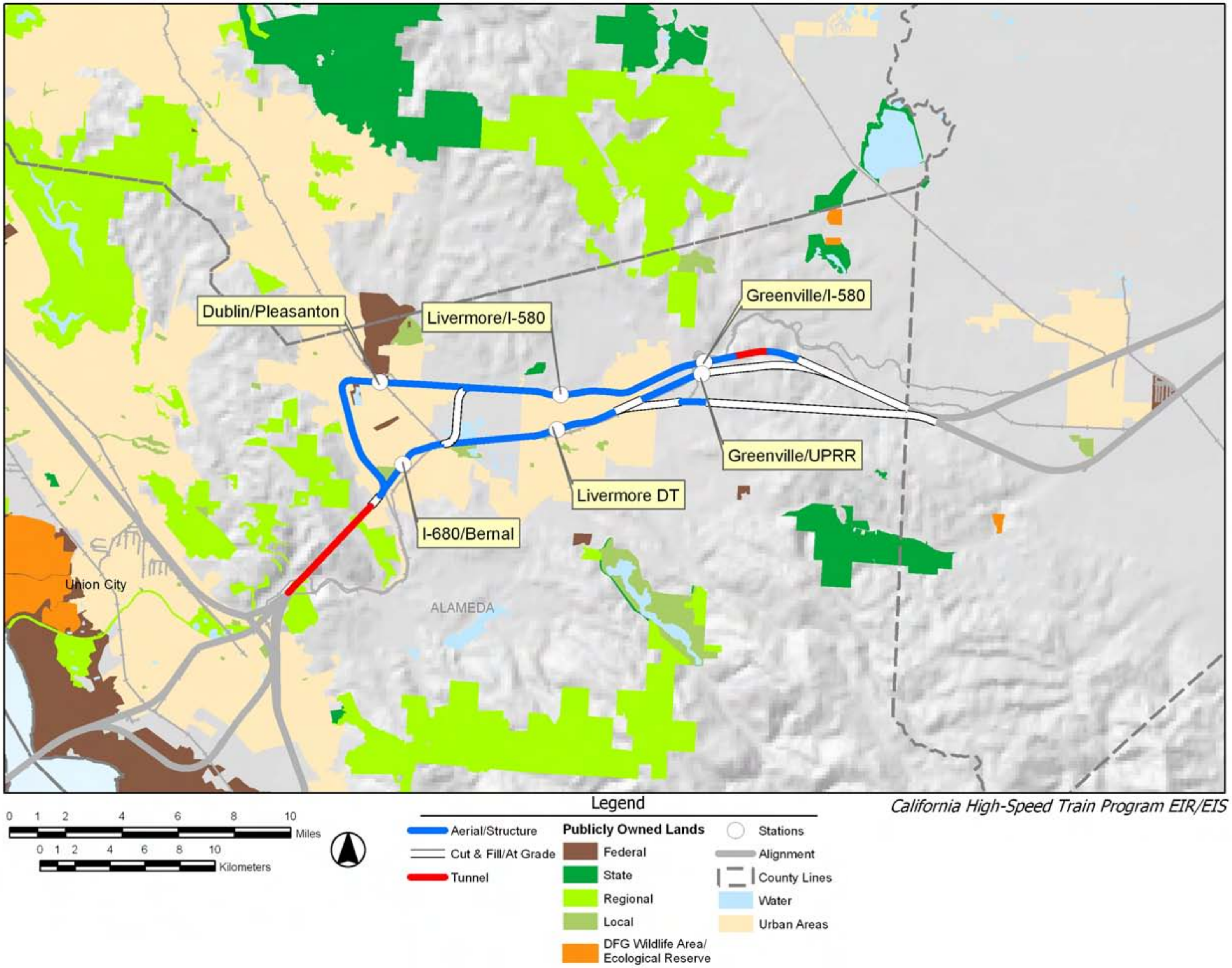

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Figure 7.3-7
HST Alignment Alternatives
Altamont Pass Alignment Alternatives
(Niles Canyon to Altamont Pass)

Table 7.3-7
Altamont Pass Alignment Alternatives: Niles Canyon to Altamont Pass

	I-680/I-580/UPRR	I-580/UPRR	Patterson Pass/UPRR	UPRR
	reduce existing automobile traffic flow. The alignment alternative would provide connectivity to the BART station in Pleasanton.	automobile traffic flow and reduce air pollution at some existing rail crossings.		
Noise and Vibration:[i] High, medium, and low potential impacts	Low potential of noise impacts. Low potential of vibration impacts due to proximity of residential land use along the Tri-Valley segment. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings.	Low potential of noise impacts and low potential of vibration impacts due to proximity of alignment alternative to industrial/commercial land uses. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings.	Medium potential of noise impacts and a medium potential of vibration impacts due to proximity of residential land use along the Tri-Valley. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings.	Medium potential of noise impacts and a medium potential of vibration impacts due to proximity of residential land use along the Tri-Valley segment. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. Environmental Justice: This alignment alternative has low environmental justice impact rating.	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. It exhibits low compatibility where it does not follow a transportation right-of-way in the Altamont Pass area. Environmental Justice: This alignment alternative has low environmental justice impact rating.	Compatibility: The majority of these alignment alternatives are compatible (high rating), given that they are within or immediately adjacent to an existing major rail or highway rights-of-way. They exhibit low compatibility where they do not follow a transportation rights-of-way in the Altamont Pass area. Environmental Justice: These alignment alternatives have low environmental justice impact ratings. Community: These alignment alternatives would not affect community cohesion, given that they are mostly within or immediately adjacent to an existing major rail or highway rights-of-way. Property: These alignment alternatives have the potential for low to medium property impacts.	

Table 7.3-7
Altamont Pass Alignment Alternatives: Niles Canyon to Altamont Pass

	I-680/I-580/UPRR	I-580/UPRR	Patterson Pass/UPRR	UPRR
	Community: This alignment alternative would not affect community cohesion, given that it is mostly within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for high property impacts in the Niles to Sunol area, Dublin /Pleasanton areas, where additional property will be required.,	Community: This alignment alternative would not affect community cohesion, given that it is mostly within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for medium property impacts.		
Aesthetics and Visual Resources: General impacts and rating.	Includes a trench alignment from tunnel portal to I-680, an elevated alignment along I-680, an elevated alignment through I-680, I-580 interchange, elevated approaches to station, and an elevated crossing of I-580. Overall medium visual impact.	Include a trench alignment from tunnel portal to east of I-680, an elevated alignment along existing UPRR in Pleasanton, an at-grade alignment along existing UPRR through Livermore, and a deep cut at Altamont Summit. Overall medium visual impact.	Includes an aerial alignment from tunnel portal to east of I-680, an elevated alignment along existing UPRR in Pleasanton, and at-grade alignment along existing UPRR through Livermore, and cut and fill across summit. Overall low visual impact.	Includes a trench alignment from tunnel portal to east of I-680, an elevated alignment along existing UPRR in Pleasanton, an at-grade alignment along existing UPRR through Livermore, and a deep cut and fill across summit. Overall medium visual impact.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 14 ac (5.5 ha) Would have greatest potential impacts on farmlands. Impact up to 11.7 ac (4.7 ha) of prime farmland.	Farmland: 12 ac (4.9 ha) Similar farmland impacts as the I-680/I-580/UPRR, but have the greatest impact on prime farmland. All farmland impact would be prime farmland.	Farmland: 10 ac (3.9 ha) Less potential for farmland impacts than either the I-680/I-580/UPRR or I-580/UPRR. Impact up to 7.1 ac (2.9 ha) of prime farmland.	Farmland: 7 ac (2.9 ha) Would have least potential impacts on farmlands including prime farmland. All farmland impact would be prime farmland.

Table 7.3-7
Altamont Pass Alignment Alternatives: Niles Canyon to Altamont Pass

	I-680/I-580/UPRR	I-580/UPRR	Patterson Pass/UPRR	UPRR
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 20 known cultural resources. Much of the area has seen recent development. Architectural resources include buildings from the 1890s and residential properties dating from 1910 to 1940.	There are 17 known cultural resources. The Livermore Valley is known to be rich in prehistoric resources, including habitation sites and burials. Previously recorded resources include archaeological sites and architectural resources dating from the 1900s.	There are 6 known cultural resources. There are few previously recorded archaeological sites or architectural resources. This alignment alternative would have a low sensitivity for cultural resources.	There are 6 known cultural resources. There are few previously recorded archaeological sites or architectural resources. This alignment alternative would have a low sensitivity for cultural resources.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains, and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 3.7 ac (1.5 ha) direct/ 18.8 ac (7.61 ha) indirect Streams: 2,582 linear ft (787.3 linear m) direct/ 13,310 linear ft (4,056.9 linear m) indirect Lakes/Waterbodies: 0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha) indirect Potentially affect at least 17 unnamed and named water resources, including Alameda Creek, Laurel Creek, Gold Creek, Arroyo Valle, Arroyo De La Laguna, Tassajara Creek, Cottonwood Creek, Arroyo Las Positas, Arroyo Seco, and South Bay Aqueduct. Constructed on aerial structure with the least amount of impact on floodplains.	Floodplains: 8.2 ac (3.32 ha) direct/ 33.7 ac (13.64 ha) indirect Streams: 2,280 linear ft (694.9 linear m) direct/ 9,243 linear ft (2,817.3 linear m) indirect Lakes/Waterbodies: 2.1 ac (0.85 ha) direct/ 7.5 ac (3.04 ha) indirect Potentially affect 15 unnamed and named water resources, including (i.e., not limited to) Arroyo Valle, Arroyo De La Laguna, Cottonwood Creek, Arroyo Las Positas, Arroyo Seco, Arroyo Gravel Pits/Arroyo Mocho, South Bay Aqueduct, and Patterson Run (canal). Constructed at-grade and potentially impact more area of floodplain.	Floodplains: 9.4 ac (3.8 ha) direct/ 20.6 ac (8.34 ha) indirect Streams: 1,861 linear ft (567.2 linear m) direct/ 6,253 linear ft (1905.9 linear m) indirect Lakes/Waterbodies: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0ha) indirect Potentially affect 9 unnamed and named water resources, including Arroyo Valle, Arroyo De La Laguna, Arroyo Las Positas, Arroyo Seco, Arroyo Gravel Pits/Arroyo Mocho, and South Bay Aqueduct and Patterson Run (canal). Constructed on aerial structure through most of the areas within the 100-year floodplain and would not impede storm flows.	Floodplains: 7 ac (2.83ha) direct/ 16.2 ac (6.56 ha) indirect Streams: 1,957 linear ft (596.5 linear m) direct/ 6,195 linear ft (1,888.2 linear m) indirect Lakes/Waterbodies: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha)) indirect Potentially affect 12 unnamed and named water resources, including Alameda Creek, Arroyo Valle, Arroyo De La Laguna, Arroyo Las Positas, Arroyo Seco, Arroyo Gravel Pits/Arroyo Mocho, South Bay Aqueduct, and Patterson Run (canal). Many of the watercourses would be crossed at-grade.

Table 7.3-7
Altamont Pass Alignment Alternatives: Niles Canyon to Altamont Pass

	I-680/I-580/UPRR	I-580/UPRR	Patterson Pass/UPRR	UPRR
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 0.66 ac (0.27 ha) direct/ 72.1 ac (29.19 ha) indirect Non-Wetland Waters: 2,380 linear ft (725.4 linear m) Species: 24 special-status plant and 29 special-status wildlife species This alignment alternative would have potential to directly impact the least wetlands, but the most plant and wildlife species. Potential species impacts include palmate-bracted bird's beak, longhorn fairy shrimp, valley elderberry longhorn beetle, vernal pool tadpole shrimp, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.	Wetlands[v]: 5.17 ac (2.1 ha) direct/ 226.3 ac (91.57 ha) indirect Non-Wetland Waters: 2,612 linear ft (796.1 linear m) Species: 24 special-status plant and 29 special-status wildlife species This alignment alternative would have potential to directly impact the most wetlands, non-wetland waters, and plant and wildlife species. Potential species impacts include palmate-bracted bird's beak, longhorn fairy shrimp, valley elderberry longhorn beetle, vernal pool tadpole shrimp, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.	Wetlands[v]: 2.59 ac (1.0 ha) direct/ 160.1 ac (64.78 ha) indirect Non-Wetland Waters: 1,371 linear ft (417.9 linear m) Species: 20 special-status plant and 28 special-status wildlife species This alignment alternative would have potential to impact the least plant and wildlife species. Potential species impacts include palmate-bracted bird's beak, valley elderberry longhorn beetle, vernal pool tadpole shrimp, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.	Wetlands[v]: 3.22 ac (1.3 ha) direct/ 184 ac (74.46 ha) indirect Non-Wetland Waters: 1,152 linear ft (351.1 linear m) Species: 20 special-status plant and 28 special-status wildlife species This alignment alternative would have potential to directly impact the least non-wetland waters and plant and wildlife species. Potential species impacts include valley elderberry longhorn beetle, vernal pool tadpole shrimp, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.
Fault Crossings	Calaveras (Active) – Tunnel Pleasanton (Active) – Above Grade Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade	Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade	Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade Corral Hallow (Potentially Active) – At Grade	Calaveras (Active) – Tunnel Livermore (Potentially Active) – Above Grade Greenville (Active) – Above Grade

Table 7.3-7
Altamont Pass Alignment Alternatives: Niles Canyon to Altamont Pass

	I-680/I-580/UPRR	I-580/UPRR	Patterson Pass/UPRR	UPRR
Section 4(f) and 6(f) Resources:[4] Number of resources rated high (potential direct effects)	Public parks, recreation lands, wildlife and waterfowl refuges 0–150 ft (46 m) from center of alignment alternative include (1) Augustin-Bernal Park, (2) Muirwood Park, (3) Dublin Sports Grounds Park, (4) Iron Horse Trail, (5) Vargas Plateau, (6) Bay Ridge Trail, (7) Pleasanton Ridge, and (8) San Joaquin County to Shadow Cliffs Trail. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the alignment alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.	Public parks, recreation lands, wildlife and waterfowl refuges 0–150 ft (46 m) from center of alignment alternative include (1) Augustin-Bernal Park, (2) Iron Horse Trail, (3) Vargas Plateau, (4) Bay Ridge Trail, (5) Pleasanton Ridge, and (6) San Joaquin County to Shadow Cliffs Trail. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way, and few resources exist in areas where the alignment alternative is not adjacent to or within this existing right-of-way. Exceptions include the Augustin-Bernal Park.		

H. ALTAMONT PASS ALIGNMENT ALTERNATIVES (ALTAMONT PASS TO UPRR OR BNSF CONNECTION)

All information presented is for the area from the Altamont Pass to the UPRR or BNSF connection. This alternative is shown in Figure 7.3-8 and described in Table 7.3-8.

Table 7.3-8
Altamont Pass Alignment Alternatives: Altamont Pass to UPRR or BNSF Connection

	Tracy Downtown (BNSF Connection)	Tracy Downtown (UPRR Connection)	Tracy ACE (BNSF Connection)	Tracy ACE (UPRR Connection)
Physical/Operational Characteristics				
Alignment Alternative Description	The I-680/I-580/UPRR alignment alternative would begin at the Altamont Pass, traverse the Pass south of I-580, and parallel the UPRR line in Tracy to Downtown, with connections east of Tracy to the BNSF N/S line. The station option considered in this segment is Tracy (Downtown).	The I-680/I-580/UPRR alignment alternative would begin at the Altamont Pass, traverse the Pass south of I-580, and parallel the UPRR line in Tracy to Downtown, with connections east of Tracy to the UPRR N/S line. The station option considered in this segment is Tracy (Downtown).	The Patterson Pass/UPRR alignment alternative would begin at the Altamont Pass and would travel southeast along the southern UPRR line (ACE Line) to the Tracy ACE station, with connections east to the BNSF N/S line. The station option considered in this segment is Tracy (ACE).	The Patterson Pass/UPRR alignment alternative would begin at the Altamont Pass and would travel southeast along the southern UPRR line (ACE Line) to the Tracy ACE station, with connections east to the UPRR N/S line. The station option considered in this segment is Tracy (ACE).
Length	53.58 mi (86.22 km)	36.26 mi (58.36 km)	53.98 mi (86.87 km)	29.78 mi (47.93 km)
Cost (dollars)	$1.84 billion	$1.93 billion	$1.95 billion	$1.75 billion
Travel Time	14 min NB 15 min SB	12 min NB 11 min SB	15 min NB 16 min SB	13 min NB 12 min SB
Ridership	Longer travel times would result in somewhat less ridership potential than the UPRR Alternatives. Tracy Downtown and Tracy ACE alternatives using the BNSF would be about the same.	Would provide high ridership and revenue potential for the Altamont Pass Alternatives. Tracy Downtown and Tracy Ace alternatives using the UPRR would be about the same.	Increased travel times would result in somewhat less ridership potential than UPRR Alternatives.	Would provide high ridership and revenue potential via the Altamont Pass.
Constructability	Primarily at-grade alignment with extensive earthwork at western end.	Primarily at-grade alignment with extensive earthwork at western end.	Primarily at-grade alignment with extensive earthwork at western end.	Primarily at-grade alignment with extensive earthwork at western end.

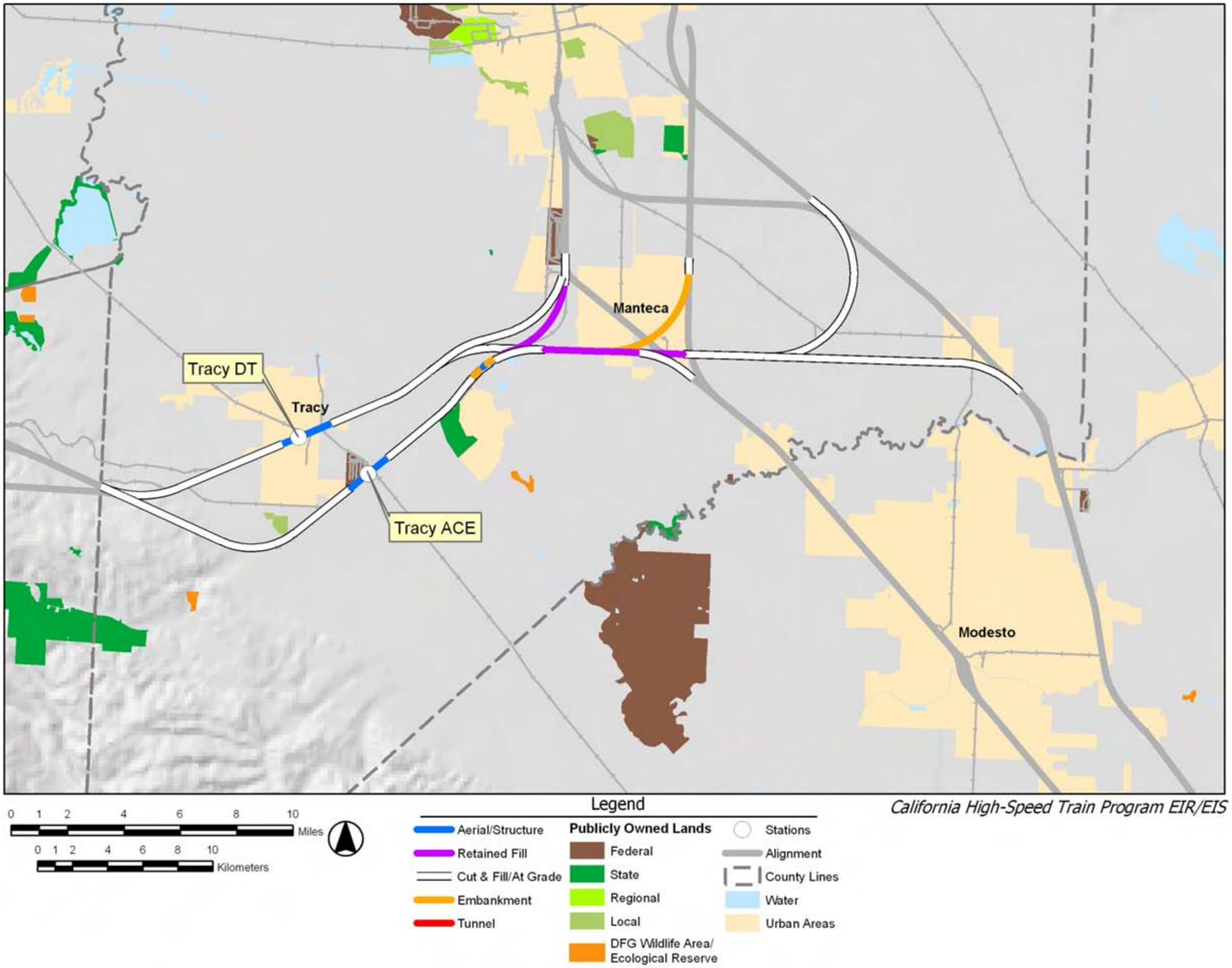

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Figure 7.3-8
HST Alignment Alternatives
Altamont Pass Alignment Alternatives
(Altamont Pass to UPRR OR BNSF Connection)

Table 7.3-8
Altamont Pass Alignment Alternatives: Altamont Pass to UPRR or BNSF Connection

	Tracy Downtown (BNSF Connection)	Tracy Downtown (UPRR Connection)	Tracy ACE (BNSF Connection)	Tracy ACE (UPRR Connection)
Operational Issues	Northbound Average speed135.5 mph (225.9 kph) Maximum speed: 210 mph (350 kph) Southbound Average speed: 141.9 mph (236.5 kph) Maximum speed: 210 mph (350 kph)	Northbound Average speed: 127.2 mph (212 kph) Maximum speed: 210 mph (350 kph) Southbound Average speed: 125.29 mph (208.7 kph) Maximum speed: 210 mph (350 kph)	Northbound Average speed: 136.1 mph (226.8 kph) Maximum speed: 210 mph (350 kph) Southbound Average speed: 147.7 mph (237.8 kph) Maximum speed: 210 mph (350 kph)	Northbound Average speed: 131.7 mph (219.6 kph) Maximum speed: 210 mph (350 kph) Southbound Average speed: 125.8 mph (209.7 kph) Maximum speed: 210 mph (350 kph)
Potential Environmental Impacts				
Travel Conditions	This alignment alternative would provide direct HST service to downtown Tracy. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode along the I-580 Corridor while improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic flow and reduce air pollution at existing rail crossings. The fully grade-separated UPRR rail corridor in the Tracy Area would improve local traffic.		This alignment alternative would provide direct HST service to southern Tracy area at the current ACE Station. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode along the I-580 Corridor while improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic flow and reduce air pollution at existing rail crossings.	
Noise and Vibration:[i] High, medium, and low potential impacts	Low potential of noise impacts. Low potential of vibration impacts due to proximity of residential land use along the Tri-Valley segment. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels	Low potential of noise impacts. Low potential of vibration impacts due to proximity of alignment to industrial/commercial land uses. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due	Medium potential of noise impacts. Low potential of vibration impacts due to proximity of residential land use along the Tri-Valley. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and	Medium potential of noise impacts. Low potential of vibration impacts due to proximity of residential land use along the Tri-Valley segment. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due

Table 7.3-8
Altamont Pass Alignment Alternatives: Altamont Pass to UPRR or BNSF Connection

	Tracy Downtown (BNSF Connection)	Tracy Downtown (UPRR Connection)	Tracy ACE (BNSF Connection)	Tracy ACE (UPRR Connection)
	due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings.	to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings.	gate noise from existing services as a result of the grade separations at some existing grade crossings.	to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is compatible (medium rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: This alignment alternative has a low environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for low to medium property impacts.	Compatibility: The majority of this alignment alternative is compatible (medium rating), given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: This alignment alternative has a low environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for low to medium property impacts.	Compatibility: The majority of these alignment alternatives are compatible (medium rating), given that they are within or immediately adjacent to an existing major rail or highway rights-of-way. Environmental Justice: These alignment alternatives have a low environmental justice impact rating. Community: These alignment alternatives would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: These alignment alternatives have the potential for low to medium property impacts.	

Table 7.3-8
Altamont Pass Alignment Alternatives: Altamont Pass to UPRR or BNSF Connection

	Tracy Downtown (BNSF Connection)	Tracy Downtown (UPRR Connection)	Tracy ACE (BNSF Connection)	Tracy ACE (UPRR Connection)
Aesthetics and Visual Resources: General impacts and rating.	Includes a new at-grade corridor from summit to I-580, an elevated crossing of I-580, an at-grade alignment through Tracy, an at-grade alignment in median of SR 120, and a new at-grade corridor from SR 99 to BNSF. Overall low visual impact.	Includes a new at-grade corridor from summit to I-580, and elevated crossing of I-580, an at-grade alignment through Tracy, and an at-grade alignment in median of SR 120. Overall low visual impact.	Includes a new at-grade corridor from summit to I-580, an elevated crossing of I-580, an at-grade alignment along UPRR, an at-grade alignment in median of SR 120, and a new at-grade corridor from SR 99 to BNSF. Overall low visual impact.	Includes a new at-grade corridor from summit to I-580, an elevated crossing of I-580, an at-grade alignment along UPRR, and an at-grade alignment in median of SR 120. Overall low visual impact.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 446 ac (180.5 ha) Would have greatest potential impacts on farmlands including prime farmland. Impact up to 204 ac (82.4 ha) of prime farmland.	Farmland: 243 ac (98.2 ha) Less potential for farmland impacts than either the Tracy Downtown (BNSF Connection) or Tracy ACE (BNSF Connection). Impact up to 152 ac (61.4 ha) of prime farmland.	Farmland: 442 ac (178.7 ha) Similar farmland impacts as the Tracy Downtown (BNSF Connection). Impact up to 162 ac (65.6 ha) of prime farmland.	Farmland: 182 ac (73.6 ha) Would have least potential impacts on farmlands including prime farmland. Impact up to 87 ac (35.2 ha) of prime farmland.
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 14 known cultural resources. Includes previously recorded archaeological and architectural resources. The majority of the architectural resources are located south of Tracy.	There are 11 known cultural resources. Includes previously recorded archaeological and architectural resources, including a railroad trestle, industrial warehouses, and residential properties. The majority of the architectural resources are located south of Tracy.	There are 15 known cultural resources. Includes previously recorded archaeological and architectural resources. Recorded resources include World War II era buildings. The majority of the architectural resources are located south of Lathrop.	There are 12 known cultural resources. This alignment alternative includes previously recorded archaeological and architectural resources. Recorded resources include World War II era buildings. The majority of the architectural resources are located south of Lathrop

Table 7.3-8
Altamont Pass Alignment Alternatives: Altamont Pass to UPRR or BNSF Connection

	Tracy Downtown (BNSF Connection)	Tracy Downtown (UPRR Connection)	Tracy ACE (BNSF Connection)	Tracy ACE (UPRR Connection)
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains, and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 41.4 ac (16.75 ha) direct/ 136 ac (55.04 ha) indirect Streams: 6,228 linear ft (1,898.3linear m) direct/ 19,257 linear ft (5,869.5 linear m) indirect Lakes/Waterbodies: 2.3 ac (0.93ha) direct/ 7.6 ac (3.08 ha) indirect Potentially affect at least 14 unnamed and named water resources, including California Aqueduct, Delta Mendota Canal, Upper Main Canal, San Joaquin River, Paradise Cut, Tom Paine Slough, Lone Tree Creek, and Avena Drain. Where either at-grade or on embankments, construction would include culverts sized appropriately to convey anticipated storm flows and to minimize ponding.	Floodplains: 32 ac (12.95 ha) direct/ 99.6 ac (40.31 ha) indirect Streams: 5,384 linear ft (1,641.0 linear m) direct/ 15,605 linear ft (4,756.4 linear m) indirect Lakes/Waterbodies: 2.3 ac (0.93 ha) direct/ 7.6 ac (3.08 ha) indirect Potentially affect at least 9 of the water resources identified in the Tracy Downtown (BNSF Connection) alignment alternative, excluding Lone Tree Creek, Avena Drain, and the Main Drain Canal. Where either at-grade or on embankments, construction would include culverts sized appropriately to convey anticipated storm flows and to minimize ponding.	Floodplains: 48.9 ac (19.79 ha) direct/ 154.5 ac 962.53 ha) indirect Streams: 7,390 linear ft (2,252.5 linear m) direct/ 24,468 linear ft (7,457.8 linear m) indirect Lakes/Waterbodies: 3 ac (1.2 ha) direct/ 13 ac (5.26 ha) indirect Potentially affect at least 14 unnamed and named water resources, including California Aqueduct, Delta Mendota Canal, Upper Main Canal, San Joaquin River, Paradise Cut, Tom Paine Slough, Lone Tree Creek, and Avena Drain. Where either at-grade or on embankments, construction would include culverts sized appropriately to convey anticipated storm flows and to minimize ponding.	Floodplains: 29.3 ac (11.86 ha) direct/ 76.8 ac (31.08 ha) indirect Streams: 5,433linear ft (1,656.0 linear m) direct/ 13,161 linear ft (4,011.5 linear m) indirect Lakes/Waterbodies: 2.1 ac (0.85 ha) direct/ 9.2 ac (3.72 ha) indirect Potentially affect at least 9 of the water resources identified in the Tracy ACE Station BNSF alignment alternative, excluding Lone Tree Creek, Avena Drain, and the Main Drain Canal. Where either at-grade or on embankments, construction would include culverts sized appropriately to convey anticipated storm flows and to minimize ponding.

Table 7.3-8
Altamont Pass Alignment Alternatives: Altamont Pass to UPRR or BNSF Connection

	Tracy Downtown (BNSF Connection)	Tracy Downtown (UPRR Connection)	Tracy ACE (BNSF Connection)	Tracy ACE (UPRR Connection)
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 4.36 ac (1.76 ha) direct/ 158.2 ac (64.02 ha) indirect Non-Wetland Waters: 6,291 linear ft (1,917.5 linear m) Species: 18 special-status plant and 27 special-status wildlife species This alignment alternative would have potential to directly impact the most wetlands. Potential species impacts include valley elderberry longhorn beetle, vernal pool tadpole shrimp, riparian (San Joaquin Valley) woodrat, riparian brush rabbit, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.	Wetlands[v]: 4.16 ac (1.68 ha) direct/ 155.4 ac (62.91 ha) indirect Non-Wetland Waters: 7,504 linear ft (2,287.2 linear m) Species: 22 special-status plant and 27 special-status wildlife species This alignment alternative would have potential to impact the most plant species. Potential species impacts include Greene's tuctoria, valley elderberry longhorn beetle, vernal pool tadpole shrimp, riparian (San Joaquin Valley) woodrat, riparian brush rabbit, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.	Wetlands[v]: 3.63 ac (1.47 ha) direct/ 312.2 ac (126.33 ha) indirect Non-Wetland Waters: 7,678 linear ft (2,340.3 linear m) Species: 21 special-status plant and 27 special-status wildlife species This alignment alternative would have potential to indirectly impact the most wetlands and waters. Potential species impacts include Greene's tuctoria, valley elderberry longhorn beetle, vernal pool tadpole shrimp, riparian (San Joaquin Valley) woodrat, riparian brush rabbit, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.	Wetlands[v]: 2.60 ac (1.0 ha) direct/ 206.0 ac (83.37 ha) indirect Non-Wetland Waters: 5,326 linear ft (1,623.4 linear m) Species: 20 special-status plant and 27 special-status wildlife species This alignment alternative would have potential to directly impact the least wetlands and waters. Potential species impacts include valley elderberry longhorn beetle, vernal pool tadpole shrimp, riparian (San Joaquin Valley) woodrat, riparian brush rabbit, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation corridors would minimize impacts.
Fault Crossings	Vernalis (Active) – At Grade		Vernalis (Active) – At Grade San Joaquin (Potentially Active) – At Grade	
Section 4(f) and 6(f) Resources:[4] Number of resources rated high (potential direct effects)	No public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative.			

I. TRANS BAY CROSSING: TRANSBAY TUBE (OAKLAND - SAN FRANCISCO)

All information presented is for a potential transbay tube connection Oakland and San Francisco. This alternative is shown in Figure 7.3-9 and described in Table 7.3-9.

Table 7.3-9
Trans Bay Crossings: Oakland to San Francisco

	Tran Bay Crossing – Transbay Transit Center	Trans Bay Crossing – 4th and King
Physical/Operational Characteristics		
Alignment Alternative Description	This alignment alternative would be in a tube under the San Francisco Bay between San Francisco and Oakland. It would connect between Oakland and the Transbay Transit Center.	This alignment alternative would be in a tube under the San Francisco Bay between San Francisco and Oakland. It would connect between Oakland and the potential 4th and King Station in San Francisco.
Length[24]	7.28 mi (11.71 km)	6.87 mi (11.06 km)
Cost[25] (dollars)	$5.36 billion	$5.20 billion
Travel Time[26]	6 min	6 min
Ridership	Would have the highest ridership potential for the Trans Bay crossing between San Francisco and Oakland.	Would have less ridership potential than the Transbay – Transbay Transit Center alternative.
Constructability	Difficult and costly construction on Bay floor.	Difficult and costly construction on Bay floor.
Operational Issues	Average speed =66.5 mph (110.9 kph) Maximum speed =100.2 mph (167 kph) .	Average speed = 69.3 mph (115.5 kph) Maximum speed =105 mph (175 kph) .
Potential Environmental Impacts		
Travel Conditions	Travel time for this connection would be about the same as to 4th and King. This alternative would provide the highest connectivity and accessibility with the terminus at the Transbay Transit Center.	Travel time for this connection would be about the same as the Transbay Transit Center.
Noise and Vibration:[i] High, medium, or low potential impacts	Low potential of noise impacts. Low potential of vibration impacts.	Low potential of noise impacts. Low potential of vibration impacts.

[24] Includes West Oakland terminal station.

[25] Includes West Oakland terminal station.

[26] Includes West Oakland terminal station.

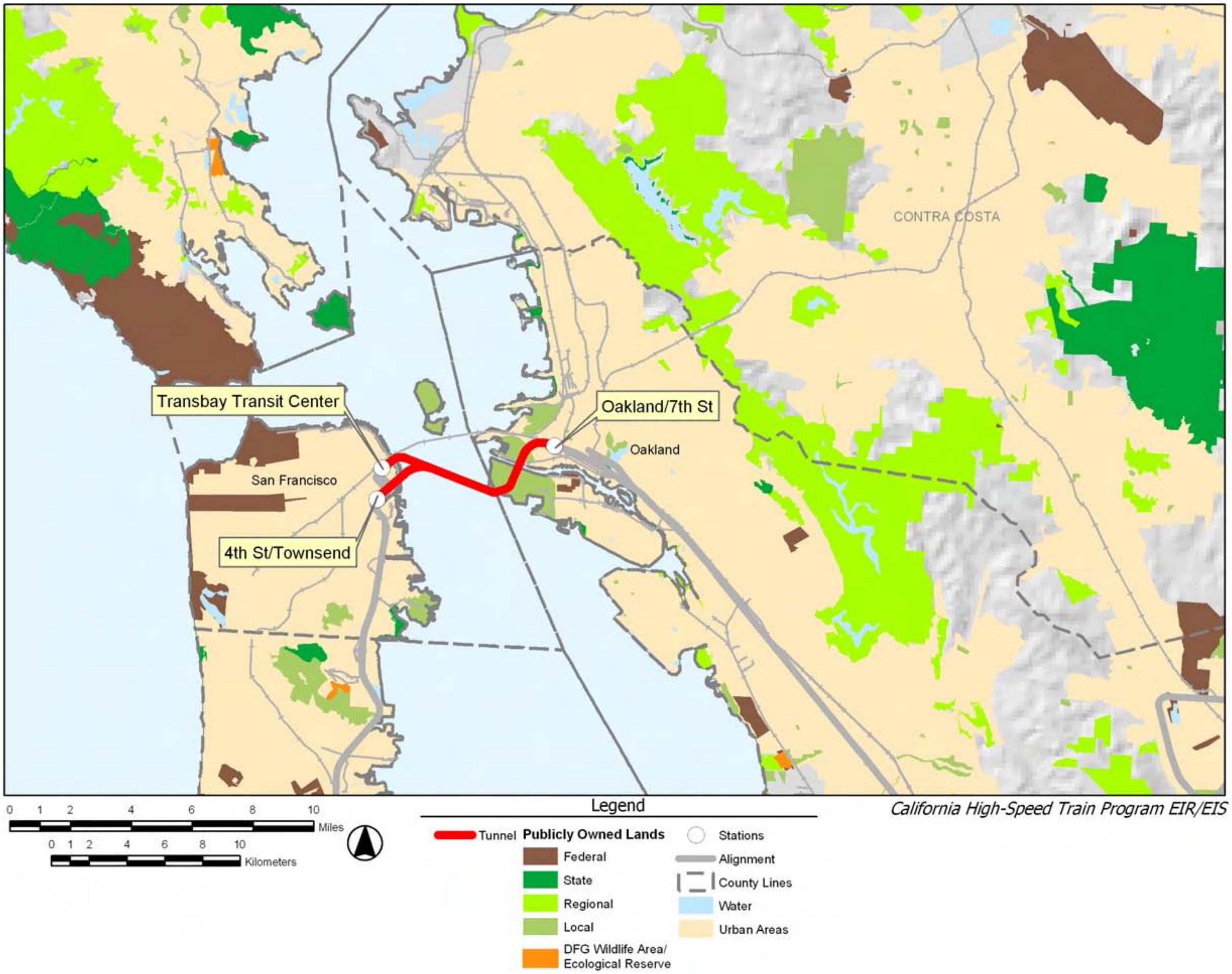

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Figure 7.3-9
HST Alignment Alternatives
Trans Bay Crossing
(Oakland to San Francisco)

Table 7.3-9
Trans Bay Crossings: Oakland to San Francisco

	Tran Bay Crossing – Transbay Transit Center	Trans Bay Crossing – 4th and King
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail and within industrial land uses. Environmental Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is in tunnel. Property: The potential for property impacts in this alignment alternative would be low to residential and nonresidential properties because it would be below grade.	Compatibility: The majority of this alignment alternative is compatible (high rating), given that it is within or immediately adjacent to an existing major rail and within industrial land uses. Environmental Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is in tunnel Property: The potential for property impacts in this alignment alternative would be low to residential and nonresidential properties because alignment would be below grade.
Aesthetics and Visual Resources: General impacts and rating.	Underground alignment. No visual impact.	
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 3 known cultural resources. The terrestrial portions are highly sensitive for both historical archaeological deposits and architectural resources. The area likely includes historic artifacts from the Gold Rush period through the 1906 earthquake and fire.	There are no known cultural resources. The terrestrial portions are highly sensitive for both historical archaeological deposits and architectural resources. The area likely includes historic artifacts from the Gold Rush period through the 1906 earthquake and fire.
Hydrology and Water Resources:[iv] Potential impacts and associated ac (ha) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha) indirect Streams: 0.0 linear ft (0.0 m) direct/ 0.0 linear ft (0.0 linear m) indirect Lakes/Waterbodies: 36.5 ac (14.77 h) direct/ 235.5 ac (95.31 ha) indirect Extend from the Oakland Inner Harbor to the city of San Francisco, crossing San Francisco Bay and impacting the most area of the Bay. Coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission.	Floodplains: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha) indirect Streams: 0.0 linear ft (0.0 m) direct/ 0.0 linear ft (0.0 linear m) indirect Lakes/Waterbodies: 35.4 ac (14.33 h) direct/ 228 ac (92.27 ha) indirect Extend from the Oakland Inner Harbor to the city of San Francisco, crossing San Francisco Bay and impact less area of the Bay. Coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission.

Table 7.3-9
Trans Bay Crossings: Oakland to San Francisco

	Tran Bay Crossing – Transbay Transit Center	Trans Bay Crossing – 4th and King
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 22.8 ac (9.24 ha) direct/ 1,366.3 (552.94 ha) indirect Bay Waters: 22.1 ac (8.94 ha) Species: 1 special-status plant species This alignment alternative would have the potential to affect more wetlands, Bay waters, and the sensitive eel grass habitat. Sensitive plant species include the beach layia. Crossing of the Bay would be subject to USACE, CDFG, and BCDC permit process.	Wetlands[v]: 22.0 ac (8.92 ha) direct/ 1,286.5 ac (520.65 ha) indirect Bay Waters: 20.07 ac (8.12 ha) Species: 1 special-status plant species This alignment alternative would have the potential to affect slightly less wetlands and Bay waters. Potential impacts to sensitive eel grass habitat. Sensitive plant species include the beach layia. Crossing of the Bay would be subject to USACE, CDFG, and BCDC permit process.
Fault Crossings	None	
Section 4(f) and 6(f) Resources:[4] Number of resources rated high potential direct effects	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative include South Park. Few direct impacts are anticipated given that the alignment would be in tunnel as it passes South Park.	No public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of alignment alternative.

J. TRANS BAY CROSSING: DUMBARTON BRIDGE OR TUBE

All information presented is for a potential Dumbarton bridge or transbay tube. This alternative is shown in Figure 7.3-10 and described in Table 7.3-10.

Table 7.3-10
Trans Bay Crossing: Dumbarton

	Dumbarton (High Bridge)	Dumbarton (Low Bridge)	Dumbarton (Tube)	Fremont Central Park (High Bridge)	Fremont Central Park (Low Bridge)	Fremont Central Park (Tube)
Physical/Operational Characteristics						
Alignment Alternative Description[27]	This alignment alternative would cross the San Francisco Bay in the Dumbarton Corridor with a high bridge over the existing navigational channel. It would travel generally east to the Shinn/Niles area.	This alignment alternative would cross the San Francisco Bay in the Dumbarton Corridor with draw bridges for the existing navigational channel. It would travel generally east to the Shinn/Niles area.	This alignment alternative would cross the San Francisco Bay in a tube in the Dumbarton Corridor. It would travel generally east to the Shinn/Niles area.	This alignment alternative would cross the San Francisco Bay in the Dumbarton Corridor with a high bridge over the existing navigational channel. It would travel south and east through a power easement and then northeast with a tunnel under Stevenson Boulevard to the Niles area.	This alignment alternative would cross the San Francisco Bay in the Dumbarton Corridor with draw bridges for the existing navigational channel. It would travel south and east through a power easement and then northeast with a tunnel under Stevenson Boulevard to the Niles/Shinn area.	This alignment alternative would cross the San Francisco Bay in a tube in the Dumbarton Corridor. It would travel south and east through a power easement and then northeast with a tunnel under Stevenson Boulevard to the Niles area.
Length	19.06 mi (30.67 km)	20.01 mi (32.21 km)	19.06 mi (30.67 km)	20.11 mi (32.36 km)	21.71 mi (34.94 km)	21.71 mi (34.94 km)
Cost[28] (dollars)	$1.93 billion	$1.53 billion	$2.32 billion	$2.73 billion	$2.24 billion	$3.09 billion
Travel Time	11 min (Niles Jct.-Redwood City)	11 min (Niles Jct.-Redwood City)	11 min (Niles Jct.-Redwood City)	11 min (Niles Jct.-Redwood City)	11 min (Niles Jct.-Redwood City)	11min (Niles Jct.-Redwood City)
Ridership	About the same.	About the same.	About the same.	About the same.	About the same.	About the same.

[27] Golden State option ends about 2.5 mi (4.0 km) southeast of Golden State station (at Beale Avenue). Truxton option ends at Truxton station (at Union Avenue).

[28] Segment cost and length begins about 2.5 mi (4.0 km) southeast of Fresno downtown Station (East Jensen Avenue).

Table 7.3-10
Trans Bay Crossing: Dumbarton

	Dumbarton (High Bridge)	Dumbarton (Low Bridge)	Dumbarton (Tube)	Fremont Central Park (High Bridge)	Fremont Central Park (Low Bridge)	Fremont Central Park (Tube)
Constructability	Considerable construction issues associated with urban construction, including aerial structures through Fremont and a new "high" bridge trans bay crossing at Dumbarton. Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required.	Considerable construction issues associated with urban construction, including aerial structures through Fremont and fewer construction issues with a new "low" bridge Trans Bay crossing at Dumbarton. Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required.	Considerable construction issues associated with urban construction, including aerial structures through Fremont and greater construction issues with a new "tube" Trans Bay crossing at Dumbarton. Constructing a new tube crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required.	Considerable construction issues associated with urban construction, including aerial structures through Fremont, tunneling under Fremont Central Park, and a new "high" bridge Trans Bay crossing at Dumbarton. Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required.	Considerable construction issues associated with urban construction, including aerial structures through Fremont, tunneling under Fremont Central Park, and a new "low" bridge Trans Bay crossing at Dumbarton. Constructing a new bridge crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required.	Considerable construction issues associated with urban construction, including aerial structures through Fremont, tunneling under Fremont Central Park, and a new "tube" Trans Bay crossing at Dumbarton. Constructing a new tube crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat. Special construction methods and mitigations would be required.
Operational Issues	Average speed: 98.9 mph (164.9 kph) Maximum speed: 165 mph (275 kph)	Average speed: 98.9 mph (164.9 kph) Maximum speed: 165 mph (275 kph) With the "low-bridge" bay crossing option, HST service would potentially be interrupted, which would adversely	Average speed: 98.9 mph (164.9 kph) Maximum speed: 165 mph (275 kph)	Average speed: 113.2 mph (188.7 kph) Maximum speed: 165 mph (275 kph)	Average speed: 113.2 mph (188.7 kph) Maximum speed: 165 mph (275 kph) With the "low-bridge" bay crossing option, HST service would potentially be interrupted, which	Average speed: 113.2 mph (188.7 kph) Maximum speed: 165 mph (275 kph)

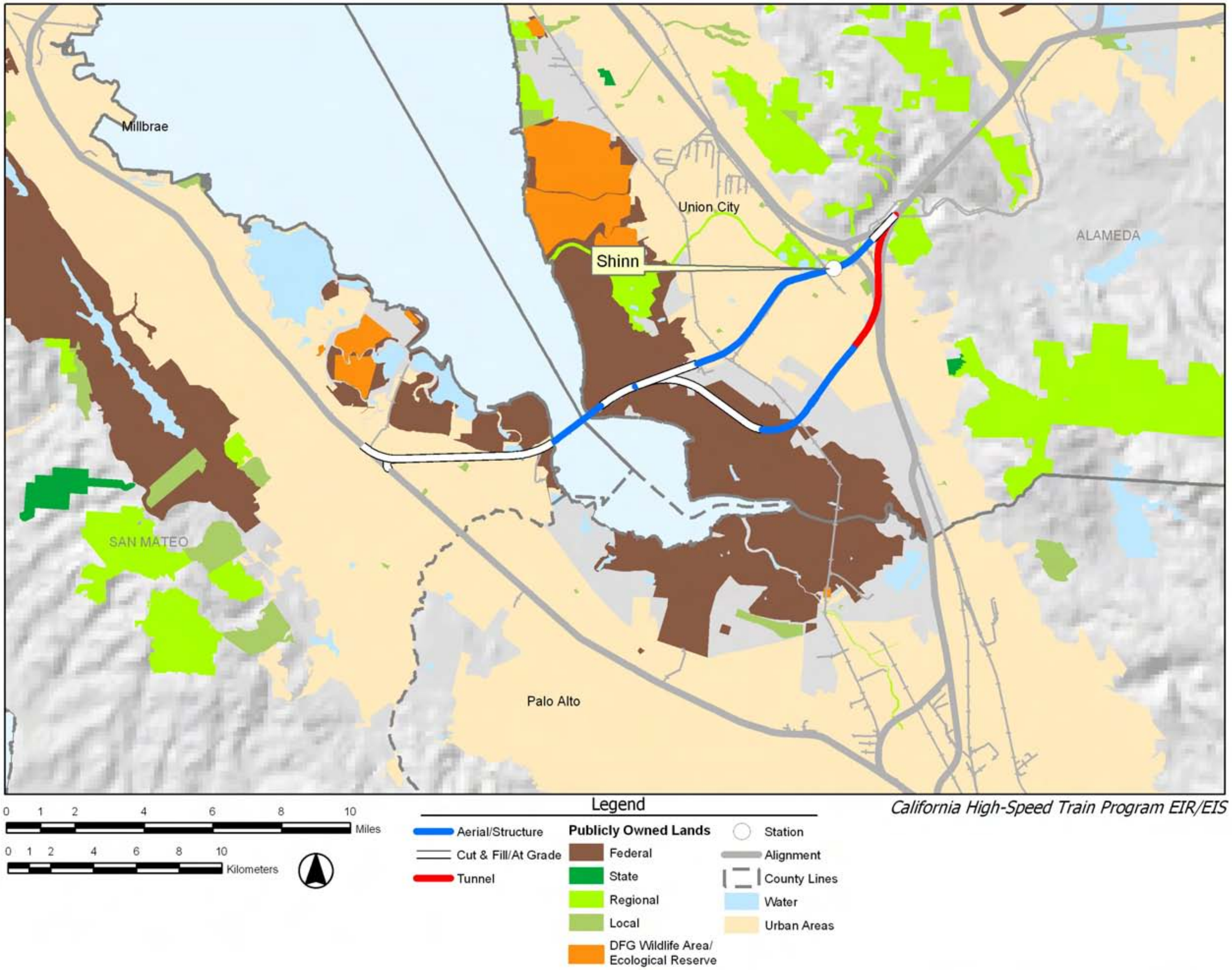

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Figure 7.3-10
HST Alignment Alternatives
Trans Bay Crossing
(Dumbarton)

Table 7.3-10
Trans Bay Crossing: Dumbarton

	Dumbarton (High Bridge)	Dumbarton (Low Bridge)	Dumbarton (Tube)	Fremont Central Park (High Bridge)	Fremont Central Park (Low Bridge)	Fremont Central Park (Tube)
		impact the reliability of the entire system.			would adversely impact the reliability of the entire system.	
Potential Environmental Impacts						
Travel Conditions	About the same as the Fremont Central Park Alternatives.			About the same as the Dumbarton Bridge or tube alternatives.		
Noise and Vibration:[i] High, medium, and low potential impacts	High potential of noise impacts. High potential of vibration impacts. High potential of noise impacts in urban areas where the alignment is predominately on aerial structure (Fremont).	High potential of noise impacts. High potential of vibration impacts. High potential of noise impacts in urban areas where the alignment is predominately on aerial structure (Fremont).	High potential of noise impacts. High potential of vibration impacts. High potential of noise impacts in urban areas where the alignment is predominately on aerial structure (Fremont).	High potential of noise impacts. High potential of vibration impacts. High potential of noise impacts in urban areas where the alignment is predominately on aerial structure (Fremont).	High potential of noise impacts. High potential of vibration impacts. High potential of noise impacts in urban areas where the alignment is predominately on aerial structure (Fremont).	Medium potential of noise impacts. High potential of vibration impacts. High potential of noise impacts in urban areas where the alignment is predominately on aerial structure (Fremont).
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is compatible (medium rating) with multi-family, residential, industrial and existing major rail right-of-way. It exhibits a low to medium compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. Environmental Justice: This alignment alternative has medium	Compatibility: The majority of this alignment alternative is compatible (medium rating) with multi-family, residential, industrial and existing major rail right-of-way. It exhibits a low to medium compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. Environmental	Compatibility: The majority of this alignment alternative is compatible (medium rating) with multi-family, residential, industrial and existing major rail right-of-way. It exhibits a low to medium compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. Environmental	Compatibility: The majority of this alignment alternative is compatible (medium rating) with multi-family, residential, industrial and existing major rail right-of-way. It exhibits a low to medium compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. Environmental Justice:	Compatibility: The majority of this alignment alternative is compatible (medium rating) with multi-family, residential, industrial and existing major rail right-of-way. It exhibits a low to medium compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area.	Compatibility: The majority of this alignment alternative is compatible (medium rating) with multi-family, residential, industrial and existing major rail right-of-way. It exhibits a low to medium compatibility where it crosses the San Francisco Bay, in Fremont along the more narrow Centerville line, in the Shinn area. Environmental

Table 7.3-10
Trans Bay Crossing: Dumbarton

	Dumbarton (High Bridge)	Dumbarton (Low Bridge)	Dumbarton (Tube)	Fremont Central Park (High Bridge)	Fremont Central Park (Low Bridge)	Fremont Central Park (Tube)
	environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for medium property impacts.	Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for medium property impacts.	Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for medium property impacts.	This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for high property impacts, given that additional right-of-way would be required.	Environmental Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for high property impacts, given that additional right-of-way would be required..	Justice: This alignment alternative has medium environmental justice impact rating. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative has the potential for high property impacts, given that additional right-of-way would be required.
Aesthetics and Visual Resources: General impacts and rating.	Medium visual impact from the bridge, on the Don Edwards San Francisco Bay National Wildlife Refuge and on the Centerville alignment across Fremont.	Low visual impact from bridge and medium impacts on Don Edwards San Francisco Bay National Wildlife Refuge and the Centerville alignment	No visual impact from tube and a medium impact on the Don Edwards San Francisco Bay National Wildlife Refuge and the Centerville alignment	Medium visual impact from bridge and on Don Edwards San Francisco Bay National Wildlife Refuge and through Newark.	Low visual impact from bridge and medium visual impacts on Don Edwards San Francisco Bay National Wildlife Refuge and through	No visual impact from tube and medium visual impacts on Don Edwards San Francisco Bay National Wildlife Refuge and through Newark.

Table 7.3-10
Trans Bay Crossing: Dumbarton

	Dumbarton (High Bridge)	Dumbarton (Low Bridge)	Dumbarton (Tube)	Fremont Central Park (High Bridge)	Fremont Central Park (Low Bridge)	Fremont Central Park (Tube)
		across Fremont.	across Fremont.		Newark.	
Cultural Resources and Paleontological Resources:[iii] Potential presence of historical resources in area of potential effect	There are 4 known cultural resources. Archaeological resources include prehistoric sites associated with burials, and historic sites from early 1900s industrial activities.	There are 4 known cultural resources. Archaeological resources include prehistoric sites associated with burials, and historic sites from early 1900s industrial activities.	There are 4 known cultural resources. Archaeological resources include prehistoric sites associated with burials, and historic sites from early 1900s industrial activities.	There are no known cultural resources. No recorded resources were identified in the records search.	There are no known cultural resources. No recorded resources were identified in the records search.	Known cultural resources: 0 No recorded resources were identified in the records search.
Hydrology and Water Resources:[iv] Potential impacts and associated linear ft (linear m) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 47.4 ac (19.18 ha) direct/ 162.1 ac (65.60 ha) indirect Streams: 1,028 linear ft (313.3 linear m) direct/ 3,627 linear ft (1,105.5 linear m) indirect Lakes/Waterbodies: 37.3 ac (15.10 ha) direct/ 143.9 ac (58.24 ha) indirect Less water resource impacts compared to Fremont Central Park due primarily to the shorter length. Coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and	Floodplains: 47.4 ac (19.18 ha) direct162.1 ac (65.60 ha) indirect Streams: 1,028 linear ft (313.3 linear m) direct/ 3,627 linear ft (1,105.5 linear m) indirect Lakes/Waterbodies: 37.3 ac (15.10 ha) direct/143.9 ac (58.24 ha) indirect Less water resource impacts compared to Fremont Central Park due primarily to the shorter length. Coordination would be required with the USACE under Section 10 of the	Floodplains: 47.ac (19.18ha)direct/ 162.1 ac (65.60 ha) indirect Streams: 1,028 linear ft (313.3 linear m) direct/ 3,627 linear ft (1,105.5 linear m) indirect Lakes/Waterbodies: 37.3 ac (15.10 ha) direct/ 143.9 ac (58.24 ha) indirect Less water resource impacts compared to Fremont Central Park due primarily to the shorter length. Coordination would be required with the USACE under Section 10 of the	Floodplains: 71.7 ac (29.02ha) direct/ 258.7 ac (104.70 ha) indirect Streams: 2,041 linear ft (622.1 linear m) direct/ 8,301 linear ft (2,530.1 linear m) indirect Lakes/Waterbodies: 46.3 ac (18.74 ha) direct/ 179.2 ac (72.52 ha) indirect Longer length results in additional impacts compared to Dumbarton options. Coordination would be required with the USACE under Section 10 of the Rivers and Harbors	Floodplains: 71.7 ac (29.02 ha) direct/ 258.7 ac (104.70 ha) indirect Stream : 2,041 liner ft (622.1 linear m) direct/ 8,301 linear ft (2,530.1 linear m) indirect Lakes/Waterbodies: 46.3 ac (18.74 ha) direct/ 179.2 ac (72.52 ha) indirect Longer length results in additional impacts compared to Dumbarton options. Coordination would be required with the USACE under Section 10 of the	Floodplains: 71.7 ac (29.02 ha) direct/ 258.7 ac (104.70 ha) indirect Streams: 2,041 linear ft (622.1 linear m) direct/ 8,301 linear ft (2,530.1 linear m) indirect Lakes/Waterbodies: 46.3 ac (18.74 ha) direct/ 179.2 ac (72.52 ha) indirect Longer length results in additional impacts compared to Dumbarton options. Coordination would be required with the USACE under Section 10 of the

Table 7.3-10
Trans Bay Crossing: Dumbarton

	Dumbarton (High Bridge)	Dumbarton (Low Bridge)	Dumbarton (Tube)	Fremont Central Park (High Bridge)	Fremont Central Park (Low Bridge)	Fremont Central Park (Tube)
	the California Coastal Commission.	Rivers and Harbors Act and the California Coastal Commission.	Rivers and Harbors Act and the California Coastal Commission.	Act and the California Coastal Commission.	Rivers and Harbors Act and the California Coastal Commission.	Rivers and Harbors Act and the California Coastal Commission.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 33.9 ac (13.7 ha) direct/ 1,641.2 ac (664.2 ha) indirect Bay Waters: 2,361 linear ft (719.6 linear m) Species: 15 special-status plant and 21 special-status wildlife species Compared to the Fremont Central Park alignment alternative, this alignment alternative would have the least potential direct impact on wetlands, but the most indirect impacts. Potential species impacts include the San Mateo thorn-mint, white-rayed pentachaeta, brown pelican, California clapper rail, California least tern, and the salt marsh harvest mouse. Crossing of the Bay would be subject to USACE, CDFG, and BCDC permit process.			Wetlands[v]: 55.35 ac (22.4 ha) direct/ 1,191 ac (482 ha) indirect Bay Waters: 3,117 linear ft (950.1 linear m) Species: 16 special-status plant and 23 special-status wildlife species Compared to the Dumbarton alignment alternative options, this alignment alternative would have the most potential direct impact on wetlands, but the least indirect impacts. Potential species impacts include the San Mateo thorn-mint, white-rayed pentachaeta, robust spineflower, vernal pool tadpole shrimp, California tiger salamander, brown pelican, California clapper rail, California least tern, and the salt marsh harvest mouse. Crossing of the Bay would be subject to USACE, CDFG, and BCDC permit process.		
Fault Crossings	Buried Trace of Unnamed Fault (Potentially Active) - At Grade Silver Creek (Potentially Active) - At Grade Hayward (Active) - Above Grade Mission (Potentially Active) - At Grade					
Section 4(f) and 6(f) Resources:[4] Ac (ha) of parkland near HST right-of-way	Public parks, recreation lands, wildlife and waterfowl refuges 0–150 ft (46 m) from center of alignment alternative include (1) Kelly Park, (2) Don Edwards San Francisco Bay National Wildlife Refuge, (3) Newark Civic Center Park, (4) Vallejo Mill Historical Park, and (5) Alameda Creek Trail. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.			Public parks, recreation lands, wildlife and waterfowl refuges 0–150 ft (46 m) from center of alignment alternative include (1) Kelly Park, (2) Don Edwards San Francisco Bay National Wildlife Refuge, (3) Blacow Park, (4) Fremont Central Park, (5) Gomes Park and (6) Vallejo Mill Park. As compared to the "Dumbarton" alternatives, more direct impacts are anticipated given that a considerable amount of this alignment alternative requires a new alignment within the Don Edwards San Francisco Bay National Wildlife Refuge.		

K. CENTRAL VALLEY ALIGNMENT ALTERNATIVES

All information presented is for potential Central Valley alignment alternatives. This alternative is shown in Figure 7.3-11 and described in Table 7.3-11.

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
Physical/Operational Characteristics						
Alignment Alternative Description[29]	This alignment alternative would travel from North Stockton South to the UPRR Connection, along the BNSF line South to Amtrak Briggsmore, then south to the UPRR/BNSF Connection, along the UPRR through Atwater to Downtown Merced, South to BNSF Connection, along the BNSF South to the Henry Miller Wye. Potential stations are at Modesto (Briggsmore) and Merced (Downtown).	This alignment alternative would connect with either the Altamont or Pacheco Pass alignments. This north-south alignment would link the Bay Area to Central Valley population centers, Sacramento, and southern California. Potential stations are at Modesto (Briggsmore) and Merced (Downtown).	This alignment alternative would connect with either the Altamont or Pacheco Pass alignments. This north-south alignment would link the Bay Area to Central Valley population centers, Sacramento, and southern California. Potential stations are at Modesto (Downtown) and Merced (Downtown).	This alignment alternative would be on BNSF line from Stockton South to Amtrak Briggsmore, would transition to the UPRR/BNSF Connection, then to Castle AFB, travel South to the BNSF connect, follow BNSF South of Castle to the UPRR Connection, and then to the Henry Miller Wye. Potential stations are at Modesto (Briggsmore) and Castle AFB.	This alignment alternative would travel south on the UPRR through Modesto to the BNSF Connection, on the BNSF N/S line to Castle AFB, then south to the connection to the UPRR, then on the Castle Connection to the Henry Miller Wye. Potential station locations are at Modesto (Briggsmore) and Castle AFB.	This alignment alternative would travel south on the UPRR to the through Modesto and Turlock to the UPRR/BNSF Connection to Atwater, from Atwater to Downtown Merced, and then Merced South to BNSF Connection to the Henry Miller Wye. Potential station locations are at Modesto (Downtown and Merced (Downtown).

[29] Golden State option ends about 2.5 mi (4.0 km) southeast of Golden State station (at Beale Avenue). Truxton option ends at Truxton station (at Union Avenue).

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
Length	92.99 mi (149.65 km)	100.38 mi (161.55 km)	83.85 mi (134.95 km)	92.42 mi (148.74 km)	86.52 mi (139.24 km)	87.09 mi (140.15 km)
Cost[30] (dollars)	$2.52 billion	$2.6 billion	$2.69 billion	$2.27 billion	$2.57 billion	$2.82 billion
Travel Time (minutes)	39 min (Bypass-Fresno)	40 min (Bypass-Fresno)	42 min (Stockton-Fresno)	41 min (Bypass-Fresno)	44 min (Stockton-Fresno)	42 min (Stockton-Fresno)
Constructability	Considerable construction issues associated with urban construction, including extensive aerial structures through Manteca, Modesto, and Merced.	Considerably less urban alignment and associated aerial construction; however, substantially more grade separations are required for at-grade alignments.	Considerable construction issues associated with urban construction, including extensive aerial structures through Manteca, Modesto, and Merced.	Considerably less urban alignment and associated aerial construction; however, substantially more grade separations are required for at-grade alignments and additional length to serve Castle station.	Considerably less urban alignment and associated aerial construction; however, substantially more grade separations are required for at-grade alignments and additional length to serve Castle station.	Considerable construction issues associated with urban construction, including extensive aerial structures through Manteca, Modesto, and Merced.
Ridership	The BNSF-UPRR (used in the Pacheco "Base" Alternative) would have about the same ridership potential (about 0.3% less) as the UPRR for the Pacheco Pass, but is for forecast to have slightly less ridership potential (1.5%) for the Altamont Pass.	The BNSF alignment alternative would have slightly less ridership potential than the BNSF-UPRR.	The UPRR alignment alternative would have high ridership and revenue potential for both the Altamont Pass and Pacheco Pass alternatives.	The BNSF Castle alignment alternative would have about the same ridership potential as the BNSF alternative.	The UPRR-Castle alignment alternative would have about the same ridership potential as the UPRR alternatives for the Altamont Pass alternatives and slightly less potential for Pacheco Pass alternatives.	The UPRR-BNSF alignment alternative would have about the same ridership potential as the UPRR for the Altamont Pass alternatives and slightly less potential than the BNSF-UPRR for Pacheco Pass alternatives.

[30] Segment cost and length begins about 2.5 mi (4.0 km) southeast of Fresno downtown Station (East Jensen Avenue).

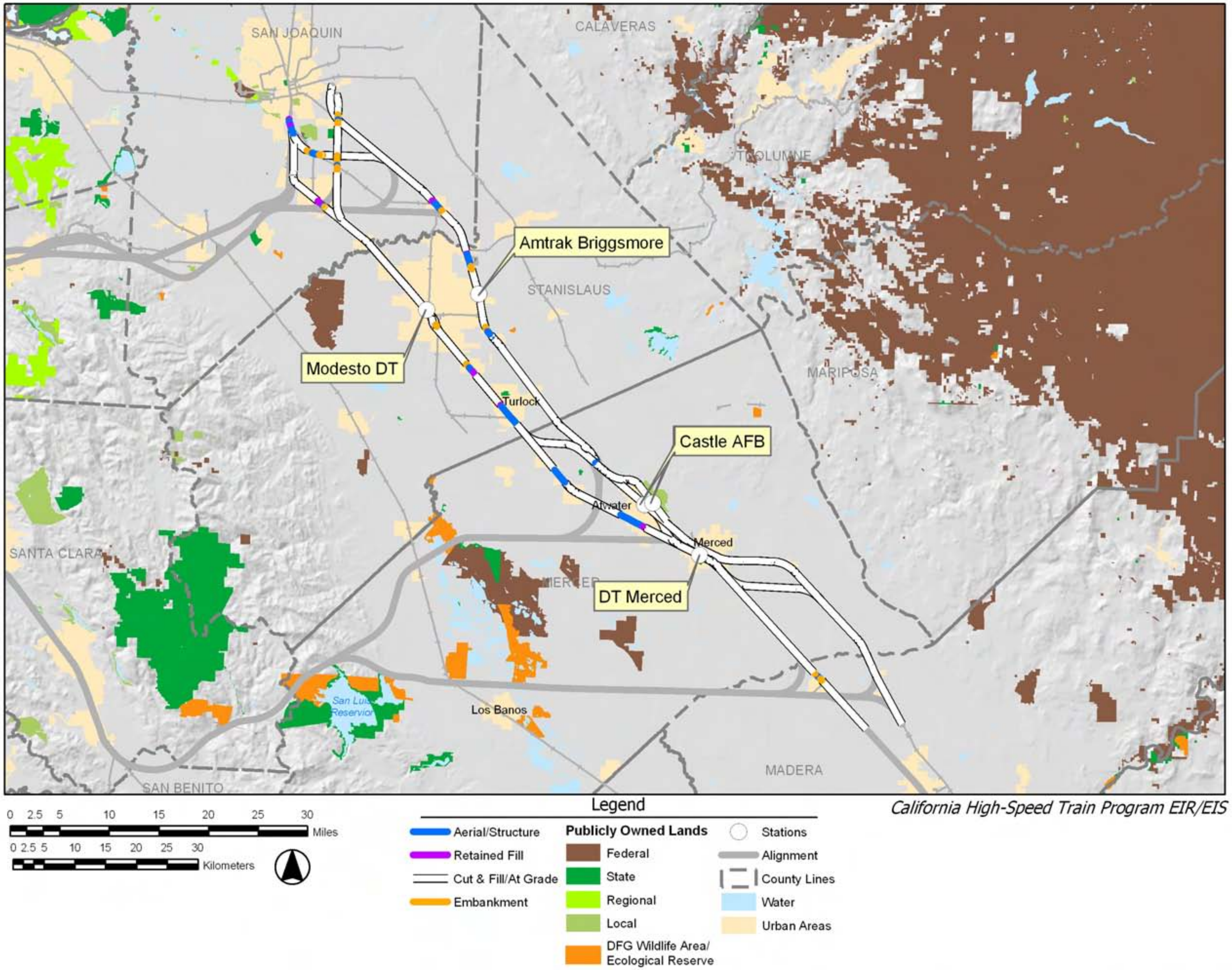

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Figure 7.3-11
HST Alignment Alternatives
Central Valley Alignment Alternatives

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
Operational Issues	Average speed: 176.7 mph (294.5 kph) Maximum speed: 198 mph (330 kph)	Average speed: 176.1 mph (293.5 kph) Maximum speed: 198 mph (330 kph)	Average speed: 169.7 mph (282.8 kph) Maximum speed: 198 mph (330 kph)	Average speed: 171.8 mph (286.4 kph) Maximum speed: 198 mph (330 kph)	Average speed: 166.2 mph (277.1 kph) Maximum speed: 198 mph (330 kph)	Average speed: 170.5 mph (284.1 kph) Maximum speed: 198 mph (330 kph)
Potential Environmental Impacts						
Travel Conditions	This alignment alternative would provide direct HST service to Briggsmore and downtown Merced. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode in the Central Valley while potentially improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic flow and reduce air pollution at some existing rail crossings.	This alignment alternative would provide direct HST service to Briggsmore and downtown Merced. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode in the Central Valley while potentially improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic flow and reduce air pollution at some existing rail crossings.	This alignment alternative would provide direct HST service to downtown Modesto and downtown Merced. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode in the Central Valley while potentially improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic flow and reduce air pollution at some existing rail crossings.	This alignment alternative would provide direct HST service to Briggsmore and Castle AFB. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode in the Central Valley while potentially improving the safety, reliability, and performance of the regional commuter service. The HST alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic flow and reduce air pollution at some existing rail crossings.	This alignment alternative would provide direct HST service to Briggsmore & Castle AFB. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode in the Central Valley while potentially improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic flow and reduce air pollution at some existing rail crossings.	This alignment alternative would provide direct HST service to Downtown Modesto and downtown Merced. The alignment alternative would provide a safer, more reliable, energy-efficient intercity mode in the Central Valley while potentially improving the safety, reliability, and performance of the regional commuter service. This alignment alternative would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic flow and reduce air pollution at some existing rail crossings.

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
Noise and Vibration:[i] High, medium, and low potential impacts	Low potential of noise impacts in overall segment. Low potential of vibration impact. Medium potential of noise impacts in urban areas. Low potential of vibration impact in urban areas. Although a majority of the alignment alternative would have low potential impacts, the BNSF-UPRR would have medium potential noise impacts in urban areas where the alignment is predominately on aerial structure. Express services travel at high speeds through these communities (220 mph [354 km]).	Low potential of noise impacts in overall segment. Low potential of vibration impact. Medium potential of noise impacts in urban areas. Low potential of vibration impact in urban areas.	Medium potential of noise impacts in overall segment. Medium potential of noise impacts in urban areas. Low potential of vibration impact in overall segment. Medium potential of vibration impact in urban areas.	Medium potential of noise impacts in overall segment. Medium potential of noise impacts in urban areas. Low potential of vibration impact in overall segment. Medium potential of vibration impact in urban areas.	Medium potential of noise impacts in overall segment. Medium potential of noise impacts in urban areas. Low potential of vibration impact in overall segment. Medium potential of vibration impact in urban areas.	Medium potential impacts in overall segment. Medium potential of noise impacts in urban areas. Low potential of vibration impact in overall segment. Medium potential of vibration impact in urban areas. .
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatibility: The majority of this alignment alternative is compatible (medium rating), given that it is within or immediately	Compatibility: The majority of this alignment alternative is compatible (medium rating), given that it is within or immediately	Compatibility: The majority of this alignment alternative is compatible (medium rating), given that it is within or immediately	Compatibility: The majority of this alignment alternative is compatible (medium rating), given that it is within or immediately adjacent to an existing	Compatibility: The majority of this alignment alternative is compatible (medium rating), given that it is within or immediately	Compatibility: The majority of this alignment alternative is compatible (medium rating), given that it is within or immediately

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
	adjacent to an existing major rail right-of-way. Environmental Justice: This alignment alternative has a medium environmental justice impact rating except for Briggsmore and Chowchilla areas, where the rating is low. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative would have the potential for low to medium property impacts.	adjacent to an existing major rail right-of-way. Environmental Justice: This alignment alternative has a medium environmental justice impact rating except for the Briggsmore and Chowchilla areas, where the rating is low. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative would have the potential for low to medium property impacts.	adjacent to an existing major rail right-of-way. Environmental Justice: This alignment alternative has a medium environmental justice impact rating except for the Manteca and Modesto areas, where the rating is low. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative would have the potential for low to medium property impacts.	major rail right-of-way. Environmental Justice: This alignment alternative has a medium environmental justice impact rating except for Briggsmore and Chowchilla areas, where the rating is low. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative would have the potential for low to medium property impacts.	adjacent to an existing major rail right-of-way. Environmental Justice: This alignment alternative has a medium environmental justice impact rating except for the Manteca and Modesto areas, where the rating is low. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative would have the potential for low to medium property impacts.	adjacent to an existing major rail right-of-way. Environmental Justice: This alignment alternative has a medium environmental justice impact rating except for the Manteca, Modesto, Turlock and Chowchilla areas, where the rating is low. Community: This alignment alternative would not affect community cohesion, given that it is within or immediately adjacent to an existing major rail or highway rights-of-way. Property: This alignment alternative would have the potential for low to medium property impacts.

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
Aesthetics and Visual Resources: General impacts and rating.	Includes elevated crossing of SR 4 viaduct in Stockton and SR 99 near French Camp, elevated structure through Escalon and Riverbank, and curve realignments at the Tuolumne and Chowchilla rivers. Overall low visual impact.	Includes new alignment south of Lodi, elevated structure through Escalon and Riverbank, and curve realignments at the Tuolumne and Chowchilla rivers and south of Merced. Overall low visual impact.	Includes elevated crossing of SR 4 viaduct in downtown Stockton, elevated crossing of SR 99 near French Camp, elevated structure through downtown Manteca, curve realignment in Modesto, elevated structures through downtown Turlock and Chowchilla. Overall low visual impact.	Includes new alignment south of Lodi, elevated structures through Escalon and Riverbank, curve realignments at Tuolumne River, south of Merced, and the Chowchilla River, and new alignment into Castle AFB. Overall low visual impact.	Includes elevated crossing of SR 4 viaduct in downtown Stockton, elevated crossing of SR 99 near French Camp, elevated structures through Escalon and Riverbank, curve realignments at Tuolumne and Chowchilla rivers, and a new alignment into Castle AFB. Overall low visual impact.	Includes elevated crossing of SR 4 viaduct in downtown Stockton, elevated Crossing of SR 99 near French Camp, elevated structures through downtown Manteca and Turlock, and curve realignments in Modesto and at the Chowchilla River. Overall low visual impact.
Farmlands:[ii] Ac (ha) potentially affected	Farmland: 776 ac (314.0 ha) BNSF-UPRR alignment alternative would have less potential impacts on farmlands than the BNSF alignment alternative. Impact up to 326 ac (132 ha) of prime farmland.	Farmland: 838 ac (339.1 ha) BNSF alignment alternative would potentially impact the most farmland, including the most prime farmland. Impact up to 407 ac (164.8 ha) of prime farmland.	Farmland: 535 ac (216.4 ha) UPRR alignment alternative would have the least potential impacts on farmlands and prime farmland. Impact up to 269 ac (108.8 ha) of prime farmland.	Farmland: 817 ac (330.8 ha) BNSF (Castle AFB) alignment alternative would potentially impact the second highest amount of farmland and prime farmland. Impact up to 386 ac (156.1 ha) of prime farmland.	Farmland: 622 ac (251.8 ha) UPRR-BNSF (Castle AFB) alignment alternative would potentially impact more farmlands that the UPRR-BNSF. Transition to BNSF may have potential severance impacts. Impact up to 331 ac (134.1 ha) of prime farmland.	Farmland: 610 ac (247.0 ha) UPRR-BNSF alignment alternative would potentially impact more farmland than UPRR. Transition to BNSF may have potential severance impacts. Impact up to 318 ac (128.8 ha) of prime farmland.
Cultural Resources and Paleontological Resources:[iii]	There are 28 known cultural resources. Generally follows existing railroad	There are 17 known cultural resources. Generally follows existing railroad lines.	There are 67 known cultural resources. Generally follows existing railroad	There are 21 known cultural resources. Generally follows existing railroad lines.	There are 24 known cultural resources. Generally follows existing railroad lines.	There are 31 known cultural resources. Generally follows existing railroad lines.

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
Potential presence of historical resources in area of potential effect	lines. The majority of architectural resources identified were related to the railroad and residential properties dating from the 1920s.	The majority of resources identified are located around Escalon and include portions of the ATSF railroad and residential properties dating from 1910.	lines. The majority of resources identified are located around the communities of Delhi, Livingston, Atwater, and Chowchilla. Archaeological resources include both prehistoric and historic sites.	Architectural resources identified were related to the railroad and residential properties dating from the 1900s. Most of the resources are within the cities of Escalon and Chowchilla.	Architectural resources identified were related to the railroad, commerce and industry, and residential properties dating from the 1900s. Most of the resources are within the cities of Modesto and Merced and include portions of the ATSF railroad.	Architectural resources identified were related to highway bridges and residential properties dating from the 1900s. Most of the architectural resources are around Chowchilla.
Hydrology and Water Resources:[iv] Potential impacts and associated linear ft (linear m) of floodplains and linear ft (m) of streams within potential impact study areas, ac (ha) lakes/other water bodies within study areas.	Floodplains: 183.5 ac (74.26 ha) direct/ 669.5 ac (270.95 ha) indirect Streams: 8,291 linear ft (2,527.1 linear m) direct/ 31,632 linear ft (9,641.4 linear m) indirect Lakes/Waterbodies: 1.5 ac (0.61 ha) direct/ 6.3 ac (2.55 ha) indirect Potentially affect at least 33 unnamed and named water resources, including Stanislaus River; Hetch Hetchy Aqueduct; Tuolumne River; Merced River; Ash Slough and	Floodplains: 191.1 ac (77.34 ha) direct/ 759.2 ac (307.25 ha) indirect Streams: 8,398 linear ft (2,559.7 linear m) direct/ 32,594 linear ft (9,934.7 linear m) indirect Lakes/Waterbodies: 1.6 ac (0.65 ha) direct/ 6.7 ac (2.71 ha) indirect Potentially affect at least 45 number of unnamed and named water resources, including Stanislaus River; Hetch Hetchy Aqueduct; Tuolumne River; Merced River; and Chowchilla River.	Floodplains: 123.4 ac (49.94 ha) direct/ 422.7 ac (171.07 ha) indirect Streams: 7,547 linear ft (2300.3 linear m) direct 41,122 linear ft (12,534.0 linear m) indirect Lakes/Waterbodies: 0 ac (0.0 ha) direct/ 0.0 ac (0.0 ha) indirect Potentially affect at least 35 unnamed water resources, including Stanislaus River; Hetch Hetchy Aqueduct; Tuolumne River; Merced River; Chowchilla River; Ash Slough and Bypass; and Berenda	Floodplains: 158.2 ac (64.02 ha) direct/ 628.8 ac (254.48 ha) indirect Streams: 6,965 linear ft (2,122.9 linear m) direct/ 30,37 linear ft (1 9,257.1 linear m) indirect Lakes/Waterbodies: 1.6 ac (0.65 ha) direct/ 6.7 ac (2.71 ha) indirect Potentially affect at least 43 unnamed and named water resources, including Stanislaus River; Hetch Hetchy Aqueduct; Tuolumne River; Merced River; Chowchilla River; Ash Slough and Bypass	Floodplains: 97.7lac (39.54 ha) direct/ 388 ac (157.02 ha) indirect Stream : 7,734 linear ft (2,357.3 linear m) direct/ 43,276 linear ft (13,190.5 linear m) indirect Lakes/Waterbodies: 0.1 ac (0.04ha) direct/ 0.4 ac (0.16 ha) indirect Potentially affect at least 34 unnamed and named water resources, including Stanislaus River; Hetch Hetchy Aqueduct; Tuolumne River; Chowchilla River; Ash Slough	Floodplains: 123.1 ac (49.82 ha) direct/ 428.7 ac (173.49 ha) indirect Streams: 9,060 linear ft (2,761.5 linear m) direct/ 44,538 linear ft (13,575.2 linear m) indirect Lakes/Waterbodies: 0.0 ac (0.0 ha) direct/ 0.0 ac (0.0ha) indirect Potentially affect at least 42 unnamed and named water resources, including Stanislaus River; Hetch Hetchy Aqueduct; Tuolumne River; Merced River; Ash Slough and Bypass; and Berenda

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
	Bypass; and the Berenda Slough. Where constructed either at-grade or on cut and fill, culverts would be sized appropriately to convey anticipated storm flows and to minimize ponding.	Where constructed either at-grade or on cut and fill, culverts would be sized appropriately to convey anticipated storm flows and to minimize ponding.	Slough. Where constructed either at-grade or on cut and fill, culverts would be sized appropriately to convey anticipated storm flows and to minimize ponding.	Berenda Slough; and Berenda Creek. Where constructed either at-grade or on cut and fill, culverts would be sized appropriately to convey anticipated storm flows and to minimize ponding.	and Bypass; Berenda Slough; and Berenda Creek. Where constructed either at-grade or on cut and fill, culverts would be sized appropriately to convey anticipated storm flows and to minimize ponding.	Slough. Where constructed either at-grade or on cut and fill, culverts would be sized appropriately to convey anticipated storm flows and to minimize ponding.
Biological Resources Including Wetlands Ac (ha) of wetland, linear ft (m) of non-wetland waters, and number of special-status species within potential impact study areas	Wetlands[v]: 3.76 ac (1.52 ha) direct/ 219.7 ac (88.9 ha) indirect Non-Wetland Waters: 10,137 linear ft (3,089.8 linear m) Species: 22 special-status plant and 22 special-status wildlife species This alignment alternative would have potential to directly impact the most wetlands. Potential species impacts include valley elderberry longhorn beetle, vernal pool fairy and tadpole shrimp, and San Joaquin kit fox. Potentially result in a barrier to wildlife	Wetlands[v]: 3.41 ac (1.38 ha) direct/ 261.1 ac (105.7ha) indirect Non-Wetland Waters: 10,528 linear ft (3,208.9 linear m) Species: 22 special-status plant and 22 special-status wildlife species This alignment alternative would have potential to indirectly impact the most wetlands and directly impact the most waters. Potential species impacts include valley elderberry longhorn beetle, vernal pool fairy and tadpole shrimp, and San Joaquin kit fox. Potentially result in a	Wetlands[v]: 3.04 ac (1.23 ha) direct/ 136.5 ac (55.2 ha) indirect Non-Wetland Waters: 7,161 linear ft (2,182.7 linear m) Species: 22 special-status plant and 21 special-status wildlife species This alignment alternative would have potential to directly impact the least waters. Potential species impacts include valley elderberry longhorn beetle and vernal pool fairy and tadpole shrimp. Placement along transportation corridors and the use of aerial structures	Wetlands[v]: 3.11 ac (1.26 ha) direct/ 234.8 ac (95 ha) indirect Non-Wetland Waters: 9,094 linear ft (2,771.1 linear m) Species: 19 special-status plant and 22 special-status wildlife species This alignment alternative would have potential to impact fewer plant species. Potential species impacts include valley elderberry longhorn beetle, vernal pool fairy and tadpole shrimp, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement. Placement along transportation	Wetlands[v]: 2.39 ac (0.97 ha) direct/ 172.7 ac (69.9 ha) indirect Non-Wetland Waters: 7,790 linear ft (2,374.4 linear m) Species: 22 special-status plant and 22 special-status wildlife species This alignment alternative would have potential to directly impact the least wetlands. Potential species impacts include valley elderberry longhorn beetle, vernal pool fairy and tadpole shrimp, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement.	Wetlands[v]: 3.04 ac (1.23 ha) direct/ 157.6 ac (63.8 ha) indirect Non-Wetland Waters: 8,833 linear ft (2,692.3 linear m) Species: 25 special-status plant and 22 special-status wildlife species This alignment alternative would have potential to indirectly impact the least wetlands. Potential species impacts include valley elderberry longhorn beetle, vernal pool fairy and tadpole shrimp, and San Joaquin kit fox. Potentially result in a barrier to wildlife movement.

Table 7.3-11
Central Valley Alignment Alternatives

	BNSF – UPRR	BNSF N/S	UPRR N/S	BNSF (Castle AFB)	UPRR- BNSF (Castle AFB)	UPRR – BNSF
	movement. Placement along transportation corridors and the use of aerial structures would minimize impacts.	barrier to wildlife movement. Placement along transportation corridors and the use of aerial structures would minimize impacts.	would minimize impacts.	corridors and the use of aerial structures would minimize impacts.	Placement along transportation corridors and the use of aerial structures would minimize impacts.	Placement along transportation corridors and the use of aerial structures would minimize impacts.
Fault Crossings	None					
Section 4(f) and 6(f) Resources:[4] Ac (ha) of parkland near HST right-of-way	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of the alignment alternative include (1) County Park, (2) Tuolumne River Regional Park, (3) Stanislaus County Fairgrounds, (4) Broadway Park, and (5) Central Park. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of the alignment alternative include (1) Main Street Park, (2) Jacob Meyer Regional Park, and (3) Zerillo Park. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of the alignment alternative include (1) County Park, (2) Tuolumne River Regional Park, (3) Stanislaus County Fairgrounds, (4) Broadway Park, and (5) Central Park. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of the alignment alternative include (1) Main Street Park, (2) Jacob Meyer Regional Park, and (3) Zerillo Park. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of the alignment alternative include (1) County Park, (2) Tuolumne River Regional Park, (3) Stanislaus County Fairgrounds, (4) Broadway Park, and (5) Central Park. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.	Public parks, recreation lands, wildlife and waterfowl refuges within 0–150 ft (46 m) from center of the alignment alternative include (1) County Park, (2) Tuolumne River Regional Park, (3) Stanislaus County Fairgrounds, (4) Broadway Park, and (5) Central Park. Few potential direct impacts are anticipated given that much of the alignment alternative is within or directly adjacent to existing transportation rights-of-way.

7.3.1 Bay Area to Central Valley Station Options

Station Name (Alignment)	Discussion
Downtown San Francisco	
Transbay Transit Center – Caltrain Alignment	The Transbay Transit Center would offer greater connectivity to San Francisco and the greater Bay Area than the existing 4th and King site because of its location in the heart of the downtown San Francisco financial district, where many potential HST passengers could walk to the station. In addition, the Transbay Transit Center would emerge as the transit hub for all major services to downtown San Francisco, with the advantage of direct connections to BART, Muni (the terminal is one block from BART/Muni), and regional bus transit (Muni, Samtrans, AC Transit, and Golden Gate Bridge District). Since the Transbay Transit Center would offer greater connectivity to San Francisco and the greater Bay Area than the existing 4th and King site, total travel times to the Transbay Transit Center are expected to be superior. The Transbay Transit Center is very compatible with existing and planned development and is the focal point of the Transbay Redevelopment Plan that includes extensive high density residential, office, and commercial/retail development. The Transbay Transit Center would have high ridership potential. Intercity ridership forecasts estimate between 9.0 and 12.7 million total boardings and alightings annually by 2030 for the Pacheco "Base" network alternative and 6.7 to 9.4 million for the Altamont "Base" network alternative. However, the rail portion of the connection between 4th and King and the Transbay Transit Center (that would be used by Caltrain and HST) requires difficult tunneling throughout the alignment and is estimated to cost nearly $786 million for the 1.3-mi (2.1-km) extension (including underground HST/Caltrain station, tail tracks, and reconfiguring of the 4th and King yard). Both station options would have low potential environmental impacts. Assuming dedicated use of four tracks and two island platforms by HST, the planned configuration of the Transbay Transit Center could serve all of the trains proposed in the operational plan, the Transbay Transit Center JPB is currently exploring a "loop" concept which could significantly increase capacity at this potential terminus site. However, given the rail facilities planned for the Transbay Transit Center (6 tracks and 3 platforms), the overall capacity available to accommodate HST and Caltrain commuter service would need subsequent cooperative operations planning analysis to determine the most efficient mix and scheduling of services to be accommodated. Any HST services that are determined not to be accommodated at the Transbay Transit Center facility could terminate at other stations along the peninsula or East Bay. Environmental Issues Traffic: 2030 No HST: V/C =0.90; LOS =D 2030 HST (Pacheco): V/C =1.08; LOS =F 2030 HST (Altamont): V/C =1.03; LOS =F Parking Space Demand: (Pacheco): 2,000 - 3,000; (Altamont): 1,500 - 2,100 Land Use/Environmental Justice: Highly compatible with existing transportation and high-density office uses. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: The Transbay Terminal and Transbay Terminal Loop Ramp were identified within the area of potential effects for this station site, and this location is in an area of high sensitivity

Station Name (Alignment)	Discussion
	for historic resources. The Transbay Terminal was built in 1939 and will be replaced with a new structure as part of the new Transbay Transit Center sometime between 2008 and 2014. Hydrology and Water Resources: This station site has the potential to impact 9.1 ac (3.68 ha) of groundwater. Biological Resources Including Wetlands: One special-status plant species, the beach layia, was identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
4th and King (Caltrain) – Caltrain Alignment	The 4th and King station is the existing terminus for the Caltrain commuter rail service. This station site (adjacent to SBC Park) is well connected to the San Francisco Muni system, but stops more than 1 mi (1.6 km) short of the financial district and does not connect to BART or regional bus transit. The station would have about a 2.5-min shorter train travel time to San Francisco than the Transbay Transit Center. The 4th and King station would also have high ridership potential. Sensitivity analysis on the Pacheco Pass "Base" forecasts (low-end forecasts) concluded that the 4th and King terminal station would attract about 1 million fewer annual passengers (about 3.0%) than the Transbay Transit Center (including long-distance commuter passengers) and would have $19 million less revenue (0.6% less). The underground 4th and King terminal station is estimated to cost $792 million. Environmental Issues Traffic: 2030 No HST: V/C =0.40; LOS =A 2030 HST (Pacheco): V/C =0.69; LOS =B 2030 HST (Altamont): V/C =0.61; LOS =B Parking Space Demand: (Pacheco): 2,000 - 3,000; (Altamont): 1,500 - 2,100 Land Use/Environmental Justice: Highly compatible with existing Caltrain station and surrounding uses. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site; however, this location is in an area of high sensitivity for historic resources. Hydrology and Water Resources: This station site has the potential to impact 40.6 ac (16.43 ha) of groundwater. Biological Resources Including Wetlands: One special-status plant species, the beach layia, was identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.

Station Name (Alignment)	Discussion
Mid-Peninsula	
Redwood City (Caltrain) – Caltrain Alignment	This station would be multi-modal station at the existing Caltrain Redwood City station location. Ridership forecasts estimate 1.7 – 2.4 million total boardings and alightings annually by 2030 for the Pacheco Pass "Base" network alternative and 1.15 million for the Altamont Pass "Base" network alternative. The Redwood City station option would have moderate construction and right-of-way issues and low potential environmental impacts, and is expected to cost about $67.5 million[31]. Environmental Issues Traffic: 2030 No HST: V/C =0.68; LOS =B 2030 HST (Pacheco): V/C =0.72; LOS =C 2030 HST (Altamont): V/C =0.71; LOS =C Parking Space Demand: (Pacheco): 3,000 - 3,900; (Altamont): 2,300 - 3,000 Land Use/Environmental Justice: Compatible with existing Caltrain station and adjacent downtown commercial/service oriented uses. Consistent with plans that promote transit alternatives to the automobile. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 6.2 ac (2.51 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Palo Alto (Caltrain) – Caltrain Alignment	This station would be a multi-modal station at the existing Caltrain Palo Alto station location. The Palo Alto station would be a stop for the Caltrain express services, and therefore would have better connectivity to the regional commuter service and to the Peninsula. The Palo Alto station would be expected to have similar costs ($67.5 million[32]), construction issues, right-of-way issues, and forecast to have about 8% higher ridership potential (1.8 – 2.6 million boardings and alightings by 2030 for the Pacheco Pass "Base" network alternative) than the Redwood City station.

[31] Shared-use station includes modification to existing platforms and passenger facilities only within existing right-of-way. Does not include full express and stopping track configuration assumed for HST stations on dedicated high-speed lines.

[32] Shared-use station includes modification to existing platforms and passenger facilities only within existing right-of-way. Does not include full express and stopping track configuration assumed for HST stations on dedicated high-speed lines.

<table>
<tr><th>Station Name (Alignment)</th><th>Discussion</th></tr>
<tr><td></td><td>Environmental Issues
Traffic: 2030 No HST: V/C =0.47; LOS =A
2030 HST (Pacheco): V/C =0.50; LOS =A
2030 HST (Altamont): V/C =0.49; LOS =A
Parking Space Demand: (Pacheco): 3,000 - 3,900; (Altamont): 2,300 - 3,000
Land Use/Environmental Justice: Compatible with Caltrain station, multi-family housing, and facilities associated with Stanford University. Consistent with multi-modal transit center. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds.
Farmlands: No farmland resources were identified at this station location.
Cultural Resources and Paleontological Resources: The existing station was built in 1941 and added to the National Register of Historic Places in 1996. This station site was identified as having a moderate sensitivity for cultural resources.
Hydrology and Water Resources: This station site has the potential to impact 20.7 ac (8.38 ha) of groundwater.
Biological Resources Including Wetlands: One special-status wildlife species, California tiger salamander, was identified for this site.
Faults: None
Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.</td></tr>
<tr><td colspan="2">San Jose</td></tr>
<tr><td>San Jose (Diridon) - Caltrain and Niles/I-880 Alignment Alternatives</td><td>Diridon station would be a multi-modal hub maximizing connectivity to downtown San Jose and the southern Bay Area. Diridon station would have high connectivity and accessibility and would serve Caltrain, ACE Commuter Rail, Capitol Corridor, Amtrak, VTA buses, and light rail, with a possible link to BART. This station would also have high ridership potential. Ridership forecasts project between 4.0 – 5.8 million total boardings and alightings annually by 2030 for the Pacheco Pass “Base” network alternative, and 2.65 million for the Altamont Pass “Base” network alternative.
The HST platforms and tracks would be on an aerial structure constructed over the existing Diridon station platforms. As a result, there would be high construction issues but low potential environmental impacts, and a medium level of compatibility with existing land uses. This station is estimated to cost $185 million.
Environmental Issues
Traffic: 2030 No HST: V/C =0.48; LOS =A
2030 HST (Pacheco): V/C =0.59; LOS =A
2030 HST (Altamont): V/C =0.58; LOS =A
Parking Space Demand: (Pacheco): 7,200 – 9,800; (Altamont): 6,500 - 8,800
Land Use/Environmental Justice: Compatible with San Jose Diridon Caltrain station and industrial uses. Consistent with plans for downtown redevelopment. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds.</td></tr>
</table>

Station Name (Alignment)	Discussion
	Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: Cultural resources, including the Diridon (Cahill) Station and surrounding area, were identified within the area of potential effects. This station site was identified as having a moderate sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 18.8 ac (7.61 ha) of groundwater. Biological Resources Including Wetlands: One special-status plant species, the robust spineflower, and one special-status wildlife species, the California tiger salamander, were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Airports	
Millbrae/SFO – Caltrain Alignment Alternative Coliseum/Airport - Niles/I-880 Alignment Alternative	Both potential airport stations would have direct connections to local and regional commuter rail services and would reduce potential travel times and costs for HST passengers who would use the trains for access to the airports. None of the two airport stations would be in the airport terminals, but each would permit easy access by potential people movers or shuttles (at SFO, BART currently provides a direct connection from the Millbrae Caltrain station to the SFO international terminal). Both potential airport stations would be on the alignments being investigated for service to San Francisco and Oakland. The shared-use station at SFO is estimated to cost $29.1 million.[33] The OAK/Coliseum station is estimated to cost $61.7 million. SFO is the northern California hub airport for national and international flights. For the Millbrae/SFO station forecasts project between 1.176 million total boardings and alightings annually by 2030 for the Pacheco Pass "Base" network alternative and 0.93 million for the Altamont Pass "Base" network alternative. This station would have high connectivity linking the HST service to BART, Caltrain, and bus services as well as to SFO. The Coliseum/Airport station would have high connectivity, linking to BART, Capitol Corridor, and AC Transit buses, as well as Oakland International Airport (OAK). Environmental Issues (Millbrae/SFO) Traffic: 2030 No HST: V/C =0.91; LOS =E 2030 HST (Pacheco): V/C =0.96; LOS =E 2030 HST (Altamont): V/C =0.96; LOS =E Parking Space Demand: (Pacheco): 2,400 - 2,500; (Altamont): 2,100 - 2,500 Land Use/Environmental Justice: Compatible with existing transportation uses at the Millbrae BART/Caltrain Station area. Station constructed at existing Millbrae BART/Caltrain Station. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds.

[33] Shared-use station includes modification to existing platforms and passenger facilities only within existing right-of-way. Does not include full express and stopping track configuration assumed for HST stations on dedicated HST lines.

Station Name (Alignment)	Discussion
	Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: Original station located nearby in Millbrae was built in 1907 and is now a museum. This station site was identified as having a high sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 11 ac (4.45 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station. Environmental Issues (Coliseum/Airport) Traffic: 2030 No HST: V/C =0.45; LOS =A 2030 HST (Pacheco): V/C =0.52; LOS =A 2030 HST (Altamont): V/C =0.52; LOS =A Parking Space Demand: (Pacheco): N/A; (Altamont): N/A Land Use/Environmental Justice: Compatible with industrial uses and commercial uses associated with the McAfee Coliseum and ORACLE Arena. Consistent with plans for transit oriented district. Station constructed at existing Coliseum/Oakland BART Station. Potential for impacts is medium as percentages of environmental justice populations within station area exceed threshold. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 1.6 ac (0.65 ha) of floodplain, 1,683 linear ft (513 linear m) of streams, and 15.1 ac (6.11 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. This station site has the potential to impact 0.64 ac (0.26 ha) of wetlands. Faults: None Section 4(f) and 6(f) Resources: One resource, Coliseum Gardens Park, within 450 ft (137 m) of station.
Oakland	
West Oakland/7th Street - Niles/I-880 Alignment Alternative	This station would directly connect with BART and would have good freeway access. Both the West Oakland and 12th Street station options would be underground and require alignments with deep-bore tunneling, with associated high construction issues and costs. The West Oakland station is estimated to cost $611 million. The 4.18-mi (6.72-km) alignment between a common point at 29th Street north of the Oakland Coliseum and West Oakland is estimated to cost $518 million (not including station, parking, or any associated right-of-way). The West Oakland station site would be adjacent to BART in a mixed-use area. Like the Transbay Transit Center (in San Francisco), this site is forecast to have high ridership potential. It has a medium ranking for potential land-use compatibility conflicts and presence of minority populations in the vicinity of the station area. Environmental Issues

Station Name (Alignment)	Discussion
	Traffic: 2030 No HST: V/C =0.16; LOS =A 2030 HST (Pacheco): V/C =0.32; LOS =A 2030 HST (Altamont): V/C =0.32; LOS =A Parking Space Demand: (Pacheco): N/A; (Altamont): N/A Land Use/Environmental Justice: Compatible with existing West Oakland BART Station and transit-oriented district. Consistent with plans for transit oriented district. Station constructed below grade. Potential for impacts is medium as percentages of environmental justice populations within station area exceed threshold. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 5.1 ac (2.06 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
12th Street/City Center - Niles/I-880 Alignment Alternative	This station would directly connect with BART and would have good freeway access. The 12th Street station would have high connectivity, as it is located in the heart of downtown Oakland where many potential HST passengers could walk to the station. The 12th Street City Center BART station is also a transfer station, providing superior connectivity to the regional rail transit system. Sensitivity analysis on the Altamont Pass (the network alternative serving Oakland and San Jose) resulted in a 2.7% increase in ridership (over 2.4 million passengers per year) as compared to using the West Oakland terminus and a 1.5% increase in revenue. In contrast, sensitivity analysis on the Pacheco Pass for the 12th Street/City Center option resulted in a 0.7% decrease in ridership and 2.5% decrease in revenue. The 12th Street/City Center option has more constructability issues than the Oakland West site. The 12th Street station is estimated to cost $611 million. The 3.17-mi (5.10-km) (cost) alignment between 29th Street north of the Oakland Coliseum and 12th Street is estimated to cost $426 million (not including station, parking, or any associated right-of-way). The 12th Street site would be in a deep tunnel under the 12th Street BART station and would have a low ranking for potential land-use compatibility conflicts and presence of minority populations in the vicinity of the station area. Environmental Issues Traffic: 2030 No HST: V/C =0.45; LOS =A 2030 HST (Pacheco): V/C =0.53; LOS =B 2030 HST (Altamont): V/C =0.53; LOS =B Parking Space Demand: (Pacheco): N/A; (Altamont): N/A Land Use/Environmental Justice: Compatible with 12th Street/City Center BART Station, civic center, and high-intensity commercial uses associated with Downtown Oakland. Consistent with plans for transit oriented district. Station would be constructed at grade. Potential for impacts is medium as percentages of environmental justice

Station Name (Alignment)	Discussion
	populations within station area exceed threshold. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a moderate sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 4.8 ac (1.94 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Southern Alameda County	
Union City (BART) - Niles/I-880 Alignment Alternative	This station location would offer the highest level of connectivity for south Alameda County. The Union City station would connect to BART, Capitol Corridor, and AC Transit and is expected to have similar ridership potential as the Fremont Warm Springs option. It would have low construction issues and low potential minority population impacts, and is estimated to cost $69.9 million. Environmental Issues Traffic: 2030 No HST: V/C =0.55; LOS =A 2030 HST (Pacheco): V/C =0.67; LOS =B 2030 HST (Altamont): V/C =0.67; LOS =B Parking Space Demand: (Pacheco): 3,000 - 3,900; (Altamont): 1,300 – 1,800 Land Use/Environmental Justice: Compatible with Union City BART Station and industrial and commercial uses. Consistent with plans for development of a regional intermodal facility and research and development campus. Station constructed near Union City BART Station. Potential for impacts is medium as percentages of environmental justice populations within station area exceed threshold. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources but a high sensitivity for paleontological resources. Hydrology and Water Resources: This station site has the potential to impact 1.1 ac (0.45 ha) of floodplain, 273 linear ft (83.2 linear m) of streams, and 56 ac (22.6 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: One resource, Charles F. Kennedy Park, within 900 ft (274 m) of the station.

Station Name (Alignment)	Discussion
Union City (Shinn) – Trans Bay Crossing – Dumbarton Alignment Alternatives	There are no current plans for this site to be a multi-modal hub station. This station location would less connectivity and accessibility than either the Union City or Fremont Warm Springs station options – and is therefore expected to have somewhat less ridership potential. There are considerable constructability issues at this site. Estimated cost is $310 million. Environmental Issues Traffic: 2030 No HST: V/C =0.46; LOS =A 2030 HST (Pacheco): N/A 2030 HST (Altamont): V/C =0.49; LOS =A Parking Space Demand: (Pacheco): N/A; (Altamont): 1,300 – 1,800 Land Use/Environmental Justice: Highly compatible with industrial uses. Low compatibility with single-family residential uses. New station constructed outside existing transportation right-of-way. Potential for impacts is high as percentages of environmental justice populations within station area exceed threshold. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site is not anticipated to result in impacts on hydrology or water resources. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: One resource, Shinn Memorial Park, within 450 ft (137 m) of the station.
Fremont (Warm Springs) – Niles/I-880 Alignment Alternative	The Warm Springs station would have good access to the I-880 freeway, a potential direct connection to a future BART station and AC Transit. Ridership forecasts estimate 377 thousand total boardings and alightings annually by 2030 for the Altamont Pass “Base” network alternative The Warm Springs station is estimated to cost $157 million. Environmental Issues Traffic: 2030 No HST: V/C =0.46; LOS =A 2030 HST (Pacheco): N/A 2030 HST (Altamont): V/C =0.47; LOS =A Parking Space Demand: (Pacheco): N/A; (Altamont): 1,300 – 1,800 Land Use/Environmental Justice: Compatible with existing industrial and transportation uses. Consistent with plans for future BART station. New station constructed outside of existing transportation right-of-way. Potential for impacts is medium as percentages of environmental justice populations within station area exceed threshold. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area

Station Name (Alignment)	Discussion
	of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources but a high sensitivity for paleontological resources. Hydrology and Water Resources: This station site has the potential to impact 81.3 ac (32.9 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Southern Santa Clara County	
Gilroy (Caltrain) - Pacheco Pass Alignment Alternative	Southern Santa Clara County would be served by a station at either Gilroy or Morgan Hill. Both of these potential stations would be at Caltrain commuter rail station locations. The Gilroy station is about 10 mi (16 km) south of Morgan Hill and therefore provides better connectivity and travel times and less access costs to the Santa Cruz, Monterey/Carmel, and Salinas markets. Ridership forecasts estimate 1.7 – 2.3 million total boardings and alightings annually by 2030 for the Pacheco Pass "Base" network alternative The Gilroy and Morgan Hill station options would have similar costs, construction issues, and operational issues, all of which were ranked as medium potential impacts. Both station options would be expected to have low potential environmental impacts; however, the Gilroy station site is located in a 100-yr floodplain and would have high potential floodplain impacts. The Gilroy aerial station option is estimated to cost $148 million[34]. Environmental Issues Traffic: 2030 No HST: V/C =0.67; LOS =B 2030 HST (Pacheco): V/C =0.74; LOS =C 2030 HST (Altamont): N/A Parking Space Demand: (Pacheco): 2,800 – 3,800; (Altamont): N/A Land Use/Environmental Justice: Highly compatible with existing Gilroy Caltrain station and commercial uses. Low compatibility with single-family residential use. Consistent with policies for development of a multi-modal transit center. Station constructed at the Gilroy Caltrain station. Potential for impacts is medium as percentages of environmental justice populations exceed thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 40.1 ac (16.23 ha) of groundwater. Biological Resources Including Wetlands: One special-status plant species, showy Indian clover, was identified for this site.

[34] Costs are reduced because of lower proposed speed for station stopping tracks, which would require less infrastructure and right-of-way.

Station Name (Alignment)	Discussion
	Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Morgan Hill (Caltrain) - Pacheco Pass Alignment Alternative	Southern Santa Clara County would be potentially served by a station at Morgan Hill. This station would be at a Caltrain commuter rail station location. This site is expected to have considerably less ridership potential than the Gilroy site. A sensitivity analysis on the Pacheco Pass "Base" forecast with both Morgan Hill and Gilroy stations resulted in over twice as many riders using the Gilroy station option. The Morgan Hill (Caltrain) station option is estimated to cost $285 million. Environmental Issues Traffic: 2030 No HST: V/C =0.59; LOS =A 2030 HST (Pacheco): V/C =0.65; LOS =B 2030 HST (Altamont): N/A Parking Space Demand: (Pacheco): 1,400 - 1,500; (Altamont): 1,400 – 1,500 Land Use/Environmental Justice: Compatible with Morgan Hill Caltrain station and commercial uses. Consistent with plans for development of multi-modal transit transfer center. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 11 ac (4.45 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
East Bay to Central Valley: Altamont Pass (Tri-Valley)	
Pleasanton (I-680/Bernal Rd) – I-580/UPRR, Patterson Pass/UPRR, and UPRR Alignment Alternatives	This station could provide a high level of connectivity to Regional Rail service such as the existing ACE trains. This location provides convenient access to I-680 and I-580. Ridership forecasts estimate 4.2 – 5.5 million total boardings and alightings annually by 2030 for the Pleasanton (I-680/Bernal Rd) site using the Altamont Pass "Base" network alternative. The station is estimated to cost $72.6 million. Environmental Issues Traffic: 2030 No HST: V/C =0.53; LOS =A 2030 HST (Pacheco): N/A 2030 HST (Altamont): V/C =0.70; LOS =C Parking Space Demand: (Pacheco): N/A; (Altamont): 6,900 - 9,100 Land Use/Environmental Justice: Incompatible with single-family residential use. Medium compatibility with

Station Name (Alignment)	Discussion
	nearby schools and community parks. Moderately consistent with plans for adjacent parks, athletics fields and public utilities. Compatible with existing ACE station. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 10.9 ac (4.41 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Pleasanton (BART) – I-680/I-580/UPRR Alignment Alternative	This station would provide a high level of connectivity to the BART system at the existing Dublin/Pleasanton BART Station. This location provides convenient access to I-680 and I-580. There would be significant constructability issues implementing this HST station over an existing BART station in the freeway median and longer total HST travel times than other options serving the Tri-Valley. Sensitivity analysis forecast 1.6% less total ridership (about 1.4 million fewer annual passengers) for an Altamont Pass “Base” network alternative using the Pleasanton BART station option (and the I-680/I-580/UPRR alignment) rather than the Pleasanton Bernal/I-680 station option to serve the Tri-Valley. The station is estimated to cost $317 million. Environmental Issues Traffic: 2030 No HST: V/C =0.44; LOS =A 2030 HST (Pacheco): N/A 2030 HST (Altamont): V/C =0.46; LOS =A Parking Space Demand: (Pacheco): N/A; (Altamont): 6,900 - 9,100 Land Use/Environmental Justice: Compatible with Dublin/Pleasanton BART station and existing transit corridor. Consistent with planned mixed-use development around BART station. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 2.4 ac (0.97 ha) of floodplain, 438 linear ft (133.5 linear m) of streams, and 16.2 ac (6.56 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None

Station Name (Alignment)	Discussion
	Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Livermore (Downtown) – Patterson Pass/UPRR and UPRR Alignment Alternatives	This station could provide a high level of connectivity to Regional Rail service such as the existing ACE trains, however Livermore stations locations are not as conveniently located for automobile accessibility as the Pleasanton station sites for a majority of the potential Tri-Valley and Contra Costa HST passengers. The Bay Area Regional Rail planning effort is considering a potential BART extension to Livermore. Sensitivity analysis forecast 1.6% less total ridership (about 1.4 million fewer annual passengers) for an Altamont Pass "Base" network alternative using the Livermore (Downtown) station option rather than the Pleasanton Bernal/I-680 station option to serve the Tri-Valley. The station is estimated to cost $73.2 million. Environmental Issues Traffic: 2030 No HST: V/C =0.82; LOS =D 2030 HST (Pacheco): N/A 2030 HST (Altamont): V/C =1.10; LOS =F Parking Space Demand: (Pacheco): N/A; (Altamont): 6,900 - 9,100 Land Use/Environmental Justice: Compatible with industrial and transportation uses. Consistent with policies for development of mixed-use downtown development. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 13.3 ac (5.38 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None
Livermore (I-580) – I-680/I580/UPRR and I-580/UPRR Alignment Alternatives	This station would provide direct access to vehicles traveling along the I-580 freeway in the Tri-Valley area, however this Livermore station location is less conveniently located for automobile accessibility for a majority of the potential Tri-Valley and Contra Costa HST passengers than the Pleasanton station options. The Bay Area Regional Rail planning effort is considering a potential BART extension to Livermore. Intercity ridership forecasts estimate similar total boardings and alightings as for the Livermore (Downtown) site. The station is estimated to cost $152 million. Environmental Issues Traffic: 2030 No HST: V/C =1.07; LOS =F 2030 HST (Pacheco): N/A 2030 HST (Altamont): V/C =1.38; LOS =F Parking Space Demand: (Pacheco): N/A; (Altamont): 6,900 - 9,100 Land Use/Environmental Justice: Compatible with existing transportation uses. Consistent with plans for neighborhood commercial land uses. Potential for impacts is low as percentages of environmental justice populations

Station Name (Alignment)	Discussion
	are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources but a high sensitivity for paleontological resources. Hydrology and Water Resources: This station site has the potential to impact 1.7 ac (0.69 ha) of floodplain, 174 linear ft (53 linear m) of streams, 15.9 ac (6.43 ha) of groundwater, and to encounter 8.3 ac (3.36 ha) of soils susceptible to erosion. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. This station site has the potential to impact 1.02 ac (0.41 ha) of wetlands. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Livermore (Greenville/UPRR) – Patterson Pass/UPRR and UPRR Alignment Alternatives	This station could provide a high level of connectivity to Regional Rail service such as the existing ACE trains. This station location is on the eastern fringe of Livermore and is not as accessible to the area's population as other potential sites and is the least conveniently located for automobile accessibility for a majority of the potential Tri-Valley and Contra Costa HST passengers. The Bay Area Regional Rail planning effort is considering a potential BART extension to Livermore. Intercity ridership forecasts estimated to be slightly less than the Livermore (Downtown) site. The station is estimated to cost $72.6 million. Environmental Issues Traffic: 2030 No HST: V/C =0.44; LOS =A 2030 HST (Pacheco): N/A 2030 HST (Altamont): V/C =0.71; LOS =C Parking Space Demand: (Pacheco): N/A; (Altamont): 6,900 - 9,100 Land Use/Environmental Justice: Compatible with industrial uses. Consistent with proposed industrial use. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 12.9 ac (5.22 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.

<table>
<tr><th>Station Name (Alignment)</th><th>Discussion</th></tr>
<tr><td>Livermore (Greenville/I-580) – I-680/I580/UPRR and I-580/UPRR Alignment Alternatives</td><td>This station would provide direct access to vehicles traveling along the I-580 freeway in the Tri-Valley area. This station location is on the eastern fringe of Livermore and is not as accessible to the area's population as other potential sites and is the least conveniently located for automobile accessibility for a majority of the potential Tri-Valley and Contra Costa HST passengers. The Bay Area Regional Rail planning effort is considering a potential BART extension to Livermore. Intercity ridership forecasts estimated to be slightly less than the Livermore (Downtown) site. The station is estimated to cost $160 million.

Environmental Issues
Traffic: 2030 No HST: V/C =0.50; LOS =A
2030 HST (Pacheco): N/A
2030 HST (Altamont): V/C =0.80; LOS =C
Parking Space Demand: (Pacheco): N/A; (Altamont): 6,900 - 9,100

Land Use/Environmental Justice: Compatible with industrial uses. Incompatible with existing and proposed agricultural uses. Not consistent with proposed agricultural use. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds.
Farmlands: No farmland resources were identified at this station location.

Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources but a high sensitivity for paleontological resources.

Hydrology and Water Resources: This station site has the potential to impact 13.8 ac (5.58 ha) of groundwater and to encounter 8.2 ac (3.32 ha) of soils susceptible to erosion.

Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. This station site has the potential to impact 1.07 ac (0.43 ha) of wetlands.

Faults: None

Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.</td></tr>
<tr><td colspan="2">East Bay to Central Valley: Altamont Pass (Tracy)</td></tr>
<tr><td>Tracy (Downtown) – Tracy Downtown (BNSF Connection) and Tracy Downtown (UPRR Connection) Alignment Alternatives</td><td>This station would be consistent with City of Tracy Redevelopment Plans for Transit Oriented Development and an intermodal station in downtown Tracy. Regional Rail planning is investigating the potential to use this site as the Tracy station for a future improved ACE service. Ridership forecasts estimate 0.8 – 1.1 million total boardings and alightings annually by 2030 for the Tracy (Downtown) site using the Altamont Pass "Base" network alternative. The station is estimated to cost $310 million.

Environmental Issues
Traffic: 2030 No HST: V/C =0.64; LOS =B
2030 HST (Pacheco): N/A
2030 HST (Altamont): V/C =0.74; LOS =C
Parking Space Demand: (Pacheco): N/A; (Altamont): 1,200 - 1,700</td></tr>
</table>

Station Name (Alignment)	Discussion
	Land Use/Environmental Justice: Highly consistent with planned downtown mixed-use development. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 11.8 ac (4.78 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Tracy (ACE) – Tracy ACE (BNSF Connection) and Tracy ACE (UPRR Connection) Alignment Alternatives	This station could provide a high level of connectivity to Regional Rail service such as the existing ACE trains. This site is a rural area outside the current urban area of Tracy. Sensitivity analysis forecasts about 0.2% less total ridership (about 190 thousand passengers annually by 2030) for the Altamont Pass "Base" network alternative using the Tracy ACE station rather than the Tracy Downtown option. The station is estimated to cost $315 million. Environmental Issues Traffic: 2030 No HST: V/C =0.02; LOS =B 2030 HST (Pacheco): N/A 2030 HST (Altamont): V/C =0.26; LOS =A Parking Space Demand: (Pacheco): N/A; (Altamont): 1,200 - 1,700 Land Use/Environmental Justice: Compatible with industrial and agricultural uses. Consistent with policies to encourage improved regional rail service. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 15 ac (6.07 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. This station site has the potential to impact 0.08 ac (0.03 ha) of wetlands. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.

Station Name (Alignment)	Discussion
Central Valley (Modesto)	
Modesto (Downtown) – BNSF-UPRR, UPRR, and UPRR-BNSF Alignment Alternatives	The downtown Modesto station maximizes connectivity to downtown Modesto, and provides convenient access to SR-99 and good bus transit access. This option through downtown Modesto would have considerable construction issues as compared with the Amtrak Briggsmore site. Ridership forecasts estimate 1.589 million total boardings and alightings annually by 2030 for the Modesto HST station (slightly higher than the Amtrak Briggsmore option) for the Altamont Pass "Base" network alternative. Sensitivity analysis forecast a 0.3% increase in total ridership (about 280 thousand passengers annually by 2030) for the Pacheco Pass "Base" network alternative using Modesto (Downtown) rather than Briggsmore (Amtrak). The station is estimated to cost $71.4 million. Environmental Issues Traffic: 2030 No HST: V/C =0.90; LOS =D 2030 HST (Pacheco): V/C =0.92; LOS =E 2030 HST (Altamont): V/C =0.92; LOS =E Parking Space Demand: (Pacheco): 2,700 - 4,000; (Altamont): 2,800 - 4,100 Land Use/Environmental Justice: Compatible with industrial and commercial uses. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low to medium to high sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 8.5 ac (3.44 ha) of groundwater. Biological Resources Including Wetlands: One special-status wildlife species, the valley elderberry longhorn beetle, was identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Briggsmore (Amtrak) – BNSF, BNSF Castle, BNSF-UPRR Alignment Alternatives	The Amtrak Briggsmore station is about 5 mi (8 km) east of downtown Modesto. This is the site of a new Amtrak station with direct connection to Amtrak services and bus services. Ridership forecasts estimate 1.29 million total boardings and alightings annually by 2030 for the Amtrak Briggsmore site using the Pacheco Pass "Base" network alternative. Sensitivity analysis forecast about 0.4% total ridership less (about 300 thousand passengers annually by 2030) than the Altamont Pass "Base" network alternative using Briggsmore (Amtrak) rather than Modesto (Downtown). The station is estimated to cost $71.4 million. Environmental Issues Traffic: 2030 No HST: V/C =0.88; LOS =D 2030 HST (Pacheco): V/C =0.91; LOS =E 2030 HST (Altamont): V/C =0.91; LOS =E Parking Space Demand: (Pacheco): 2,700 - 4,000; (Altamont): 2,800 - 4,100

Station Name (Alignment)	Discussion
	Land Use/Environmental Justice: Incompatible with single-family residential and agricultural uses. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 14.2 ac (5.75 ha) of groundwater. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Central Valley (Merced)	
Merced (Downtown) – BNSF-UPRR, UPRR, and BNSF-UPRR Alignment Alternatives	The downtown Merced station is located near the city center and transit hub of Merced, has good access to SR-99 at the bus transit hub for Merced, and would have a higher level of connectivity than the Castle AFB site. Ridership forecasts estimate 627 – 872 thousand total boardings and alightings annually by 2030 for the Merced (Downtown) station option using the Pacheco Pass "Base" network alternative, and 671 thousand for the Altamont Pass "Base" network alternative. The downtown Merced option would have higher construction issues than the Castle AFB site, and four tracks would be needed through downtown Merced to accommodate express services. The station is estimated to cost $71.4 million. Environmental Issues Traffic: 2030 No HST: V/C =1.15; LOS =F 2030 HST (Pacheco): V/C =1.16; LOS =F 2030 HST (Altamont): V/C =1.16; LOS =F Parking Space Demand: (Pacheco): 1,000 - 1,300; (Altamont): 1,200 - 1,600 Land Use/Environmental Justice: Compatible with commercial use. Incompatible with single-family residential use. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: No farmland resources were identified at this station location. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low to medium sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 11.7 ac (4.73 ha) of floodplain. Biological Resources Including Wetlands: One special-status wildlife species, the giant garter snake, was identified for this site. Noise: Although express trains would run through Merced at speeds up to 220 mph (354 kph), potential noise impacts through Merced are expected to be moderate because of mostly commercial and industrial land uses adjacent to the

Station Name (Alignment)	Discussion
	freight railroad. Many of the potential noise impacts could be offset by grade separating the adjacent freight services and eliminating horn noise from warning gates. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.
Castle AFB – BNSF Castle, and UPRR-BNSF Castle Alignment Alternatives	This station would be consistent with City of Merced's Redevelopment Plans for Transit Oriented Development and an intermodal station in the Castle AFB. This site is about 7 mi (11 km) from downtown Merced but would provide easy access to the developing UC Merced campus via a new highway alignment along Bellevue Avenue. This option would have less connectivity and accessibility than the downtown Merced station option but is estimated to have similar HST ridership and revenue. The station is estimated to cost $71.4 million. Environmental Issues Traffic: 2030 No HST: V/C =0.63; LOS =B 2030 HST (Pacheco): V/C =0.65; LOS =B 2030 HST (Altamont): V/C =0.65; LOS =B Parking Space Demand: (Pacheco): 1,000 - 1,300; (Altamont): 1,200 - 1,600 Land Use/Environmental Justice: Compatible with industrial use and inactive Castle AFB. Incompatible with residential use. Potential for impacts is low as percentages of environmental justice populations are lower than the thresholds. Farmlands: This station site would have the potential to impact up to 12 ac (4.86 ha) of prime farmland. Overall, this station would have the greatest potential impact on farmland of all the stations. Cultural Resources and Paleontological Resources: No known cultural resources were identified within the area of potential effects for this station site. This station site was identified as having a low sensitivity for cultural resources. Hydrology and Water Resources: This station site has the potential to impact 416 linear ft (126.8 linear m) of streams and canals including the Casad Lateral. Biological Resources Including Wetlands: No special-status plant or wildlife species were identified for this site. The Casad Lateral extends through a portion of the site. Noise: Would be about the same as the Merced (Downtown) option. Faults: None Section 4(f) and 6(f) Resources: No 4(f) or 6(f) resources within 900 ft (274 m) of the station.

8 PREFERRED HST ALIGNMENT ALTERNATIVES AND STATION LOCATION OPTIONS

8.1 Introduction

This chapter describes the Authority and FRA's preferred HST Network and Alignment Alternatives and station location options and evaluates Network Alternatives that supported the identification of the preferred alternative. The draft Program EIR/EIS did not identify a preference among the HST Network and Alignment Alternatives or station location options presented.

To facilitate the selection of preferred HST alignment alternatives and station location options in the Final Program EIR/EIS, the Authority staff presented recommendations to the Authority at the November 14, 2007, board meeting as an informational item (Appendix 8-A). The Authority provided direction to staff to prepare the Final Program EIR/EIS based upon these recommendations at its meeting on December 19, 2007. At the conclusion of this environmental review process, the Authority expects to certify the Final Program EIR, adopt necessary findings, and take action to approve and select preferred alignment alternative and station location options for this portion of the HST system, and it is anticipated that the FRA would issue a Record of Decision (ROD) on the Final Program EIS.

HST Network Alternatives represent different ways to combine HST Alignment Alternatives and station location options to implement the HST system in the study region. The Draft Program EIR/EIS focused on analysis of HST Alignment Alternatives. Because there are many possible combinations of alignments and stations, 21 representative HST network alternatives were considered and described to better understand the implications of selection of certain alignment alternatives and station location options. The network alternatives were developed to enable an evaluation and comparison of how various combinations of alignment alternatives would meet the project's purpose and need, how each would perform as a HST network (e.g., travel times between various station locations, anticipated ridership, operating and maintenance costs, energy consumption, and auto trip diversions), and how each would impact the environment.

The Draft Program EIR/EIS did not attempt to screen or evaluate the representative network alternatives to identify those that are likely to be reasonable and practicable and that meet the project's purpose and need. The evaluation of Network Alternatives presented in Section 8.3 below in this Final Program EIR/EIS is supported and informed by agency and public review and comment on the Network Alternatives described in the Draft Program EIR/EIS.

Chapter 7 summarizes and compares the relative differences among physical and operational characteristics and potential environmental consequences associated with the HST alignment alternatives and station location options, including:

- Physical/operational characteristics
  - Alignment
  - Length
  - Capital Cost
  - Travel Time
  - Ridership
  - Constructability
  - Operational Issues

- Potential environmental impacts
  - Transportation related topics (air quality, noise and vibration, and energy)
  - Human environment (land use and community impacts, farmlands and agriculture, aesthetics and visual resources, socioeconomics, utilities and public services, hazardous materials and wastes)
  - Cultural resources (archaeological resources, historical properties) and paleontological resources
  - Natural environment (geology and seismic hazards, hydrology and water resources, and biological resources and wetlands).
  - Section 4(f) and 6(f) resources (certain types of publicly owned parklands, recreation areas, wildlife/waterfowl refuges, and historical sites).

In identifying a preferred alignment alternative, the Authority was guided by adopted objectives and criteria for selecting preferred alignment alternatives and station location options that were also applied in the alignment screening evaluation as documented in Section 2.5.1 (Table 8.1-1 below).

Table 8.1-1
High-Speed Rail Alignment and Station Evaluation Objectives and Criteria

Objective	Criteria
Maximize ridership/revenue potential	Travel time Length Population/employment catchment area Ridership and revenue forecasts
Maximize connectivity and accessibility	Intermodal connections
Minimize operating and capital costs	Length Operational issues Construction issues Capital cost Right-of-way issues/cost
Maximize compatibility with existing and planned development	Land use compatibility and conflicts Visual quality impacts
Minimize impacts on natural resources	Water resources impacts Floodplain impacts Wetland impacts Threatened and endangered species impacts
Minimize impacts on social and economic resources	Environmental justice impacts (demographics) Farmland impacts
Minimize impacts on cultural and parks/wildlife refuge resources	Cultural resources impacts Parks and recreation impacts Wildlife refuge impacts
Maximize avoidance of areas with geologic and soils constraints	Soils/slope constraints Seismic constraints
Maximize avoidance of areas with potential hazardous materials	Hazardous materials/waste constraints

The FRA has concurred with the Authority's identification of preferred alignment alternatives and station location options and has consulted with USEPA and USACE regarding their concurrence for compliance with the requirements of Section 404 of the Clean Water Act. Although no permit is being requested at this time under the Clean Water Act, USEPA and USACE have concurred that the identified preferred alignment alternative is most likely to yield the "least environmentally damaging practicable alternative" (LEDPA) consistent with the USACE's permit program (33 CFR Part 320–331) and USEPA's Section 404(b)(1) Guidelines (40 CFR 230–233) (Appendix 8-B). In addition, the HST Alternative represents the proposed action and the Authority and FRA have identified the preferred HST Alternative as environmentally preferable under NEPA and environmentally superior under CEQA.

After the conclusion of this environmental process, the Authority and FRA would focus future project analysis in the study region on alignment alternatives and station location options selected through this program environmental process. Site-specific location and design alternatives for the preferred alternative and station location options, including avoidance and minimization alternatives, will be fully investigated and considered during next tier project-level environmental review.

8.2 Summary of Comments on the Identification of the Preferred Alternative

The identification of a preferred HST alignment between the Bay Area and Central Valley is controversial, and this program EIR/EIS process has received a considerable amount of comment from agencies (federal, state, regional, and local), organizations, and the general public (for more details, see Chapter 10, "Public and Agency Involvement"). There is a wide divergence of opinion with many favoring the Pacheco Pass, many favoring the Altamont Pass, and many favoring a combination of both passes (with the Pacheco serving as the north/south HST connection and Altamont primarily serving interregional commuter service between Sacramento/Northern San Joaquin Valley and the Bay Area).

8.2.1 Pacheco

The Pacheco Pass supporters include the Metropolitan Transportation Commission (MTC), the cities of San Francisco, San Jose, Redwood City, Fremont, Morgan Hill, Cupertino, Sunnyvale, Gilroy, and Salinas; the counties of San Francisco, Santa Clara, San Mateo, and Monterey; Congress members Lofgren, Honda, Eshoo, and Lantos; Assembly member Beale; State Senators Alquist and Maldanado; the San Francisco County Transportation Agency; the Santa Clara Valley Transportation Authority (VTA); Peninsula Corridor (Caltrain) Joint Powers Board (JPB); San Mateo County Transit District (SamTrans); San Mateo County Transportation Authority (TA); Monterey County Transportation Agency; Alameda County Congestion Management Agency; Alameda County Supervisor Scott Haggerty; the San Jose, the San Francisco, Redwood City, and the San Mateo County Chamber of Commerce; the Silicon Valley Leadership Group; and a number of members of the public representing themselves.

There are a number of reasons supporters give for preferring the Pacheco Pass, including: 1) quicker travel times between San Jose/Silicon Valley and Southern California; 2) more frequent/better service between Bay Area and southern California; 3) higher ridership potential; 4) less potential environmental impacts; 5) avoiding impacts on wildlife and sensitive habitat through Don Edwards San Francisco Bay National Wildlife Refuge; 6) best serves the Caltrain Corridor (San Francisco to Gilroy); 7) provides good HST access for the three county Monterey Bay area with a south Santa Clara HST station; 8) can serve San Francisco, Oakland, and San Jose without a new crossing of the Bay; 9) all service through San Jose/best serves south Bay; and 10) less cost for first phase of system between the Bay Area and Anaheim.

There are a considerable number of organizations, agencies, and individuals who have expressed concern regarding potential impacts on the GEA and/or the uninhabited portions of the Pacheco Pass by HST alternatives via the Pacheco Pass. These include the USFWS, CDFG, California Department of Parks and Recreation, Grassland Water District, Grassland Resources Conservation District, Grassland Conservation, Education & Legal Defense Fund, Ducks Unlimited, California Outdoor Heritage Alliance, California Waterfowl Association, Sacramento Area Council of Governments, Citizens' Committee to Complete the

Refuge, Bay Rail Alliance, California Rail Foundation (CRF), California State Parks Foundation (CSPF), Defenders of Wildlife, Planning and Conservation League (PCL), Regional Alliance for Transit (RAFT), Sierra Club, Train Riders Association of California (TRAC), and Transportation Solutions Defense and Education Fund (TRANSDEF). California Department of Parks and Recreation raised concerns regarding potential impacts on State Parks and reserve resources through the Pacheco Pass. In addition, the town of Atherton opposes use of the Caltrain Corridor between San Jose and San Francisco and the City of Millbrae has raised concerns regarding potential impacts through the City of Millbrae.

8.2.2 Altamont

The Altamont Pass supporters include the cities of Oakland, Union City, and Atwater; the town of Atherton; the counties of San Joaquin, Stanislaus, Mariposa, and Kern; the California Partnership for the San Joaquin Valley; the San Joaquin Regional Policy Council; Sacramento Area Council of Governments; San Joaquin County Council of Governments; Tulare County Association of Governments; Altamont Commuter Express (ACE); California Department of Parks and Recreation; California Environmental Coalition; California State Parks Foundation (CSPF); Planning and Conservation League (PCL); Sierra Club; Grassland Water District; Grassland Resources Conservation District; Grassland Conservation, Education & Legal Defense Fund; California Outdoor Heritage Alliance; Bay Rail Alliance; Transportation Involves Everyone (TIE); San Joaquin COG Citizens Advisory Committee; Tracy Region Alliance for a Quality Community; Ducks Unlimited; Transportation Solutions Defense and Education Fund (TRANSDEF); California Rail Foundation (CRF); Defenders of Wildlife; Regional Alliance for Transit (RAFT); Citizens' Committee to Complete the Refuge; Train Riders Association of California (TRAC); and a number of members of the public representing themselves.

There are a number of reasons supporters give for preferring the Altamont Pass including: 1) quicker travel times between Sacramento/Northern San Joaquin Valley and the Bay Area; 2) best serves the Central Valley; 3) more Northern San Joaquin markets served on the Authority's adopted first phase of construction between the Bay Area and Anaheim; 4) higher ridership potential; 5) less potential for environmental impacts; 6) avoids impacts on wildlife and sensitive habitat through Pacheco Pass and the GEA; 7) serves a greater population/more population along the alignment; 8) best serves ACE corridor and reduces traffic along I-580; 9) better service between Bay Area and Southern California (either reduced frequency is needed on shared Caltrain alignment or HST trains can be split); 10) best serves San Jose since it would be a terminus station and with much faster travel times to commuter markets in the Northern San Joaquin Valley; and 11) is less sprawl inducing.

There are a considerable number of organizations, agencies, and individuals who have expressed concern regarding potential impacts on the San Francisco Bay and Don Edwards San Francisco Bay National Wildlife Refuge by HST alternatives via the Altamont Pass using a Dumbarton Crossing. These include the MTC; BCDC; USEPA; USFWS; Don Edwards San Francisco Bay National Wildlife Refuge; Congress members Zoe Lofgren, Michael Honda, Anna Eshoo, and Tom Lantos; State Senators Elaine Alquist and Abel Maldanado; Assembly member Jim Beale; Santa Clara County; San Mateo County Transit District (SamTrans); San Mateo County Transportation Authority (TA); Peninsula Corridor (Caltrain) Joint Powers Board (JPB); San Francisco Bay Trail Project; San Jose Chamber of Commerce; San Francisco Bay Trail Project; the City of San Jose; the City of Oakland; and Don Edwards (Member of Congress, 1963-1995). The East Bay Regional Park District has raised concerns in regards to potential impacts on nine regional parks, in particular the Pleasanton Ridge and Vargas Plateau regional parks, and the Alameda Creek Regional Train between Pleasanton and Niles Junction for Altamont Pass alternatives. In addition, the City of Fremont opposes the Altamont Pass, and the City of Pleasanton does not support the Altamont Pass but remains "open" to terminating Altamont alternatives in Livermore. The MTC and Alameda County Supervisor Scott Haggerty also support the investigation of Altamont Pass alternatives terminating in Livermore.

8.2.3 Combined Pacheco and Altamont

After completing a two-year "Regional Rail" planning process, the MTC has re-confirmed support for the Pacheco alignment via the San Francisco Peninsula as "the main HSR express line between Northern and Southern California due to several of the reasons stated in Resolution N. 3198:

- has the highest statewide ridership demand, and best serves HSR's key market—Northern California to Southern California, connecting the two most congested regions in the state
- provides direct service to all three major cities—San Francisco, San Jose and Oakland
- avoids construction of a new bay crossing or tube required by the Altamont Pass entry for San Francisco service."

MTC's resolution also "endorse(s) the Altamont route as better suited to serve interregional and local travel between the Bay Area and the Northern San Joaquin Valley." It states:

> At the same time the Pacheco pass alignment is being built, the CHSRA should upgrade interregional services between Peninsula—Tri Valley—Sacramento & San Joaquin Valley. As a first step, ACE service can be improved by adding tracks and improving signaling to provide higher speed and more reliable service that would connect with a future BART station in Livermore (Greenville Road or Isabel/Stanley based on further BART analyses); these improvements would need to be compatible with future HSR. An electrified regional train capable of higher speeds, with additional grade separations that would improve road circulation, would replace longer-term, ACE service; the trains would also be compatible with lightweight equipment operating in the Dumbarton Corridor…. [MTC] request[s] that the CHSRA also evaluate an alternative in the Altamont Corridor that terminates HSR at a proposed BART Livermore station where HSR passengers could be dispersed to Bay Area locations throughout the BART system, together with improved ACE service to Santa Clara County… [and] … request[s] that CHSRA consider seeking additional HSR bond funds dedicated to upgrading the Altamont corridor for regional service.

The Tri-Valley Policy Working Group and Technical Advisory Committee (Tri-Valley PAC) took a similar position. Tri-Valley PAC is a partnership that includes the cities of Dublin, Livermore, Pleasanton, Danville, San Ramon, and Tracy along with transportation providers LAVTA, ACE, and BART. The Tri-Valley supports "continued study of high speed rail through the Altamont Corridor on the Union Pacific corridor <u>PROVIDED</u>:

a. There are no significant Right-of-Way takes.

b. There is no major aerial structure through Pleasanton."

In addition, the Tri-Valley PAC provided the following comments for consideration by the Authority:

> The Draft Bay Area EIR/EIS includes a Bay Area HSR alignment that would include High Speed Train service through the Pacheco Pass and regional overlay service provided through the Altamont pass. The Policy Advisory Committee believes that this option may present the best way of addressing our concerns and delivering optimal HST service to the region as a whole.
>
> The combined Altamont/Pacheco(Hybrid) alignment option allows HSR to provide frequent service along the most direct route between northern and southern California, while still serving the important regional transportation corridors in Northern California, including those in the Central Valley, the Tri-Valley, and between Sacramento and the Bay Area. The Draft EIR/EIS demonstrates that the corridors served by the Altamont alignment include some of the greatest travel demand in the entire system.
>
> While providing these important transportation advantages, a system that provides service in both major corridors also mitigates some of the possible negative impacts identified in the Draft EIR/EIS. Specifically related to the Tri-Valley's key concerns, it would improve

the likelihood that HST service could be delivered within the existing Union Pacific Right-of-Way without the need for major aerial infrastructure, or significant right-of-way acquisition through the developed portions of the Tri-Valley.

U.S. Congressman Jim Costa stated that he'd rather not view this as one route over another. He would rather the Valley see a vision for both, and the Capitol Corridor JPB supports "in principle the concept of the two high-speed alignments into and out of the Bay Area. Each alignment would provide a means to meet the high-speed travel markets for (1) long distance travelers from Los Angeles/Southern California using the Pacheco Pass route and (2) the interregional travelers from the Central Valley using the Altamont Pass route." The MTC recommendations are also supported by the Alameda County Congestion Management Agency and Alameda County Supervisor Scott Haggerty.

While the Silicon Valley Leadership Group and the City of San Jose strongly support the Pacheco Pass and the HST link between northern and southern California, they also support high-speed commuter service/improvements to ACE service via the Altamont Pass, and while the California Partnership for the San Joaquin Valley strongly prefers the Altamont Pass, they also commented that the Authority "evaluate the economic feasibility of developing both the Altamont and Pacheco Pass routes to see if each one of those routes, on its own merits, will generate an economic surplus. If it does, then we would like to see both routes implemented." They also state, "if it turns out that one of the two routes must be implemented first, they cannot be implemented concurrently, then our strong preference is for the Altamont route." However, some members of the public have expressed opposition to the "hybrid" idea (Pacheco and Altamont) raising issue with the additional costs and concern that only one pass would be implemented.

The USEPA recommended "eliminating from further consideration a high speed rail alternative connecting Bay Area to Central Valley that includes both an Altamont and a Pacheco Pass alignment, termed, "*Pacheco Pass with Local Service*" in the Draft PEIS. This scenario would effectively result in twice the habitat fragmentation, noise, and indirect impacts to aquatic resources. This alternative would likely result in CWA Section 404 permitting challenges because it is difficult to demonstrate that mountain crossings at both Pacheco and Altamont Passes represent the LEDPA given the increased indirect impacts to aquatic resources and habitat fragmentation associated with this alternative."

8.3 Network Alternatives Evaluation

The purpose of the HST system is defined in Chapter 1 of the Final Program EIR/EIS as follows: The purpose of the Bay Area HST is to provide a reliable high-speed electrified train system that links the major Bay Area cities to the Central Valley, Sacramento, and Southern California, and that delivers predictable and consistent travel times. Further objectives are to provide interfaces between the HST system and major commercial airports, mass transit, and the highway network and to relieve capacity constraints of the existing transportation system in a manner sensitive to and protective of the Bay Area to Central Valley region's and California's unique natural resources.

Chapter 1 of the Final Program EIR/EIS also outlines the objectives that the Authority has adopted, including, "maximize intermodal transportation opportunities by locating stations to connect with local transit, airports, and highways" and states that the Authority's statutory mandate is to plan, build, and operate a HST system that is "coordinated with the state's existing transportation network, particularly intercity rail and bus lines, commuter rail lines, urban rail transit lines, highways, and airports."

The 21 network alternatives described in this Final Program EIR/EIS present information about overall effects of combinations of HST Alignment Alternatives and station location options to implement the HST system in the study region. The 21 network alternatives fall among the three basic approaches for linking the Bay Area and Central Valley: Altamont Pass (11 network alternatives); Pacheco Pass (six network alternatives); and Pacheco Pass with Altamont Pass (local service) (four network alternatives). The network alternatives vary in the degree they serve urban areas/centers and international airports. All but one would provide direct HST services to (i.e., include a HST station within) one and up to three of the major urban centers in the Bay Area—San Francisco, San Jose, and Oakland. Some of the network alternatives would provide service to one or more of the three Bay Area international airports at San Francisco, Oakland, and San Jose. Connectivity and enhancement of other transit systems (e.g. ACE, Caltrain, Capitol Corridor, BART, and Valley Transportation Authority) also vary greatly among the network alternatives.

Overall, implementing the HST system would greatly increase the capacity for intercity and commuter travel and reduce existing automobile traffic in specific travel corridors. Full grade-separation along Bay Area rail corridors used by the HST would improve local traffic flow and reduce air pollution at existing rail crossings. The more extensive the HST system implemented in the Bay Area, the greater the travel condition benefits, including increased connectivity to other transit systems, increased convenience, increased reliability, and improved travel times. In particular, more direct connections to the region's airports provide increased connectivity for air transportation system riders.

Recognizing the benefits described above, as well as other attributes, the cities of San Francisco, Oakland, and San Jose all strongly support direct HST service to their respective downtowns. This support was expressed as comments on the Draft Program EIR/EIS, and is consistent with comments/input provided by these cities over the ten years since the Authority was created. MTC, the regional transportation planning and programming agency for the Bay Area, supports direct HST service to the downtowns of each of these three major Bay Area urban centers.

A number of network alternatives clearly do not meet the purpose and need for the HST system. The Altamont Pass network alternative that terminates in Union City fails since it does not provide direct HST service to San Francisco, Oakland, or San Jose (the major Bay Area cities) nor does it provide interface with the major commercial airports. Also failing are a Pacheco Pass network alternative that terminates in San Jose and three Altamont Pass network alternatives that only serve one of the three major urban areas/centers. These four alternatives directly provide HST service to at most only one major Bay Area city and one of the region's major commercial airports.

8.3.1 Pacheco Pass Network Alternatives Evaluation

Six representative Pacheco Pass network alternatives were investigated. These six alternatives encompass the range of different ways to combine HST Alignment Alternatives and station location options to implement the HST system via the Pacheco Pass. All six Pacheco Pass network alternatives provide direct service to downtown San Jose. The Pacheco Pass network alternatives consist of: 1) HST to San Francisco via the San Francisco Peninsula; 2) HST to Oakland via the East Bay; 3) HST to San Francisco via the San Francisco Peninsula and to Oakland via the East Bay (no bay crossing); 4) HST terminating in San Jose; 5) HST to San Francisco via the peninsula and then to Oakland via a new transbay tube; and 6) HST to Oakland via the East Bay and then to San Francisco via a new transbay tube. As previously explained, the alternative that would terminate in San Jose and not serve either San Francisco or Oakland directly does not meet the purpose and need for the proposed HST system.

The Pacheco Pass alternatives with the greatest environmental impacts and greatest construction issues are the two alternatives that include a new transbay tube. These alternatives would have over 36 acres of potential direct impacts on the San Francisco Bay. To put this into perspective, these alternatives would have 40.3–41 ac of potential impacts on waterbodies (lakes + San Francisco Bay), whereas the preferred Pacheco Pass alternative (HST to San Francisco via the San Francisco Peninsula) would have only 3.8 ac of potential direct impacts. The cost of the additional 8.8-mile HST segment needed to implement a new transbay tube is estimated at about $4.6 billion—over $500 million per mile. Moreover, there is only slightly higher ridership and revenue potential (about 2% higher ridership or 1.9 million passengers per year by 2030) when comparing the transbay tube alternative via the San Francisco Peninsula versus the preferred alternative. To implement alternatives that included a new transbay tube, extensive coordination would be required with the USACE under Section 10 of the Rivers and Harbors

Act, USFWS, and the California Coastal Commission. Crossing the Bay would also be subject to the USACE, CDFG, and BCDC permit process.

The preferred Pacheco Pass alternative (serving San Francisco via the San Francisco Peninsula) has similar potential environmental impacts as the Oakland to San Jose via the East Bay alternative. Both alternatives maximize the use of existing transportation corridors and avoid impacts on the San Francisco Bay. The preferred alternative to San Francisco would have slightly less potential impacts on wetlands (15.6 ac vs. 17.4 ac), waterbodies (3.8 ac vs. 4.5 ac), and streams (20,276 linear ft. vs. 21,788 linear ft.) but would have slightly more potential impacts on floodplains (520.8 ac vs. 477.5 ac) and species (plant and wildlife), and would potentially impact a greater number of cultural resources (165 vs. 106) than the Pacheco Pass alternative to Oakland via the East Bay. Both alternatives would have high ridership potential and similar costs. The alternative to downtown San Francisco (Transbay Transit Center) is forecast to have about 2.3% (2.17 million riders per year by 2030) higher ridership potential than the alternative to Oakland (West Oakland), but is estimated to cost about 6.8% more ($800 million).

The Oakland and San Jose via the East Bay alternative has considerable logistical constraints. In its adopted Regional Rail Plan for the San Francisco Bay Area, the MTC raised certain issues associated with an East Bay HST alignment to Oakland and San Jose and are not recommending an East Bay alignment. The Authority and FRA examined these and other issues as discussed below and concurred with MTC's evaluation of not recommending an East Bay alignment:

- Right-of-Way Constraints and Duplicate Investment – Commitments have already been made to improve Capitol Corridor service and to extend BART to San Jose but these improvements would not be compatible with HST service, which would need to use separate tracks. Non-electric, conventional Capitol Corridor trains will continue to share track with standard freight services in the constrained UPRR owned right-of-way. When fully developed, BART and Capitol Corridor will provide complementary rail options with BART serving more local stops and Capitol Corridor primarily serving regional stops. The capital cost of the East Bay line segment is approximately $4.9 billion.
- Risk of UPRR Right-of-Way Agreement – The risk of reaching an agreement from UPRR to obtain the right to construct additional tracks for the HST along the Niles Subdivision where the high-speed alignment is proposed between Mission Boulevard and Oakland is high.
- Potential Environmental Justice Concerns – The environmental screening in the MTC Regional Rail Plan indicated potential concerns with construction of a new elevated alignment though existing urbanized areas especially in the East Bay between Fremont and Oakland.
- Right-of-Way Constraints within I-880 – The East Bay alignment segment south of Fremont would need to be constructed along I-880 freeway south of Mission Boulevard towards San Jose with the potential for a long process with Caltrans to define and construct the elevated HST trackway within the freeway right-of-way. Caltrans has serious concerns about construction within the constrained median.

The Pacheco Pass alternative that serves San Francisco, Oakland, and San Jose without a new bay crossing provides the highest level of connectivity and accessibility to the Bay Area of the Pacheco Pass Alternatives by directly serving the three major Bay Area urban centers, serving both the San Francisco Peninsula and the East Bay, and providing good connectivity to the region's three international airports (SFO, Oakland, and San Jose). However, this alternative has greater environmental impacts and greater costs ($3.6 billion more) than the preferred alternative since it requires over 42 additional miles of HST alignment to be constructed along the East Bay and would have the same logistical constraints as described above for the Oakland and San Jose via the East Bay alternative. In addition, because this alternative would split the frequency of the HST services (express, suburban express, skip-stop, local, and regional) between the San Francisco Peninsula and the East Bay, this resulted in somewhat less ridership and revenue projected for this alternative as compared to the preferred Pacheco Pass alternative (7.8 million passengers a year by 2030 representing 8.4% of the preferred alternative's ridership).

The Pacheco Pass alternative to downtown San Francisco via the San Francisco Peninsula is preferred because it provides HST direct service to downtown San Francisco, SFO, and the San Francisco Peninsula while minimizing potential environmental impacts and logistical constraints by maximizing use of existing rail right-of-way through shared-use with improved Caltrain commuter services. The HST is complimentary to Caltrain (which intends to use lightweight electrified trains) and would share tracks with express Caltrain commuter rail services. In addition, this alternative provides direct service to northern California's major hub airport at SFO and major transit, business, and tourism center at downtown San Francisco, and would enable the early implementation of the HST/Caltrain section between San Francisco, San Jose, and Gilroy.

The City and County of San Francisco, San Francisco County Transportation Authority, Peninsula Corridor (Caltrain) Joint Powers Board (JPB), San Mateo County Transit District (SamTrans), San Mateo County Transportation Authority (TA), City of Gilroy, City of Redwood City, County of Monterey, and City of Morgan Hill all support HST to San Francisco via San Jose and the San Francisco Peninsula (Caltrain Corridor)—the staff recommended alternative. The MTC recommends use of the Pacheco Pass via the San Francisco Peninsula "as the main HSR express line between Northern and Southern California" but their recommendation also includes a new transbay tube to bring direct service to Oakland. MTC recommends that the first step in implementing HST in Northern California and the Bay Area is "investment in the Peninsula trackage with regional and high-speed rail funding can make this corridor high-speed rail ready," noting that Caltrain intends to use lightweight electrified trains that would be compatible with HST equipment.

8.3.2 Altamont Pass Network Alternatives Evaluation

Eleven representative Altamont Pass network alternatives were investigated. These 11 alternatives encompass the range of different ways to combine HST Alignment Alternatives and station location options to implement the HST system via the Altamont Pass. The Altamont Pass network alternatives consist of: 1) HST to San Francisco (via Dumbarton) and San Jose (via I-880); 2) HST to Oakland and San Jose via the East Bay; 3) HST to San Francisco (via Dumbarton) and Oakland and San Jose via the East Bay; 4) HST terminating in San Jose; 5) HST terminating in to San Francisco; 6) HST terminating in Oakland; 7) HST terminating in Union City; 8) HST to San Francisco and San Jose via San Francisco Peninsula (and Dumbarton crossing); 9) San Francisco and San Jose, Oakland—no Bay Crossing; 10) Oakland and San Francisco—via transbay tube; and 11) San Jose, Oakland and San Francisco—via transbay tube. The four Altamont Pass network alternatives that would terminate in Union City or provide direct service to only one of the three major urban centers of the Bay Area (San Francisco, San Jose, and Oakland) do not meet the purpose and need for the proposed HST system.

The two Altamont Pass network alternatives that require a new transbay tube would have high potential environmental impacts and considerable construction issues. These alternatives would have over 36 acres of potential direct impacts on the San Francisco Bay. They would have 38.8 ac of potential impacts on waterbodies (lakes + San Francisco Bay) whereas the Oakland and San Jose Termini Altamont Pass network alternative would have only 2.3 ac of potential direct impacts. The cost of the additional 8.8-mile HST segment needed to implement a new transbay tube is estimated at about $4.6 billion—over $500 million per mile. Moreover, there is only slightly higher ridership and revenue potential (less than 2% higher ridership or 1.0–1.6 million passengers per year by 2030) when comparing the transbay tube alternative via the East Bay versus the related Altamont Pass network alternative that terminates in Oakland. To implement alternatives that included a new transbay tube, coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act, USFWS, and the California Coastal Commission. Crossing the Bay would also be subject to the USACE, CDFG, and BCDC permit process.

The Altamont Pass network alternative that serves San Francisco, Oakland, and San Jose (with a Dumbarton crossing) provides a high level of connectivity and accessibility to the Bay Area by directly serving the three major Bay Area urban centers, serving both the San Francisco Peninsula and the East Bay, and providing good connectivity to the region's three international airports (SFO, Oakland, and San

Jose). However, this alternative has greater environmental impacts, logistical constraints, and costs ($2.4 billion more) than the San Francisco and San Jose Termini Altamont Pass alternative since it requires nearly 38 additional miles of HST alignment to be constructed along the east bay. In addition, because this alternative would further spilt the frequency of the HST services (express, suburban express, skip-stop, local, and regional) between San Francisco, San Jose, and Oakland (a three way split east of Niles Junction) this resulted in somewhat less ridership and revenue projected for this alternative as compared to the San Francisco and San Jose Termini Altamont Pass network alternative (about 6.8 million passengers a year by 2030 representing 7.7% of the other alternative's ridership).

The Altamont Pass network alternative that serves San Francisco, Oakland, and San Jose—no Bay Crossing provides a high level of connectivity and accessibility to the Bay Area by directly serving the three major Bay Area urban centers, serving both the San Francisco Peninsula and the East Bay, and provides good connectivity to the region's three international airports (SFO, Oakland, and San Jose). However, this alternative has greater environmental impacts and greater costs ($4.5 billion more) than the Oakland and San Jose Termini Altamont Pass alternative since it requires over 62 additional miles of HST alignment to be constructed along the San Francisco Peninsula. In addition, this alternative results in non-competitive travel times from San Francisco, SFO, or Palo Alto/Redwood City to the HST stations to the south including Bakersfield, Los Angeles, Anaheim, Riverside, and San Diego. The non-competitive travel times to San Francisco and the San Francisco Peninsula resulted in somewhat less ridership and revenue projected for this alternative as compared to the Oakland and San Jose Termini Altamont Pass network alternative (about 2.8 million passengers a year by 2030 representing over 3.1% of the other alternative's ridership).

There are considerable trade-offs in comparing the three most promising Altamont Pass network alternatives: San Francisco and San Jose Termini; Oakland and San Jose Termini; and San Francisco and San Jose—via San Francisco Peninsula. Of these three Altamont Pass network alternatives, the Oakland and San Jose Altamont Pass network alternative is estimated to have the least potential environmental impacts predominately because the other two alternatives require a Bay crossing at Dumbarton. The Oakland and San Jose Termini network alternative is estimated to have fewer potential impacts on waterbodies (2.3 ac vs. 39.6 ac), wetlands (12.3 ac vs. 44.4-45.9 ac), special status plant species (40 vs. 56), special status wildlife species (44 vs. 50), non-wetland waters (14,032 linear ft. vs. 15,947-16,773 linear ft.), and cultural resources (128 vs. 149-180) than the two network alternatives serving San Francisco and San Jose termini. Constructing a new bridge or tube crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat, requiring special construction methods and mitigations. All the Dumbarton crossing alternatives would result in direct impacts on Don Edwards San Francisco Bay National Wildlife Refuge and would have potential direct impacts on 15 special-status plant and 21 special-status wildlife species. To implement this alternative across the bay, extensive coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission and the Bay crossing would be subject to the USACE, CDFG, and BCDC permit process. BCDC scoping comments note that bridge alternatives that could have adverse impacts on Bay resources can only be approved by BCDC "if there is not an alternative upland location for the route and if the fill in the minimum necessary to achieve the purposes of the project" (BCDC scoping response, December 15, 2005).

The major issues with Oakland and San Jose network alternative are the logistical constraints previously described (Section 8.3.1) along the East Bay, and that it does not provide direct HST service to SFO (northern California's major hub airport), the San Francisco Peninsula (Caltrain Corridor), and downtown San Francisco, the major transit, business, and tourism center of the region. Service utilizing the Caltrain corridor better satisfies the purpose and need of the HST and also best supports the Authority's adopted phasing plan. The two Altamont Pass alternatives to San Francisco and San Jose have similar environmental impacts and costs. However, the San Francisco and San Jose Termini network alternative would offer quicker travel times to San Jose than the San Francisco and San Jose—via the San Francisco Peninsula (2 hours 19 minutes vs. 2 hours 37 minutes for SJ-LA; and 49 minutes vs. 1 hour and 3 minutes SJ-Sacramento). The Peninsula route would have slightly higher ridership (2.85 million additional riders).

The City of Oakland supports direct service to the West Oakland station option via the Altamont Pass. The City of Union City supports direct service to Union City via Altamont Pass. The City of Fremont opposes the Altamont Pass alternatives, but in particular opposes the east-west alignment through Fremont (for Altamont Pass alternatives to San Francisco via Dumbarton). Congress members Zoe Lofgren, Michael Honda, Anna Eshoo, and Tom Lantos; State Senators Elaine Alquist and Abel Maldanado; and Assembly member Jim Beale as well as Santa Clara County, San Jose Chamber of Commerce, Don Edwards, and the City of San Jose all oppose HST alternatives requiring a Dumbarton crossing through the Don Edwards San Francisco Bay National Wildlife Refuge. The City of Oakland, USEPA, USFWS, BCDC, and San Francisco Bay Trail Project also raised concerns regarding potential impacts on Don Edwards San Francisco Bay National Wildlife Refuge and a new crossing of the bay. The City of Pleasanton, Alameda County Congestion Management Agency, and Alameda County Supervisor Scott Haggerty as well as the MTC support the future investigation of terminating Altamont Pass HST alternatives in Livermore. Rail advocacy groups such as the Bay Rail Alliance support the Altamont San Francisco and San Jose Termini network alternative.

The Bay Area Regional Rail Plan adopted by MTC favors the San Francisco and San Jose—via the San Francisco Peninsula Altamont Pass alternative because this alternative would utilize the Caltrain alignment between San Francisco and San Jose and would "maximize the partnership opportunities with CHSRA, could be incrementally developed, provides consistency with existing plans and minimizes duplication with committed plans and investments" (MTC, Sept 2007, pg 86). However, the MTC preference for Altamont also includes an ultimate connection to Oakland from San Francisco via a new transbay tube.

8.3.3 Pacheco Pass with Altamont Pass (Local Service) Network Alternatives Evaluation

Four representative Pacheco Pass with Altamont Pass (local service) network alternatives were investigated. These four alternatives encompass the range of different ways to combine HST Alignment Alternatives and station location options to implement the HST system via the Pacheco Pass while also providing local HST service via the Altamont Pass. The Pacheco with Altamont Pass (local service) network alternatives consist of: 1) HST with San Francisco and San Jose Termini; 2) HST with Oakland and San Jose Termini; 3) HST with San Francisco, San Jose, and Oakland Termini (without Dumbarton Bridge); and 4) HST terminating in San Jose. The Pacheco Pass and Altamont Pass (local service) network alternative that would terminate in San Jose does not serve either San Francisco or Oakland directly and does not meet the purpose and need for the proposed HST system.

The network alternative to Oakland and San Jose is estimated to be the least costly of the remaining three network alternatives serving both the Pacheco and Altamont passes ($2.3 billion less than the alternative serving San Francisco and San Jose), would have the least environmental impacts, and would have high ridership potential, but it would not provide direct HST service to downtown San Francisco, SFO, and the San Francisco Peninsula (Caltrain Corridor) between San Francisco and San Jose. The network alternative to San Francisco and San Jose is estimated to have the highest ridership potential (3.27 million passengers a year by 2030 higher than the Oakland and San Jose alternative) but is also estimated to have the highest environmental impacts since it would require a new crossing at Dumbarton. The network alternative to San Francisco, Oakland, and San Jose (without Dumbarton Bridge) would have the highest costs ($4.4 billion more than the Oakland and San Jose alternative), and the least ridership potential (8.34 million passenger a year by 2030 less than the San Francisco and San Jose alternative), but would provide direct HST service to Oakland, San Francisco, and San Jose and the region's three international airports without requiring a new bay crossing.

The Pacheco Pass with Altamont Pass (local service) network alternatives do not compare well against either the Pacheco Pass or Altamont Pass network alternatives in the Draft Program EIR/EIS for HST service to be provided by the Authority. These network alternatives resulted in similar ridership and revenue forecasts (with less revenue than comparable Pacheco Pass network alternatives) while having considerably higher capital costs ($4.4–6.0 billion more for comparable terminus station locations). Although the Pacheco Pass with Altamont Pass (local service) alternatives would increase connectivity and accessibility by potentially providing direct HST service to additional markets, these alternatives would have higher environmental impacts, construction issues, and logistical constraints than Altamont or Pacheco Pass alternatives. The USEPA concluded that the Pacheco Pass with Altamont Pass (local service) network alternatives are not likely to contain the Least Environmentally Damaging Alternative (LEDPA).

8.3.4 Comparison of Pacheco Pass and Altamont Pass Alternatives

Public Input: There is a wide divergence of opinion for the selection of the alignment between the Bay Area and Central Valley with many favoring the Pacheco Pass, many favoring the Altamont Pass, and many favoring doing both passes (with the Pacheco serving as the north/south HST connection and Altamont primarily serving interregional commuter service between Sacramento/Northern San Joaquin Valley and the Bay Area). San Francisco, Oakland, and San Jose, the three major urban centers of the Bay Area, all want direct HST service. The Central Valley (including Sacramento) and many transportation and environmental organizations strongly prefer the Altamont Pass, whereas much of the Bay Area (MTC, San Francisco, San Jose, San Francisco Peninsula, and Monterey Bay Area) agencies strongly support the Pacheco Pass. Opposition has been raised to potential impacts for both the Pacheco Pass (impacts on the GEA, Pacheco Pass, the Town of Atherton, and Millbrae), and the Altamont Pass (impacts on the San Francisco Bay, Don Edwards San Francisco Bay National Wildlife Refuge, East Bay regional parks, the City of Fremont, City of Livermore, and the City of Pleasanton).

Ridership and Revenue: The HST ridership and revenue forecasts done by MTC in partnership with Authority concluded that both the Pacheco Pass and Altamont Pass network alternatives have high ridership and revenue potential. Distinct differences were found between the Pacheco Pass and Altamont Pass for certain markets, and the sensitivity tests help in the selection of alignment alternatives and station location options within the corridors studied. Nonetheless, while additional forecasts with different assumptions may result in somewhat different results, the bottom-line conclusion is expected to remain the same: both the Pacheco Pass and Altamont Pass have high ridership potential. This overall conclusion is consistent with the previous ridership analysis done for the Authority's Business Plan (June 2000). It is the conclusion of this analysis that both the Pacheco Pass and Altamont Pass alternatives have high ridership potential and that ridership and revenue do not differentiate between these alternatives.

Capital and Operating Costs: Capital and operating costs are not substantially different between the Pacheco Pass and Altamont Pass alternatives that meet the purpose and need of the proposed HST system and serve similar termini stations. It is therefore the conclusion of this analysis that capital and operating costs do not differentiate between the Pacheco Pass and Altamont Pass alternatives.

Travel Times/Travel Conditions: Either the Pacheco Pass or Altamont Pass would provide quick, competitive travel times between northern and southern California. The Pacheco Pass would provide the quickest travel times between the south Bay and southern California (10 minutes less than the Altamont alternatives serving San Jose via the East Bay [I-880], and 28 minutes less than the Altamont San Francisco and San Jose—via San Francisco Peninsula alternative for express service). The Pacheco Pass enables a potential station in southern Santa Clara County (at Gilroy or Morgan Hill), which provides superior connectivity and accessibility to south Santa Clara County and the three Monterey Bay counties and utilizes the entire Caltrain corridor between San Francisco and Gilroy. San Francisco and San Jose would be served with one HST alignment along the Caltrain corridor providing the most frequent service to these destinations, whereas the most promising Altamont Pass alternatives would require splitting HST services (express, suburban express, skip-stop, local, regional) between two branch lines to serve San Jose and either San Francisco or Oakland. The Altamont Pass would provide considerably quicker travel times between Sacramento/Northern San Joaquin Valley and San Francisco or Oakland than the Pacheco

Pass (41 minutes less between San Francisco and Sacramento for express service). The Altamont alternatives using the East Bay to San Jose would have express travel times about 29 minutes less than the Pacheco pass between Sacramento and San Jose, while the Altamont San Francisco and San Jose—via the San Francisco Peninsula alternative would take 15 minutes less than the Pacheco Pass for this market. The Altamont Pass would enable a potential Tri-Valley HST station and a potential Tracy HST station, which provide superior connectivity to the Tri-Valley/Eastern Alameda County, Contra Costa County, and the Tracy area and provide for the opportunity for shared infrastructure with an improved ACE commuter service, although additional infrastructure would be necessary for commuter overlay service with associated impacts. The Altamont Pass would have more potential Central Valley stations served on the Authority's adopted first phase for construction between the Bay Area and Anaheim (Tracy and Modesto). The travel time for direct service and travel conditions would be significantly different between the Altamont Pass alternative to Oakland and San Jose in comparison to the other two promising Altamont alternatives and the preferred Pacheco Pass alternatives (which directly serve San Francisco and San Jose). The Oakland and San Jose alternative would provide superior travel times, connectivity and accessibility to Oakland, Oakland International Airport, and the East Bay, but would not directly serve downtown San Francisco, SFO, or the San Francisco Peninsula/Caltrain Corridor.

Constructability Issues and Logistical Constraints: There are constructability issues and logistical constraints with both the Pacheco and Altamont pass alternatives. However, the construction related issues and logistical constraints associated with the Altamont Pass alternatives are greater than those for the Pacheco Pass. All Altamont Pass alternatives have considerable constructability issues through the right-of-way constrained Tri-Valley area (Livermore and Pleasanton) and tunneling/seismic issues in the Pleasanton Ridge/Niles Canyon area. All Altamont Pass alternatives have tunneling/seismic issues (Calaveras Fault) in the Pleasanton Ridge as well as seismic issues in the East Bay (Hayward Fault). For direct service to San Francisco, the most promising Altamont Pass alternatives require a new Bay Crossing at Dumbarton, which must also go through the Don Edwards San Francisco Bay National Wildlife Refuge and the City of Fremont (which opposes construction of the east-west link through Fremont). For the Altamont Pass alternative serving Oakland, the MTC concluded that "development of an East Bay option with direct service to San Jose and Oakland would include significant right-of-way risk gaining an agreement from UPRR to provide access to Oakland." For the Altamont Pass east bay link to San Jose, Caltrans District 4 has commented that use of the I-880 median would result in significant construction stage impacts between Fremont and San Jose. The Pacheco Pass requires coordination and shared-use on the Caltrain corridor and would have tunneling and environmental issues through the Pacheco Pass, as well as require aerial structures and other design refinements and mitigation measures to minimize or avoid potential impacts on the GEA.

Environmental Impacts: The preferred Pacheco Pass alternative would have greater potential impacts on acres of farmlands than the most promising Altamont Pass alternatives (1,372 ac vs. 758 – 764 ac) and potentially impact more acres of floodplains (521 ac vs. 219-318ac) and more linear feet of streams (20,276 linear ft vs. 16,824–17,660 linear ft). This alternative would also potentially result in impacts on resources within the generally designated GEA and would have the potential to impact wildlife movement. The preferred Pacheco Pass alternative would have somewhat less potential impacts for noise and vibration and would affect a fewer number of 4(f) and 6(f) resources (16 vs. 20–22) than the most promising Altamont Pass alternatives. The differences in the impacts on waterbodies, wetlands, nonwetland waters, species, and cultural resources would vary considerably depending upon the Altamont Pass alternative. The two Altamont Pass alternatives providing direct service to San Francisco would include a new Bay crossing at Dumbarton and would cross areas within the Don Edwards San Francisco Bay National Wildlife Refuge (wetlands and sensitive habitat) and therefore would have considerably higher impacts on waters, wetlands, and 4(f) resources than the Pacheco Pass alternative. In comparison to these Altamont Pass alternatives, the Pacheco Pass alternative would have considerably less potential impacts on waterbodies (3.8 ac vs. 39.6 ac), considerably less potential impacts on wetlands (15.6 ac vs. 44.4–45.9 ac), and fewer potential impacts on nonwetland waters (14,395 linear ft. vs. 15,947–16,773 linear ft), while having relatively similar potential impacts on the number of special status plant species (58 vs. 56), special status wildlife species (53 vs. 49-50), and cultural resources (165 vs. 149-180). In comparing the Altamont Pass alternative to Oakland and San Jose along the east bay, the Pacheco Pass alternative to San Francisco and San Jose would have slightly more potential impacts on waterbodies (3.8 ac vs. 2.3 ac), wetlands (15.6 ac vs. 12.3 ac), and nonwetland waters (14,395 linear ft vs. 14,032 linear ft), special-status plant species (58 vs. 40), special-status wildlife species (53 vs. 44), and cultural resources (165 vs. 128). The Pacheco Pass Alternative would avoid impacts on the Don Edwards San Francisco Bay National Wildlife Refuge, and it would include mitigation measures to reduce or avoid potential impacts on resources within the GEA and in particular along existing Henry Miller Road (see Section 3.15.5). The program-level analysis of impacts to 4(f)/6(f) resources generally supports the selection of the preferred Pacheco Pass (San Francisco and San Jose Termini) network alternative, although all network alternatives have potential to impact 4(f)/6(f) resources.

8.4 The MTC's "Regional Rail Plan for the San Francisco Bay Area"

The MTC, BART, Caltrain, and the Authority, along with a coalition of rail passenger and freight operators, prepared a comprehensive "Regional Rail Plan for the San Francisco Bay Area" (Plan) adopted by MTC in September 2007. The Plan establishes a long-range vision to create a Bay Area rail network that addresses the anticipated growth in transportation demand and meets that demand. This Plan examines ways to incorporate expanded passenger train services into existing rail systems, improve connections to other trains and transit, expand the regional rapid transit network, increase rail capacity, coordinate rail investment around transit-friendly communities and businesses, and identify functional and institutional consolidation opportunities. The plan also includes an analysis of potential high-speed rail routes between the Bay Area and the Central Valley. The Plan is separate from the Authority's Final Program EIR/EIS but is accounted for in Section 3.17, "Cumulative Impacts," of the Final Program EIR/EIS. The Plan, which was issued and approved during the Draft Program EIR/EIS comment period, provides useful additional information for consideration as part of the Authority's decision-making process.

As the HST system involves major infrastructure investment, the Plan identifies and evaluates options for providing overlay services (use of the HST infrastructure for regional rail service with additional investments in facilities and compatible rolling stock). Overlay services are considered for each HST Network Alternative. Regional overlay operations on HST lines could provide service to additional local stations along the HST lines. Such local stops typically would be developed as four-track sections with a pair of outside platforms for regional trains and two express tracks (no platforms) in the center. The extent of the four-track sections would depend on the prevailing speed of the line for statewide service as well as the spacing and location of the local stops. The regional overlay services would be operated with compatible equipment, but the average speeds would be lower and the overall travel times would be greater than the HST because of the additional stops. Additional investment would be necessary to provide the infrastructure for such regional overlay services.

The Plan concludes that the Bay Area needs a Regional Rail Network. "As the BART system becomes more of a high-frequency, close stop urban subway system, it needs to be complemented with a larger regional express network serving longer-distance trips" and "High-Speed Rail complements and supports development of regional rail—a statewide high-speed train network would enable the operation of fast, frequent regional services along the high-speed lines and should provide additional and accelerated funding where high-speed and regional lines are present in the same corridor" (MTC, 2007 *Regional Rail Plan*, pg ES-3).

The Plan concludes that "an Altamont alignment would have higher regional ridership (between points located from Merced and north) of 20-million trips in Year 2030 vs. about 16-million trips for a Pacheco alignment—by contrast, a Pacheco alignment would have higher ridership between Northern California and Southern California (between points located from Fresno and south) of 40-million trips in Year 2030 vs. about 34-million trips for an Altamont alignment." In addition, "if either Altamont or Pacheco were selected as the sole option, 4-track sections would be needed at regional stations as well as approaching and departing regional stops. These four-track sections would be required along the Altamont route between Fremont and Tracy and along the Pacheco route between San Jose and Gilroy. By contrast, with an Altamont + Pacheco option, two-track sections would suffice from San Jose to Gilroy and from Fremont to Tracy; additionally, a lower-cost bridge connection at the Dumbarton crossing could be developed thereby reducing the cost of a combination alternative by as much as $1 billion compared to simply building both of the alignments separately" (MTC, 2007, *Regional Rail Plan*, pg ES-17). The Plan also concludes that, "Regardless of which Altamont or Pacheco options would be developed, an initial phase of investment in the Peninsula alignment between San Jose and San Francisco would help make Caltrain, with an express/limited stop ridership potential of 6.3 million riders per year in 2030 'high speed rail ready'" (MTC 2007, *Regional Rail Plan*, pg. ES-18).

8.5 Preferred HST Network Alternative

The Authority identifies as the preferred alternative:

- Pacheco Pass to San Francisco (via San Jose) for the proposed HST system (see Figure 8.5-1)

The Pacheco Pass alternative serving San Francisco and San Jose termini best meets the purpose and need for the proposed HST system. Key reasons include:

1. The Pacheco Pass minimizes impacts on wetlands, waterbodies, and the environment.

The statewide HST system should provide direct service to Northern California's major hub airport at SFO and major transit, business, and tourism center at downtown San Francisco. The Pacheco Pass alternative serving San Francisco and San Jose termini has the <u>least</u> potential environmental impacts overall while providing direct HST service to downtown San Francisco, SFO, and the San Francisco Peninsula (Caltrain Corridor) and minimizes construction issues which can lead to delay and cost escalation.

The Pacheco Pass enables San Francisco, SFO, and the San Francisco Peninsula to be directly served without a crossing of the San Francisco Bay. Altamont Pass alternatives requiring a San Francisco Bay crossing would have the greatest potential impacts on the San Francisco Bay and have high capital costs and constructability issues. The Dumbarton Crossing would also have the greatest potential impacts on wetlands and the Don Edwards San Francisco Bay National Wildlife Refuge. To implement these alternatives, extensive coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission, and the Bay crossing would be subject to the USACE, CDFG, and BCDC permit process. A number of agencies, organizations, and individuals have raised concerns regarding to the construction of a HST crossing of the San Francisco Bay. These include the MTC, BCDC, USEPA, USFWS, Congress members Zoe Lofgren, Michael Honda, Anna Eshoo, and Tom Lantos, State Senators Elaine Alquist and Abel Maldonado, and Assembly member Jim Beale as well as Santa Clara County, San Mateo County Transit District (SamTrans), San Mateo County Transportation Authority (TA), Peninsula Corridor (Caltrain) Joint Powers Board (JPB), San Francisco Bay Trail Project, San Jose Chamber of Commerce, the City of San Jose, the City of Oakland, and Don Edwards (Member of Congress, 1963–1995).

While a considerable number of comments have raised concerns about potential environmental impacts for Pacheco Pass alternatives (in particular relating to potential impacts on the GEA), HST via the Pacheco Pass is feasible and preferred because it would result overall in fewer impacts when compared to the Altamont Pass alternatives with a Bay crossing. Additionally, the Pacheco Pass alternative would include various measures to avoid, minimize, and/or mitigate environmental impacts to the extent feasible and would offer opportunities for environmental improvements along the HST right of way that could be accomplished during project design, construction, and operation, including through use of tunnels and aerial structures where appropriate. This contrasts with the more uncertain regulatory approvals that would be needed for crossings of San Francisco Bay and the Don Edwards San Francisco Bay National Wildlife Refuge. Identification of a preferred alternative in the Final Program EIR/EIS is required for NEPA compliance. Since the identified preferred alternative would have the least overall environmental impacts, it is also identified as the environmentally superior alternative for CEQA compliance and the environmentally preferable alternative under NEPA.

2. The Pacheco Pass best serves the connection between the Northern and Southern California.

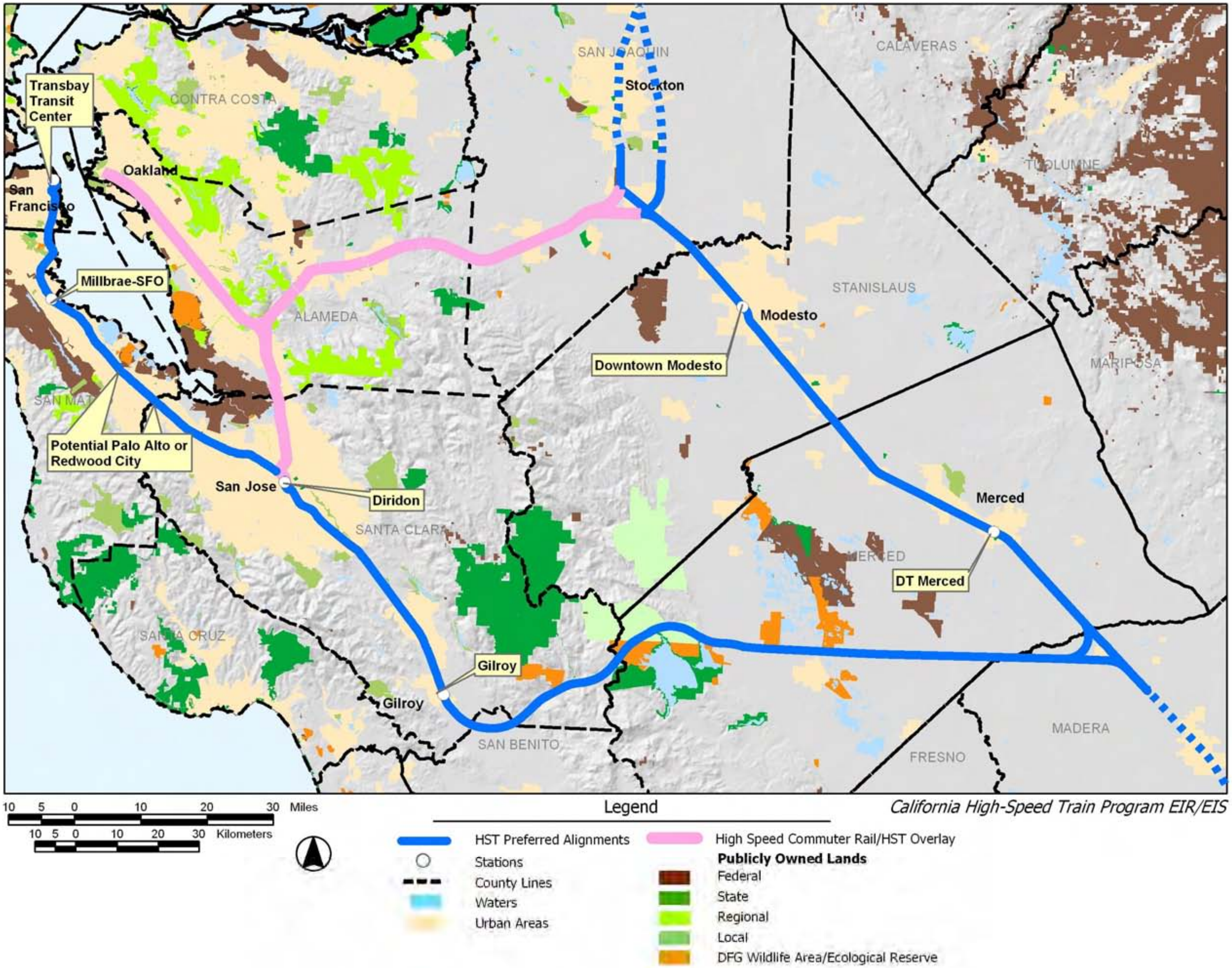
Operational benefits result in greater frequency and capacity:
San Francisco and San Jose would be served with one HST alignment along the Caltrain corridor providing the most frequent service to these destinations, whereas the most promising Altamont Pass alternatives would split HST services (express, suburban express, skip-stop, local, regional) between two branch lines to serve San Jose and either San Francisco or Oakland—reducing the total capacity of the system to these markets. The proposed HST system already has two locations where there are branch splits (north of Fresno—to Sacramento and the Bay Area, and south of Los Angeles Union Station—to Orange County and the Inland Empire). Avoiding additional branch splits in the HST alignment would benefit train operations and service.

Provides a superior connection between the South Bay and Southern California
The Pacheco Pass enables the shortest connection to be constructed between the South Bay and Southern California with the quickest travel times between these markets. A southern Santa Clara County HST station increases connectivity and accessibility for the South Bay and the three county Monterey Bay area.

Fewer stations between the Major Metropolitan Areas
The core purpose of the HST system is to serve passenger trips between the major metropolitan areas of California. There is a critical tradeoff between the accessibility of the system to potential passengers that is provided by multiple stations and stops, and the resulting HST travel times. Additional or more closely spaced stations (even with limited service) would lengthen travel times, reduce frequency of service, and the ability to operate both express and local services. The Pacheco Pass has the advantage of fewer stops through the high-speed trunk of the system between San Francisco or San Jose and Southern California, the most populated regions of the state.

Between Merced and Gilroy, the high-speed trains will be maintaining speeds well over 200 mph. The fact that there is no significant population concentrations between Merced and Gilroy along the Pacheco Pass is a positive attribute since there are fewer communities and hence fewer community impacts. Additionally there will be no HST station between Gilroy and Merced. As a result, the Pacheco Pass minimizes the potential for sprawl inducement as compared with the Altamont Pass.

Minimizes Logistical Constraints
The Pacheco Pass avoids construction issues and logistical constraints through the Tri-Valley and Alameda County. The Tri-Valley PAC has raised serious concerns with all the Altamont Pass alternatives regarding land use compatibility and right-of-way constraints and the need for aerial structures through the Tri-Valley. All Altamont Pass alternatives have tunneling/seismic issues (Calaveras Fault) in the Pleasanton Ridge/Niles Canyon area as well as seismic issues in the East Bay (Hayward Fault). Both the City of Fremont and the City of Pleasanton are opposed to HST alternatives through these cities because of potential environmental issues, right-of-way constraints, and other logistical issues.



U.S. Department of Transportation
Federal Railroad Administration

Figure 8.5-1
Bay Area to Central Valley HST Preferred Alternative

3. The Pacheco Pass best utilizes the Caltrain corridor.

The Pacheco Pass alternative would enable the early, incremental implementation of the entire Caltrain Corridor section between San Francisco, San Jose, and Gilroy. The HST system is complimentary to Caltrain and would utilize the Caltrain right-of-way and share tracks with express Caltrain commuter rail services. Caltrain intends to use lightweight, electrified trains that would be compatible with HST equipment. Because it utilizes the Caltrain corridor, environmental impacts would be minimized. The Authority's phasing plan identifies the Caltrain Corridor (between San Francisco and San Jose) as allowing the Authority to maximize the use of local and regional funds dedicated to train service improvements, and thereby helping to reduce the need for state funds.

4. The Pacheco Pass is strongly supported by the Bay Area region, cities, agencies, and organizations.

Many of the Bay Area local and regional governments, transportation agencies, and business organizations strongly support the Pacheco Pass alternative to San Francisco via San Jose and the Caltrain Corridor. As described in Section 8.2.1, there is strong local and regional government support along the Pacheco Pass alignment throughout the Bay Area. This support is critical towards implementing this major infrastructure project through the heavily urbanized Bay Area linking San Francisco, San Jose and Gilroy.

The Central Valley (including Sacramento) and many transportation and environmental organizations are united in strongly preferring the Altamont Pass. However, to reach the major markets in the Bay Area, the Altamont Pass alternatives must go through Alameda County, including Livermore and Pleasanton in the Tri-Valley and Fremont. The Tri-Valley PAC (a partnership that includes the cities of Dublin, Livermore, Pleasanton, Danville, San Ramon, and Tracy along with transportation providers LAVTA, ACE, and BART) has raised serious concerns regarding right-of-way constraints and the need for aerial structures through the Tri-Valley. The Tri-Valley PAC supports HST service through the Pacheco Pass and "regional overlay service provided through the Altamont pass." They believe that this option may present the best way of addressing their concerns and delivering optimal HST service to the region as a whole. The Alameda County Congestion Management Agency and Alameda County Supervisor Scott Haggerty both support the MTC recommendation for the Pacheco alignment via the San Francisco Peninsula as the main HST express line between Northern and Southern California while also supporting upgraded interregional services between the Bay Area—Sacramento and the San Joaquin Valley via the Altamont Pass. The City of Fremont opposes the Altamont Pass alternative as does the City of Pleasanton although Pleasanton remains "open" to terminating Altamont alternatives in Livermore. The concerns through Alameda County are significant enough that the MTC, Alameda County Congestion Management Agency, and Alameda County Supervisor Scott Haggerty have requested that "the CHSRA also evaluate an alternative in the Altamont Corridor that terminates HSR at a proposed BART Livermore station"—even with the main HST express line using the Pacheco Pass.

8.6 Preferred HST Alignment Alternatives and Station Location Options for the Preferred Pacheco Pass Network Alternative

8.6.1 San Francisco to San Jose

A. PREFERRED ALIGNMENT ALTERNATIVE

- Caltrain Corridor (Shared Use)

Analysis

The Draft Program EIR/EIS analyzed one alignment alternative between San Francisco and San Jose along the San Francisco Peninsula that would utilize the Caltrain rail right-of-way and share tracks with express Caltrain commuter rail services. The Caltrain Corridor (Shared Use) is the preferred alignment alternative for direct service to San Francisco and San Francisco International Airport (SFO).

The alignment between San Francisco and San Jose is assumed to have 4 tracks, with the two middle tracks being shared by Caltrain and HST and the outer tracks used by Caltrain. The HST could operate at maximum speeds of 100–125 mph along the Peninsula providing 30-minute express travel times between San Francisco and San Jose. Environmental impacts would be minimized since this alignment utilizes the existing Caltrain right-of-way. This alignment alternative would increase connectivity and accessibility to San Francisco, the Peninsula, and SFO, the hub international airport for northern California. The HST system would provide a safer, more reliable, energy efficient intercity mode along the San Francisco Peninsula while improving the safety, reliability, and performance of the regional commuter service because of the fully grade separated tracks with fencing to prevent intrusion, additional tracks, and a state-of-the-art signaling and communications system. The HST alignment would greatly increase the capacity for intercity and commuter travel and reduce automobile traffic.

Many comments in favor of the proposed HST on the San Francisco Peninsula were received from agencies and the public, including MTC, the City of San Francisco, Caltrain JPB, SamTrans, the Transbay Transit Center JPB, the City of Santa Clara, the County of Santa Clara, the City of Morgan Hill, and the San Francisco Chamber of Commerce. There was also opposition to improvements on the Caltrain corridor raised by some members of the public. The City of Menlo Park supported investigating options to avoid the San Francisco Peninsula area by substituting existing transit systems for the HST, and the Town of Atherton supports options that would avoid HST service through the Town of Atherton as well as investigating trench concepts through the Town of Atherton at the project level.

B. PREFERRED STATION LOCATION OPTIONS

- Downtown San Francisco Terminus: Transbay Transit Center

<u>Analysis</u>

The Transbay Transit Center site is the preferred station location option for the San Francisco HST Terminal. The Transbay Transit Center would offer greater connectivity to San Francisco and the Bay Area than the 4^{th} and King site (about a mile from the financial district) because of its location in the heart of downtown San Francisco and since it would serve as the regional transit hub for San Francisco. The Transbay Transit Center is located in the financial district where many potential HST passengers could walk to the station. The Transbay Transit Center is also expected to emerge as the transit hub for all major services to downtown San Francisco, with the advantage of direct connections to BART (1 block from the terminus), Muni, and regional bus transit (SamTrans, AC Transit, and Golden Gate Transit). Moreover, the Transbay Transit Center is compatible with existing and planned development and is the focal point of the Transbay redevelopment plan that includes extensive high-density residential, office, and commercial/retail development. Sensitivity analysis on the Pacheco Pass "Base" forecasts (low-end forecasts) concluded that the Transbay Transit Center would attract about 1 million more annual passengers a year by 2030 than the 4^{th} and King station location option.

The capital costs needed for the HST component of the Transbay Transit Center (including the 1.3-mile extension) is estimated to be similar to the estimated costs for the 4^{th} and King option. Since the rail component would be shared with Caltrain services, the Transbay Joint Powers Authority funding plan assigns only a portion of the rail related Transbay Transit costs to the HST system. The rail facilities planned for the Transbay Transit Center are limited to 6 tracks and 3 platforms; however, Caltrain is planning to continue using the existing 4^{th} and King terminal. The Authority's operational analysis indicated that to serve all of the HST trains proposed in the Authority's operational plan, four tracks and two island platforms would have to be dedicated to HST service. Further cooperative operations planning analysis of Transbay terminal rail capacity is needed to determine the most efficient mix and scheduling of both HST and Caltrain commuter services.

Public and agency comments have largely favored the Transbay Transit Center site. The City of San Francisco, the Transbay Terminal JPB, San Mateo County Transit District (SamTrans), the Peninsula Corridor (Caltrain) Joint Powers Board (JPB), San Mateo County Transportation Authority (TA), the San Francisco Chamber of Commerce, and AC Transit all submitted comments in favor of the Transbay Terminal site.

- San Francisco Airport Connector Station: Millbrae (SFO)

Analysis

SFO serves as the "hub" airport for international travel in Northern California and is located about 12 miles south of downtown San Francisco. The conceptual design is to link to SFO at the Millbrae Caltrain/BART station location option which is adjacent to SFO (but not directly at the airport). This multi-modal station would link to the airport by the existing BART connection and could possibly be reached in the future by the airport people mover system. The Millbrae (SFO) HST station supports the objectives of the HST project by providing an interface with the northern California hub airport for national and international flights. The Millbrae (SFO) is the preferred HST airport connector station on the San Francisco peninsula.

- Mid-Peninsula Station: Continue to investigate both potential sites and working with local agencies and the Caltrain JPB determine whether a Mid-Peninsula station site should be recommended.

Analysis

The Palo Alto and Redwood City station location options would both be multi-modal stations, with similar costs, construction issues, right-of-way issues, and potential environmental impacts. The Redwood City station would have slightly more riders (0.06 million by 2030), but the Palo Alto station would greater connectivity The City of Redwood City and the Redwood City Chamber of Commerce support the Redwood City station location option. Future project-level studies should continue to investigate both potential sites and working with local agencies and the Caltrain JPB determine whether a Mid-Peninsula station site should be recommended.

8.6.2 San Jose to Central Valley: Pacheco Pass

A. PREFERRED ALIGNMENT ALTERNATIVE

- Pacheco Pass via Henry Miller Road (UPRR Connection). At the project-level, however, the Authority will continue to seek and evaluate alignment alternatives (both to the north and south of Henry Miller Road) utilizing the Pacheco Pass that would minimize or avoid impacts to resources in the GEA. The Final Program EIR/EIS has no Los Banos Station and the Authority has reiterated and expanded its commitment that there will be no station between Gilroy and Merced.

Analysis

The Pacheco Pass via Henry Miller (UPRR Connection) alignment alternative would provide slightly higher ridership potential, provide the fastest travel times and the most direct link between the Bay Area and Southern California (3-4 minutes faster), have slightly less capital costs, and would generally parallel Henry Miller Road, an existing roadway corridor through the environmentally sensitive areas in the Central Valley (resulting in fewer potential severance impacts), while having similar potential environmental impacts as the other Pacheco Pass alignment alternatives evaluated.

The GEA North alignment alternative is estimated to have higher potential visual impacts (medium vs. low), severance impacts, and cultural impacts than either Henry Miller alignment alternative. Potential impacts on farmlands, streams, lakes/waterbodies, and 4(f) and 6(f) resources are estimated to be about the same for each alignment alternative. The GEA North alignment alternative is estimated to have higher potential impacts on wetlands (17.96 ac vs. 11.61 ac), but less potential impacts on non-wetland waters (6,771 linear ft vs. 10,588 linear ft.) when compared to the Henry Miller (UPRR Connection) alignment alternative. Both alignment alternatives would have the potential to impact special-status plant and wildlife species. While both alignment alternatives would likely result in impacts on the GEA, the GEA North alignment alternative would have greater impacts on publicly owned lands and be more disruptive to wildlife movement patterns than the Henry Miller Road alignment alternative. The GEA North alignment alternative would be on a new alignment and bisect the GEA and result in a new barrier to wildlife movement. The Henry Miller alignment alternative would be elevated through large portions of the GEA parallel to an existing roadway that, along with a nearby canal, already bisects the GEA and disrupts wildlife movement. The Henry Miller alignment alternative would provide greater opportunities for mitigation and environmental improvements for wildlife.

The Authority has received a considerable amount of input regarding each of the three alignment alternatives investigated for the “San Jose to Central Valley” corridor. Most of these comments are in regard to concerns over potential impacts on the GEA including comments from the Grassland Water District, Grassland Resources Conservation District, Grassland Conservation, Education & Legal Defense Fund, USFWS, CDFG, and Ducks Unlimited.

As noted above, the comments from these agencies and organizations concerned potential impacts on special status species and biological resources including the San Joaquin kit fox, waterfowl, amphibians, and plants; vernal pools; and wetlands that may be affected by the Pacheco Pass via Henry Miller Road (UPRR Connection) either through or near the GEA, in the San Luis National Wildlife Refuge Complex, on state or federal-owned lands, and on other conservation areas, such as private lands subject to conservation easements. The biological analysis for this EIR/EIS was conducted at a program level and identifies the need for field reconnaissance-level surveys to be conducted in the future at the project level. These future surveys will determine specific habitat conditions and impacts along alignment alternatives and surrounding areas and will identify specifically where impacts on special-status species could occur, leading eventually to focused species surveys. The Pacheco section of the HST system will be further designed at the project-level to avoid or minimize potential impacts. Broad program mitigation measures have been identified and will be further refined at the project level that will mitigate most of the impacts identified by these agencies and organizations. The Authority and FRA will continue coordination with all agencies and organizations involved to identify specific issues and develop solutions that avoid, minimize, and mitigate potential biological impacts.

Concerns have been raised by the Grasslands Water District, the Sierra Club, and others regarding potential impacts on the GEA by a potential HST station to serve Los Banos and/or a maintenance facility in the vicinity Los Banos along the Henry Miller Road alignment alternative. Between Merced and Gilroy, the high-speed trains will be maintaining speeds well over 200 mph. As previously noted, the fact that there is no population between Merced and Gilroy along the Pacheco Pass is a positive attribute for HST operations since there are fewer communities and hence fewer community impacts. The Authority’s certified Statewide Program EIR/EIS states, “The Authority has determined that the Pacheco Pass alignment HST station at Los Banos (Western Merced County) should not be pursued in subsequent environmental reviews because of low intercity ridership projections for this site, limited connectivity and accessibility, and potential impacts to water resources and threatened and endangered species. Although the City of Los Banos supports the Pacheco Pass alignment with a potential station at Los Banos, considerable public and agency opposition has been expressed about a potential Los Banos station because of its perceived potential to result in growth related impacts" (Page 6A-9). This Final Program EIR/EIS has no Los Banos Station, and the Authority has reiterated and expanded its commitment that there will be no station between Gilroy and Merced. In addition, there are no maintenance and storage facilities considered in the Los Banos area (or in the vicinity of the GEA) as part of this Final Program EIR/EIS (see Section 2.5.3), and the Merced (Castle AFB) site has been identified as the preferred location within the study area for a maintenance facility (see Section 8.6.4).

From a biological perspective, the Pacheco Pass via Henry Miller Road (UPRR Connection) is the recommended preferred alignment alternative because the measures that would be necessary to avoid, minimize, and/or mitigate biological impacts could be accomplished during project design, construction, and operation, and this alignment alternative offers greater opportunities for environmental improvement (see Section 3.15.5).

B. PREFERRED STATION LOCATION OPTIONS

- Downtown San Jose Terminus: Diridon Station

Analysis

Diridon Station is the preferred HST station location option for downtown San Jose and the Southern Bay Area, serving Caltrain, ACE Commuter Rail, the Capitol Corridor, Amtrak long distance services, VTA buses and light rail, and a possible future link to BART (from Fremont). Diridon Station is a multi-modal hub that maximizes connectivity to downtown San Jose, San Jose International Airport (Diridon Station is just over 3 miles from San Jose International Airport and the City of San Jose expects there will be a direct local rail line connecting these to two major transportation hubs), and the southern Bay Area, and would have high ridership potential. The Authority identifies the Diridon Station as the preferred HST station location option for San Jose and the southern Bay Area. Diridon Station is favored by the City of San Jose and the Valley Transportation Authority (VTA).

- Southern Santa Clara County: Gilroy Station (Caltrain)

Analysis

Gilroy (Caltrain) Station is the preferred HST station location option to serve Southern Santa Clara County and the Monterey Bay Area. This station location option would provide the highest accessibility and connectivity for these regions and would have the highest ridership potential.

8.6.3 Central Valley

A. PREFERRED ALIGNMENT ALTERNATIVE

- UPRR N/S alignment alternative. However, at the project-level, the Authority would continue to evaluate the BNSF alignment alternative because of the uncertainty of negotiating with the UPRR for use of some of their right-of-way, and would continue investigation of alignments/linkages to a potential maintenance facility at Castle AFB.

Analysis

The alignment alternatives considered for the "Central Valley Alignment" generally followed the two existing freight corridors of the UPRR and the BNSF. With that in mind, HST impacts throughout the Central Valley that have already been reduced and avoided could be further avoided and minimized by sharing the existing freight railroad right-of-way. If a decision were made to proceed with the

HST system, the Authority would seek agreements with freight operators to utilize portions of the existing rail right-of-way to the greatest feasible extent.

The UPRR alignment alternative would have high potential ridership for both the Pacheco Pass and Altamont Pass corridors and would serve potential downtown station sites at Modesto and Merced. This alignment alternative would provide the highest connectivity and accessibility for this part of the Central Valley and would best meet the Authority's adopted transit-oriented development criteria for station location options by serving the downtowns of these Central Valley cities. However, the UPRR has expressed opposition to the use of its right-of-way.

The UPRR alignment alternative would have somewhat higher potential noise and visual impacts and more potential impacts on cultural resources (67 vs. 17-28) since it goes through more urban areas, but would have somewhat fewer potential impacts on farmlands (535 ac vs. 776-838 ac), lakes/waterbodies (0.0 ac vs. 1.5-1.6 ac), wetlands (3.04 ac vs. 3.11-3.76 ac) and non-wetland waters (7,161 linear ft vs. 9,094–10,528 linear ft), and floodplains (124.4 ac vs. 158.2-191.1 ac) than the BNSF alignment alternatives.

B. PREFERRED STATION LOCATION OPTIONS

- Modesto: Downtown Modesto

Analysis

The Downtown Modesto Station is the preferred HST station location option for Modesto since it maximizes connectivity and accessibility to downtown Modesto and would best meet the Authority's adopted transit-oriented development criteria for station location options by serving the downtown of this Central Valley city. This option is expected to have slightly higher ridership potential and is more compatible with surrounding land uses than the Amtrak Briggsmore site with similar costs and environmental impacts. The Downtown Modesto Station is favored by the City of Modesto and the San Joaquin County Council of Governments. The Amtrak Briggsmore site would need to continue to be investigated as a part of future project-level analysis since it would be the station site to serve the Modesto area for the BNSF alignment alternative.

- Merced: Downtown Merced

Analysis

The Downtown Merced Station is the preferred HST station location option for the Merced area since it maximizes connectivity and accessibility to downtown Merced and would best meet the Authority's adopted transit-oriented development criteria for station location options by serving the downtown of this Central Valley city. This option is expected to have less potential impacts on farmlands (0 ac vs. 12 ac) and is more compatible with surrounding land uses than the Castle AFB site with similar costs, ridership, and environmental impacts. The Castle AFB site would need to continue to be investigated as a part of future project-level analysis since it could be the station site to serve the Merced area for the BNSF alignment alternative. The Castle AFB is recommended as the preferred site for the maintenance facility within the study region.

8.6.4 Maintenance Facilities

A. PREFERRED LOCATION WITHIN STUDY AREA

- Merced area (Castle AFB)

Analysis

The preferred maintenance and storage facility location to support the HST fleet in the study region is the Merced area (Castle AFB). The number of maintenance facilities needed for the statewide system, their locations, and sites will be further defined at the project level. Two locations were considered for “Fleet Storage/Service and Inspection/Light Maintenance” within the study region: (1) West Oakland; and (2) Merced (near or at Castle AFB). There is strong support in the Merced region (Merced County, U.C. Merced, Congressman Cardoza, Merced County HSR Committee, and the Merced County Association of Relaters) for the maintenance facility. The West Oakland site would not serve the preferred Pacheco Pass alternative but should be considered as a part of future Regional Rail/HST project via the Altamont corridor. Program-level evaluation considered only a site in the Bay Area at West Oakland as representative of system maintenance needs in the Bay Area. Possible Bay Area locations and sites for fleet storage/service and inspection/light maintenance facility along the preferred HST alternative between Gilroy and San Francisco will be considered as part of project-level engineering and environmental review.

8.6.5 San Francisco Bay Crossings

A. PREFERRED ALIGNMENT ALTERNATIVE

- No Bay crossing for the proposed HST system.

Analysis

The preferred alternative has no San Francisco Bay crossing. The Trans Bay Crossing between Oakland and San Francisco is estimated to result in potential direct impacts on 20.07–22.1 acres of Bay Waters and indirect impacts on 228–235.5 acres of waterbodies. The cost associated with this approximately 7-mile crossing is estimated at over $5 billion (over $700 million per mile) with a ridership increase of up to about 2%. To implement this alignment alternative, extensive coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission and crossing the Bay would be subject to the USACE, CDFG, and BCDC permit process.

The Dumbarton Crossing would result in potential direct impacts on 33.9–55.4 acres of wetlands (predominately through the Don Edwards San Francisco Bay National Wildlife Refuge) and direct impacts of 2,361–3117 linear feet of Bay waters. All of the Dumbarton alignment alternatives are estimated to have high noise impacts where the alignment is predominately on aerial structure through Fremont, and the bridge alignment alternatives (high bridge and low bridge) would have high potential noise and vibration impacts throughout the alignment. The cost associated with this approximately 19–21.7-mile crossing is estimated at $1.5 billion (low bridge) to over $3 billion (tube). With the low-bridge alternative, HST service would be interrupted by water traffic, adversely impacting the reliability and service quality of the HST system. Constructing a new bridge or tube crossing along the Dumbarton corridor would involve major construction activities in sensitive wetlands, saltwater marshes, and aquatic habitat, requiring special construction methods and mitigations. All the alignment alternatives would result in direct impacts on Don Edwards San Francisco Bay National Wildlife Refuge and would have potential direct impacts on 15 special-status plant and 21 special-status wildlife species. To implement this alignment alternative across the bay, extensive coordination would be required with the USACE under Section 10 of the Rivers and Harbors Act and the California Coastal Commission and the Bay crossing would be subject to the USACE, CDFG, and BCDC permit process. BCDC scoping comments note that bridge alignment alternatives that could have adverse impacts on Bay resources can only be approved by BCDC “if there is not an alternative upland location for the route and if the fill in the minimum necessary to achieve the purposes of the project” (BCDC scoping response, December 15, 2005). The Authority has received comments signed by 5 members of Congress and 4 members of the California Legislature stating that any alignment alternative requiring construction through the Don Edwards San Francisco Bay

National Wildlife Refuge with additional impacts on the San Francisco Bay and Palo Alto shore of the Bay should be rejected. The City of Fremont opposes the Dumbarton Crossing alignment alternatives because of the potential impacts on Fremont neighborhoods.

The MTC supports a new Transbay Tube between San Francisco and Oakland (via the San Francisco Peninsula) and the Town of Atherton supports a new Transbay Tube between Oakland and San Francisco (via the East Bay).

8.7 Altamont Pass Project

The Altamont Pass provides superior travel times between Sacramento/Northern San Joaquin Valley and the Bay Area and is strongly supported by the Central Valley. Many of the comments received in support of the Altamont Pass are related to its great potential for serving long-distance commuters between the Central Valley and the Bay Area. As indicated by the comments received by the Tri-Valley PAC, many of the negative impacts associated with construction of HST through the Tri-Valley might be considerably reduced by the elimination of the additional tracks needed for HST express services.

The Authority is pursuing a partnership with "local and regional agencies and transit providers" to propose and develop a joint-use (Regional Rail and HST) infrastructure project in the Altamont Pass corridor—as advocated in MTC's recently approved "Regional Rail Plan for the San Francisco Bay Area." Regionally provided commuter overlay services would require regional investment for additional infrastructure needs and potentially need operational subsidies. The Authority cannot unilaterally plan for regionally operated commuter services.

"Regional Rail" in the Altamont Pass corridor will be pursued by the partnership as an independent project to satisfy a different purpose and need[1] from the proposed HST system, but that would also accommodate HST service. The Authority's pursuit of improved regional rail service in the Altamont Pass corridor is dependent upon forming a partnership with the region for the joint-use infrastructure. After a partnership is established, the Authority will spearhead (or some combination of lead, collaborate, and coordinate) future environmental studies and work in partnership with other agencies to secure local, state, federal, and private funding to develop a joint-use infrastructure project in the Altamont corridor, including recommending that this corridor be added as part of the HST funding package.

The Authority's analysis suggests that Altamont HST overlay service might terminate in Oakland and/or San Jose via the East Bay (see Figure 8.5-1), whereas the Regional Rail Plan recommends it cross the Bay at Dumbarton. MTC also recommends future study of terminating this service in Livermore. As a part of future studies, the Authority will need to work with MTC and other agencies to define the appropriate alternatives to be investigated for Regional Rail/HST in the Altamont Pass to serve long-distance interregional commuters. The Authority is pursuing potential joint-use Altamont Corridor Regional Rail/HST services and identifying alternatives for further evaluation, including direct service to Oakland and/or San Jose or potentially terminating HST service at Livermore (connecting to an extended and enhanced BART system). The Authority's objective is that the infrastructure would be electrified, fully grade-separated, and compatible with and shared by HST services. Providing connectivity and accessibility to Oakland and Oakland International Airport would be a crucial objective for this project.

To lay the groundwork for a future Regional Rail/HST Altamont Pass project, the Authority will work with ACE, SJRRC, San Joaquin County Council of Governments, the Tri-Valley Pac, Alameda County, Santa Clara County, and others to get the Altamont Regional Rail/HST project identified in the update

[1] As defined in CEQA and NEPA implementing regulations, procedures, and guidelines.

to the 2035 Regional Transportation Plan (RTP) and funds programmed in the 2035 RTP and RTIP. Once the Bay Area to Central Valley HST Program EIR/EIS is certified, the Authority will lead a Altamont Regional Rail/HST Steering Committee that will include MTC and agencies and transit providers along the Altamont corridor project study that will address the Altamont Pass, the East Bay connections, and stations in partnership, and provide the information necessary for the Authority to undertake an environmental study for this project.

9 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

This chapter of the Program EIR/EIS describes any potentially significant adverse environmental effects, identifiable at the program level of environmental review, that cannot be avoided should the proposed HST system or a network alternative be implemented and any unavoidable adverse impacts of the alternatives, as required by CEQA and NEPA, respectively. This chapter also describes any significant irreversible or irretrievable commitments of resources or foreclosures of future options, identifiable at the program level of environmental review, that would be involved in the proposed HST system or network alternatives should one be implemented.

This Program EIR/EIS represents the second part of the first conceptual planning stage of a tiered environmental evaluation that analyzes a broad range of HST Alignment Alternatives and a number of Network Alternatives. Most potentially significant impacts that have been described in previous chapters of this document can be avoided or minimized by selecting an alignment alternative that avoids or minimizes impacts on environmental resources through refinement to the design or specific location of the alignment or station, or through incorporation of mitigation measures. For example, some potentially significant impacts on sensitive habitat or wetlands would occur in areas where alignment alternatives are available that would avoid or minimize the impact, such as tunneling or designing the alignment to avoid the sensitive area. In addition, potential noise impacts would occur in residential areas along the alignment alternatives where significant noise levels could be reduced to less than significant with implementation of mitigation measures such as noise walls between the train track or highway and the residential receptors. However, there are some unavoidable potentially significant impacts that could occur as a result of implementation of the HST Network Alternatives under consideration. Those impacts are discussed below.

9.1 Potentially Adverse Unavoidable Significant Impacts

9.1.1 Fuel Consumption and Energy Use

Potentially significant impacts of the No Project Alternative that cannot be mitigated or reduced to less than significant include consumption of an estimated 408 million barrels of oil per year under the No Project Alternative in 2030, over 63 million barrels of oil per year more than existing conditions.[1] The No Project Alternative would continue California's dependency on automobiles and airplanes for intercity travel. The statewide HST system would annually consume approximately 386 million barrels of oil. The proposed HST system would result in a savings of about 22 million barrels of oil (a 5% difference) over the 2030 No Project Alternative.

Operation of the proposed HST system would potentially increase the load on the statewide electric power system by an estimated 794 MW during the peak period in 2030. Overall, the HST electricity demand would represent about a 0.96% increase in 2030. During construction, energy consumption for the HST system is estimated to be approximately 128 MMBTUs, or 22 million barrels of oil.

9.1.2 Biological Resources and Wetlands, Agricultural Land, Section 4(f) and 6(f) Resources, Cultural and Paleontological Resources, and Visual Resources

The HST Network Alternatives would each commit the use of land and natural resources to a transportation right-of-way, even though much of the system would be constructed along existing transportation facilities. Some potentially significant unavoidable impacts on biological resources (wetlands and habitat for threatened and endangered species) might occur where the land required for

1 No Project Alternative energy consumption based on June 11, 2007, forecasts provided by Cambridge Systematics. See Chapter 2, "Alternatives."

right-of-way for the proposed HST alignment alternative contains wetlands or wildlife habitat for special-status species. Some potentially significant unavoidable impacts on agricultural land may occur where the land required for right-of-way is in agricultural use. Similarly, potential unavoidable impacts on Section 4(f) and 6(f), cultural, and visual (scenic landscapes) resources could occur where the HST alignment calls for tunnels, elevated alignments, or right-of-way adjustments. The proposed HST alignment would require relatively straight, flat, long linear features; moving or curving the alignment to avoid resources might not always be feasible and could result in impacts on other resources. Similar effects would occur from property acquisition and land use along the width and length of the proposed HST Network Alternatives.

Only general statements of potential impacts can be made at this program level of review because detailed field studies were not conducted and the study areas used for some of the analysis was many times larger than the actual right-of-way (direct impact areas) for the network alternatives under consideration in most instances. Potential impacts would need to be further studied and clarified in the next stage of project design and environmental review, when more specific information would be available on the right-of-way needed for proposed HST Network Alternatives alignments and station location options and on the specific properties potentially affected. The objective at the project-specific stage of analysis would be to identify design options (plans and profiles) that would avoid these sensitive resources to the extent feasible.

9.1.3 Construction Impacts

Construction of the HST Network Alternatives would result in the irreversible commitment of resources. Fossil fuels, labor, and construction materials would be expended as part of construction. Further, labor and natural resources would be used in the fabrication and preparation of construction materials. Once used or expended, these materials are generally not retrievable. However, these materials are not in short supply and their use would not have an adverse effect on the continued availability of resources. Any construction of the proposed HST Network Alternatives would also require the expenditure and allocation of local, state, and federal funds, which are not retrievable. Once used, these funds could not be used for other projects.

Short-term construction impacts related to earthwork (cut and fill and grading) that would result in dust (PM10 and PM2.5) and localized emissions and noise from construction equipment would occur under each of HST Network Alternatives. Other short-term construction impacts include impacts to already impaired waters. The construction of the San Francisco Bay crossings may include trench or bored tunnels for tubes; this type of construction is likely to disrupt Bay sediment and may disrupt any contaminants trapped in the sediment. These impacts would be in addition to the construction impacts associated with already planned projects included in the No Project Alternative. Because the construction period would last a number years and the length of the HST statewide system under construction at any one time would extend beyond just the Bay Area to Central Valley corridor, these physical impacts would potentially be significant. The potential impacts of this construction activity would be addressed in more detail during project-level analysis. This same construction activity would also have potential benefits to employment and to the California economy from construction jobs and contracts for the services and materials. The California High Speed Rail Authority's final business plan (Business Plan) (California High Speed Rail Authority 2000) describes that an estimated 300,000 job-years of employment would be created as a result of HST system construction.

9.2 Relationship Between Short-Term Uses of Environment and Enhancement of Long-Term Productivity

Any change to the Bay Area to Central Valley transportation system of the magnitude needed to meet the projected intercity travel demand by the year 2030 would have short-term effects on the human and physical environment, but it would enhance long-term productivity and reduce risks to health and safety.

Implementation of the proposed HST Network Alternatives would result in short-term population changes from relocations associated with potential property acquisitions and potential relocation of wildlife from habitat disturbance during construction and operation. These factors would be considered in more detail during project-level review. While some relocations associated with property acquisition are likely, long-term benefits would also result, including enhanced long-term productivity related to increased mobility and safety and the reduced travel time, air pollutant emissions, and energy use that an improved intercity transportation system would provide.

Short-term benefits of any of the HST Network Alternatives include employment opportunities during construction (spread over a number of years) and locally purchased materials and services.

As indicated in Chapter 1, "Purpose and Need and Objectives," the existing and programmed transportation improvements in California will not keep up with the currently projected rate of future population growth and the increased intercity travel demand projected for California. As described in Chapter 5, "Economic Growth and Related Impacts," the proposed HST system would provide user benefits (travel time savings, cost reductions, and accident reductions) and accessibility improvements for Bay Area and Central Valley citizens. The HST system would improve accessibility to labor and customer markets, thereby improving the competitiveness of industries and the overall local and regional economy. With this second effect, businesses that chose to locate in proximity to an HST station could operate more efficiently than businesses that locate elsewhere. The analysis shows that any of the HST Network Alternatives would be more efficient, compared to the No Project Alternative, in terms of the land consumed per new job and resident, and could provide an incremental development density that is about 4.0% more efficient.

9.3 California Environmental Quality Act Significance

This section describes those environmental effects identified in Chapter 3 that would be considered significant under CEQA. The potential for the proposed project and alternatives to stimulate unplanned growth is considered in Chapter 5, "Economic Growth and Related Impacts." Cumulative impacts are discussed in Section 3.17, "Cumulative Analysis."

Use of the term "significant" differs under NEPA and CEQA. While CEQA requires that the significance of impacts be discussed in an EIR, NEPA does not require such discussion in an EIS. Under NEPA, significance is used to determine whether an EIS or some other level of documentation is required, and once a decision to prepare an EIS is made, the EIS reports all impacts and discusses feasible mitigation. Under CEQA, significance is used to determine whether to prepare an EIR, and then to evaluate the severity of potential adverse environmental impacts in the EIR. The EIR must also discuss feasible mitigation measures that could reduce potentially significant effects. For this reason, CEQA significance criteria and the determination of significant impacts under CEQA have been addressed separately in this section.

NEPA anticipates that mitigation will be considered where feasible for the potential impacts of a project. Therefore, while consideration of some mitigation strategies described in this Program EIR/EIS and in this section is appropriate under NEPA, the potential impacts they address may not be considered significant under CEQA.

9.3.1 California Environmental Quality Act Significance Thresholds

CEQA requires that an EIR identify the potentially significant environmental effects of the project (CEQA Guidelines Section 15126), but does not promulgate specific thresholds for significance. Instead, CEQA Guidelines Section 15064(b) states "the determination…calls for careful judgment on the part of the public agency involved…" and that "an ironclad definition of significant effect is not possible because the significance of an activity may vary with the setting." The fundamental definition of significant effect under CEQA is "a substantial adverse change in physical conditions." This criterion underlies the evaluation of environmental impacts for most of the impact issues identified in the CEQA Environmental Checklist Form (Guidelines Appendix G). CEQA encourages lead agencies to develop and publish their own thresholds of significance for the purpose of determining the significant effects of their projects. Given the planning-level impact analysis considered in this Program EIR/EIS, the Authority has not developed project-specific significance thresholds.

Some impact categories lend themselves to scientific or mathematical analysis, and therefore to quantification. Some categories have significance thresholds established by regulatory agencies, such as noise criteria or regional air pollutant criteria. For other impact categories that are more qualitative or are entirely dependent on the immediate setting, a hard-and-fast threshold is not generally feasible, and the "substantial adverse change in physical conditions" is applied as the significance criterion. In the current analysis, the CEQA checklist thresholds have been used to evaluate the significance of effects of the HST Alignment Alternatives.

CEQA states that economic and social changes resulting from a project shall not be treated as significant effects on the environment (CEQA Guidelines, 15064[e]). Economic or social changes may be used, however, to determine that a physical change should be regarded as a significant effect on the environment. Where a physical change is caused by economic or social effects of a project, it may be regarded as a significant effect in the same manner as any other physical change resulting from the project. If it causes adverse economic or social effects on people, those adverse effects may be used as a factor in determining whether the physical change is a significant effect on the environment. Where the HST Network Alternatives would involve widening or expanding existing transportation rights-of-way, the potential for adverse environmental impacts and for potential economic or social effects is limited because the transportation corridor and its associated impacts are already well established. However, where the HST Network Alternatives would involve new transportation facilities on new rights-of-way (e.g., stations or alignment) or would bring large numbers of people to new station areas, there is greater potential for significant effect.

9.3.2 Potentially Significant and Unavoidable Adverse Impacts

This section identifies those environmental categories that, given their potential for impact, would be those most likely to experience potentially significant unavoidable adverse effects at some locations along the alignment alternatives being considered for the proposed HST Network Alternatives between the Bay Area and Central Valley. The planning level of environmental review presented in this Program EIR/EIS does not seek to quantify impacts as would typically be done at a project level. Instead, this Program EIR/EIS evaluates the potential for significant effects for the HST Network Alternatives based on the amount or density of resources and/or sensitive receptors within the project vicinity and ranks the potential for impacts as high, medium, or low. This is an appropriate assessment of potential impacts at this stage of such a large undertaking. The Program EIR/EIS considers HST Network Alternatives, identifies the lesser-impact Network Alternative, and provides a basis for identifying mitigation strategies that is relevant to the decisions at hand.

Based on this planning level of analysis, potentially significant unavoidable impacts are only identified generally. With the scope of this project and the size and diversity of the geographic areas traversed by the potential HST alignment alternatives and station location options, it is likely not feasible to avoid or reduce all of the potentially significant impacts of the proposed HST system at every location under consideration through project modifications or to mitigate all these potential impacts to a less-than-significant level. Table 9.3-1 provides a summary list of the environmental categories, general mitigation strategies, potentially significant impacts, and potential levels of significance after mitigation. Depending on the Network Alternative (discussed in Chapter 7, "High Speed Train Network and Alignment Alternatives Comparisons") that may ultimately be selected, potentially significant unavoidable effects can be expected at some locations in the general environmental categories of agricultural lands, biological resources and wetlands, hydrology and water resources, and cultural resources. However, neither the extent of such potential impacts nor the potential locations for such impacts can be determined at this level of analysis. For several of the environmental categories listed in the table below (including agricultural lands, wetlands, hydrology, and cultural resources), the quantities presented represent areas within which potential impacts might occur by including all the potentially affected resources or acreage in the study area for the resource topic listed. For example, the area of floodplains includes all floodplains within 25 ft (7.6 m) of either side of the centerline of the HST alignment where there are two tracks, whereas where there are four tracks and/or proposed new station facilities, the area analyzed for direct impacts measures 50 ft (15.2 m) of either side of the centerline or station perimeter. Therefore, the determination of significance is potential rather than absolute. The determination of a potentially significant or unavoidable impact would be used to focus attention at the next phase of planning and environmental review (project-specific, detailed analysis).

9.3.3 California Environmental Quality Act Environmentally Superior Alternative

The CEQA Guidelines state that where the No Project Alternative is the environmentally superior alternative, the EIR shall also identify the environmentally superior alternative from among the other alternatives (CEQA Guidelines 15126.6[e][2]). Based on the evaluations documented in Chapters 3, 7, and 8 of this Program EIR/EIS, the Pacheco Pass, San Francisco and San Jose Termini Network Alternative has been identified as the environmentally superior alternative.

Table 9.3-1
Summary of Key Environmental Impact/Benefits of Alternatives

Key Environmental Issues	Alternative		Mitigation Strategy for HST	Potential Significance for HST	
	No Project	HST Network Alternatives		Before Mitigation	After Mitigation
Traffic and Circulation	Capacity is insufficient to accommodate projected growth. 13 of the 18 intercity highway segments considered would operate at unacceptable levels of service with increased congestion, travel delays, and accidents compared to existing conditions. Congestion would increase.	Congestion reduction on intercity highways compared to the No Project Alternative. 15 of the 18 intercity highway segments would experience diversion of trips from vehicles to the HST system yielding improved V/C ratios. Reduce automobile travel in the state 61 billion miles annually. Localized traffic conditions around some stations would be adversely affected.	Encourage use of transit to stations. Work with transit providers to improve station connections.	Potentially significant	Potentially less than significant/ potentially significant/ unavoidable
Travel Conditions (travel time, reliability, safety, connectivity, sustainable capacity, passenger cost)	Longer travel times, more delay. Lower reliability due to dependence on the automobile. Increase in injuries and fatalities due to increase in highway travel. No net improvement to connectivity options. No significant increase in capacity for highway or air infrastructure, and significant worsening of congestion due to increased demand.	Travel time reduction compared to the No Project Alternative. Greatest improvement in reliability due to high reliability of HST mode; significant levels of diversion to HST from auto and air result in reduced congestion; and additional modal option improves reliability for overall transportation system. Decrease in injuries and fatalities due to diversion of trips from highways. Highest level of connectivity. New mode would add a variety of connections to existing modes, additional frequencies, and greater flexibility. HST system would provide sufficient capacity to meet representative demand and would provide substantial additional capacity with minimal additional infrastructure.	N/A	Beneficial	N/A

Key Environmental Issues	Alternative		Mitigation Strategy for HST	Potential Significance for HST	
	No Project	HST Network Alternatives		Before Mitigation	After Mitigation
		HST system would provide a release valve for the existing intercity modes. Overall savings in passenger costs of 22% to 87% on the HST compared to No Project, depending on city pair. HST passenger costs are competitive with the automobile travel and less expensive than air travel.			
Air Quality (Conformity Rule; Statewide tons of pollutants/year)	Statewide emissions predicted to decrease in 2030 due to low emission vehicles; CO_2 to increase statewide. Estimated CO 625,975 tons/year (79% decrease); PM10 25,185 tons/year (same as existing); PM2.5 17,155 tons/year (10% decrease); NO_x 174,470 tons/year (73% decrease); TOG 92,345 tons/year (73% decrease); CO_2 644 million tons/year (38% increase).	Air quality benefit. Pacheco Alternative - Annual decrease in pollutants compared to No Project: CO 32,120 tons/year; PM10 1,460 tons/year, PM2.5 1,095 tons/year, NO_x 7,665 tons/year; TOG 5,110 tons/year; CO_2 8.8 million tons/year (1.4% less than No Project). Altamont Alternative - Annual decrease in pollutants compared to No Project: CO 32,850 tons/year; PM10 1,460 tons/year, PM2.5 1,095 tons/year, NO_x 7,665 tons/year; TOG 5,110 tons/year; CO_2 5.9 million tons/year (0.9% less than No Project). Overall reduction of Greenhouse Gas Emissions compared to No Project.	Control of construction-related emissions.	Beneficial	N/A
Energy Use (Statewide)	Energy consumption of 408 million barrels of oil annually in California in 2030; 63 million over existing conditions.	Energy benefit. Lower statewide energy consumption compared to No Project. Operation of the statewide HST system would result in a savings of 22 million barrels (5%)	Develop and implement energy conservation plan for construction.	Beneficial	N/A

Key Environmental Issues	Alternative		Mitigation Strategy for HST	Potential Significance for HST	
	No Project	HST Network Alternatives		Before Mitigation	After Mitigation
		of oil in 2030. Increase in electric power demand/use of natural gas. Construction-related energy consumption of the HST system would result in a one-time, non-recoverable energy cost of about 22 million barrels of oil.			
Land Use (compatibility and property impacts)	Expansion of urban sprawl as population grows and congestion increases; development on open space and agricultural lands.	Controlled growth around stations, urban in-fill; compatible with transit-first policies. Majority of property acquisition along existing rights of way, some acquisition along new rights of way in undeveloped areas. Impacts to adjoining land uses (residential and industrial) at select locations prior to mitigation. Environmental Justice impacts at select locations along alignments and stations prior to mitigation.	Continued coordination with local agencies. Explore opportunities for joint and mixed- use development at stations. Relocation assistance during future project-level review. Overall mitigation strategies for affected land uses and in EJ areas.	Potentially significant	Potentially less than significant
Visual Quality	No predictable change to existing landscape.	Low to high visual contrasts for elevated structures; low to high sensitivity in scenic open space and mountain crossings.	Design strategies to minimize bulk and shading of bridges and elevated guideways. Use neutral colors and materials to blend with surrounding landscape features.	Potentially significant	Potentially less than significant/ potentially significant/ unavoidable
Noise	More traffic and more air operations from growth in the intercity demand generate more noise.	0 to 20 mi (32.4 km) or 0% to 9% of network alternative length would have high impacts on noise-sensitive land use/populations. Noise increase attributable to HST frequencies. Noise reduction from existing conditions due to	Consider sound barriers along noise-sensitive corridors; track treatment for vibration.	Potentially significant	Potentially less than significant

Key Environmental Issues	Alternative		Mitigation Strategy for HST	Potential Significance for HST	
	No Project	HST Network Alternatives		Before Mitigation	After Mitigation
		elimination of horn and crossing gate noise resulting from grade separation of existing grade crossings. 0 to 52 mi (84.3 km) or 0% to 25% of network alternative length would have high impacts related to vibration. (Range based on HST Network Alternatives. See Chapter 7)			
Farmland (includes area within 25 ft [7.6 m] on each side of alignment centerline [50 ft or 15.2 m total], and station footprint area)	No predictable change from existing conditions as a result from the No Project transportation improvements. Continued loss of farmland in California at rate of 49,700 ac (20,100 ha) per year from population growth and urbanization (845,000 ac [341,960 ha] by 2020).	Right-of-way needs of the HST could potentially impact a total of 755–1,384 ac (306–560 ha) of farmlands. HST alignments along new corridors through farmlands could have potential severance impacts. (Range based on HST Network Alternatives. See Chapter 7)	Avoid or reduce impacts by sharing existing rail rights-of-way to the maximum extent possible and avoiding alignment options in established farmlands. Consider farmland preservation strategies.	Potentially significant	Potentially significant/ unavoidable
Biological Resources and Wetlands (includes area within 50 ft [15 m] on each side of alignment centerline; 100 ft or 30 m total], and station footprint area)	No predictable change from existing conditions.	10.7 to 56.1 ac (4.3 to 22.7 ha) of wetland; 13,113 to 19,891 linear ft (3,997 to 6,063 linear m) of non-wetland waters; 38 to 71 special-status plant species, and 36 to 58 special-status wildlife species. (Range based on HST Network Alternatives. See Chapter 7)	Work with resource agencies to develop site-specific mitigation and impact avoidance strategies for project-level review in coordination with local and regional plans and policies.	Potentially significant	Potentially significant/ unavoidable
Hydrology and Water Resources (includes area within 25 ft [7.6 m] on each side of alignment centerline for two tracks, 50 ft [15 m] on each side of centerline for four tracks and	No predictable change from existing conditions.	178 to 573 ac (72 to 232 ha) of floodplains; 14,400 to 30,300 linear ft. (4,389 to 9,235 m) of streams; 2 to 42 ac (0.8 to 17 ha) of lakes/San Francisco Bay; and 12 to 40 polluted 303(d) waters crossed by HST alignment. (Range based on HST Network Alternatives. See Chapter 7)	Avoid or minimize footprint in floodplains; conduct project-level analysis of surface hydrology and coastal lagoons; BMPs for construction as part of Storm Water Pollution Prevention Plan.	Potentially significant	Potentially less than significant/ potentially significant/ unavoidable

Key Environmental Issues	Alternative		Mitigation Strategy for HST	Potential Significance for HST	
	No Project	HST Network Alternatives		Before Mitigation	After Mitigation
station footprint area)					
Section 4(f) and 6(f) (Public Parks, Recreation, Wildlife and Waterfowl Refuges) (includes area within 900 ft [274 m] on each side of alignment centerline [1,800 ft or 549 m total])	No predictable change from existing conditions.	8 to 46 Section 4(f) and 6(f) properties potentially affected. HST Network Alternatives that extend across the Bay at Dumbarton Bridge would potentially impact Don Edwards San Francisco Bay National Wildlife Refuge, those that extend across Pacheco Pass would potentially impact Upper Cottonwood Creek Wildlife Area (Range based on HST Network Alternatives. See Chapter 7)	Consider design options to avoid parkland, wildlife refuges, and wildlife areas; identify potential site-specific mitigation measures.	Potentially significant	Potentially less than significant/ potentially significant/ unavoidable
Cultural Resources (including Section 4(f) historical resources) (includes area within 500 ft [152 m] on each side of alignment centerline for new routes, 100 ft [30 m] from centerline along existing transportation facilities, and 500 ft [152 m] around station locations)	Low ranking for impacts on archaeological resources and historic property.	78 to 222 known archaeological and cultural resources within Area of Potential Effect. Low to high ranking for potential impacts on archaeological resources and historic properties (HST would use existing rail corridors and some stations and nearby resources developed in historic period). (Range based on HST Network Alternatives. See Chapter 7)	Develop procedures for fieldwork, identification, evaluation, and determination of effects for cultural resources in consultation with State Historic Preservation Office and Native American Tribes.	Potentially significant	Potentially significant/ unavoidable
Growth Potential (includes 11 county study area)	Study area population is expected to grow by about 44%, employment is expected to increase by 37%, and urbanized areas in the study area are expected grow by 39% between 2005 and 2030.	Compared to the No Project condition, the study area population in 2030 is expected to increase about 1.6% with the Pacheco Pass Network Alternatives to 2.2% with Altamont Pass (149,000 to 199,800), employment is expected to increase by 1.7% with Pacheco Pass to 1.8% with Altamont Pass (96,000 to 102,100 jobs), and	Work with local communities to prepare land use plans and policies that encourage higher density development around stations.	Potentially beneficial	N/A

Key Environmental Issues	Alternative		Mitigation Strategy for HST	Potential Significance for HST	
	No Project	HST Network Alternatives		Before Mitigation	After Mitigation
		urbanized areas are expected to increase by 0.1% with Pacheco Pass to 0.6% with Altamont Pass (9,650 ac [3,905 ha] to 14,500 ac [5,868 ha]). Highest growth rates in Madera and Merced Counties, plus Stanislaus for Altamont Pass Network Alternatives. Highest urbanization rates in Madera, Merced, and Fresno Counties, plus San Joaquin and Stanislaus for Altamont Pass Network Alternatives. HST would have similar growth inducement potential regardless of network alternative. Oakland and San Francisco termini options have similar overall growth potential, but spatial shift between East Bay and Peninsula. Service termination in San Jose would lower areawide growth inducement. HST station options have similar systemwide growth inducement potential. Downtown HST station options have lower urbanization rates for home county. (Range based on HST Network Alternatives. See Chapter 5)			
Public Utilities	No impact.	Potential conflicts with 33 to 126 identified utilities, depending on network alternative. (Range based on HST Network Alternatives.)	Relocate, reconstruct, or restore utility; consolidate several utilities underground into one conduit during relocation.	Potentially significant	Potentially less than significant
Geology	Potentially susceptible to seismic hazards.	Potential seismic hazards and slope stability in cut sections.	Use of ground motion data and instruments; routine maintenance of	Potentially significant	Potentially less than significant

Key Environmental Issues	Alternative		Mitigation Strategy for HST	Potential Significance for HST	
	No Project	HST Network Alternatives		Before Mitigation	After Mitigation
			track; slope reinforcement.		
Electromagnetic Fields (EMF) and Electromagnetic Interference (EMI)	General EMF levels may be increased from low-level radiofrequency and infrared for radar and radar-like purposes, and from wireless data transfer and advanced technologies; not likely to cause significant changes in EMF or EMI levels.	Various components of HST infrastructure and trains would be sources of extremely low frequency magnetic fields and radiofrequency EMFs; overall, HST would introduce additional EMF exposures or EMI at levels for which there are not established adverse impacts.	Design features that reduce fields at the source (overhead catenary system, substations, transmission lines; some shielding with metal panels or screens).	No significant impact	Less than significant
Hazardous Materials	Disposal, clean-up, or remediation of exposure to hazardous materials during construction	Estimated 0 to 18 additional hazardous materials/waste sites potentially affected by construction: Superfund (0 to 4 sites), SPL (0 to 6 sites), and SWLF (0 to 8 sites). (Range based on HST Network Alternatives.)	Detailed Initial Site Assessment, avoid known hazardous sites where practicable, sub-surface investigation where needed to characterize sites and identify remediation.	Potentially Significant	Potentially less than significant

ac = acres
CO = carbon monoxide
CO_2 = carbon dioxide
ha = hectares
m = meters
MMBtus = million British thermal units
N/A = not available.
NO_x = oxides of nitrogen
PM10 = particulate matter 10 microns in diameter or less
PM2.5 = particulate matter 2.5 microns in diameter or less
RTPs = regional transportation plans
TOG = total organic gases

10 PUBLIC AND AGENCY INVOLVEMENT

The Authority and the FRA have involved the public and other public agencies in the program environmental review process pursuant to the requirements of CEQA and NEPA. This chapter describes the public and agency involvement efforts in the preparation of this Program EIR/EIS. The public and agency involvement program includes the following efforts.

- Public involvement and outreach—informational materials, including region-specific fact sheets; information and scoping meetings, including public and agency scoping meetings; meetings with individuals and groups; presentations; and briefings.
- Agency involvement—agency scoping meetings, interagency working group, and other agency consultation.
- Notification and circulation of the Draft Program EIR/EIS.

10.1 Public Involvement and Outreach before Draft Program EIR/EIS Release

10.1.1 Public Information

A. MAILING LIST

A mailing list database was developed and used to provide information and announcements concerning the preparation of the Program EIR/EIS to the public. The database was based on an existing Authority contact list and had more than 3,175 entries of federal, state, and local agency representatives; elected officials; property owners; interested persons; and interested organizations. The mailing list was updated for this environmental process by adding public meeting participants and others who asked to be added. Over the course of the project, the list grew to over 3,600 names. This list was used to provide notification of scoping events. The mailing list does not represent the distribution list for the Program EIR/EIS, which is presented in Chapter 13.

B. PUBLICATIONS AND MATERIALS

During the scoping phase, an announcement, fact sheet, and exhibits were developed on various topics. The general announcement regarding scoping meetings was translated into Spanish. The announcement, fact sheet, and exhibits covered the following general topics:

- Dates and agendas of scoping meetings.
- Role and responsibilities of the Authority.
- Project description.
- Project purpose and need, objectives, and alternatives.
- Preliminary alignment and station options in the study area.
- Types of high-speed trains being considered.
- Typical cross sections of high-speed trains.
- Environmental review process.
- Environmental issues and technical studies.

C. CALIFORNIA HIGH SPEED RAIL AUTHORITY WEB SITE

During the program environmental review process, project information and announcements have been posted on the Authority's web site (www.cahighspeedrail.ca.gov). The Authority uses the web site to make public documents widely available. The site includes information on HST, the Final Statewide Program EIR/EIS document, the Authority's Implementation Plan, newsletters, press releases, board of directors meeting information, recent developments and new information regarding status of the Bay Area to Central Valley HST Program environmental review process, information on contacting the Authority, and related links. The scoping report and the alternatives screening reports and public materials, in addition to other reports, have been made available on the web site, which is generally updated monthly.

10.1.2 Public Meetings

The Authority and the FRA held informal and formal public meetings during the EIR/EIS preparation process. Various meeting formats (e.g., open house, formal presentation, and question and comment session) were used to present information and provide opportunities for input by participants. Numerous briefings, presentations, and small group meetings were included in the process (See Chapter 11, "Organization, Agency, and Business Outreach before Draft Program EIR/EIS Release," for a list of meetings in addition to those noted here). There were three general categories of public meetings: public and agency scoping meetings, Authority governing board meetings, and presentations and briefings to interested groups.

A. PUBLIC AND AGENCY SCOPING MEETINGS

The scoping activities for the Bay Area to Central Valley HST Draft Program EIR/EIS were conducted between November 15 and December 16, 2005 (scoping period). The public workshops/scoping meetings drew more than 500 participants. The geographical extent and complexity of the proposed project led to scoping meetings being held in multiple locations from the Bay Area to the Central Valley.

The scoping process included six officially noticed agency and public scoping meetings (Table 10.1-1). At each location, two sessions were held, the first from 3:00 to 5:00 p.m. and the second from 6:00 to 8:00 p.m. Each session consisted of an open house followed by a presentation. Given the important relationship of HST alignments and stations to a regional rail system in the northern California area, the Bay Area to Central Valley HST Program EIR/EIS scoping meetings were held in conjunction with public meetings on the San Francisco Bay Area Regional Rail Plan initiation meetings.

Exhibits and handouts used during scoping meetings were distributed at the meetings and through the Authority's web site. These materials included:

- NOP and NOI.
- Scoping meeting announcement postcard.
- Bay Area to Central Valley HST fact sheet.
- Scoping meeting presentation.
- Exhibit posters.
- Scoping period comment card.

At each meeting, attendees were asked to sign in and provide contact information so that updates and future notices could be sent to them. Authority and regional rail staff facilitated the scoping meeting to provide general information and instruction on how to provide public comment.

Table 10.1-1
Scoping Meeting Locations and Times

Date	City	Location/Address	Time of Public Agency & General Public Meetings
11/29/05	Oakland	Joseph P. Bort Metro Center, Larry D. Dahms Auditorium, 101 Eighth Street, Oakland	3:00–5:00 p.m. 6:00–8:00 p.m.
11/30/05	San Jose	New San Jose City Hall—Council Wing, Community Room W120, 200 East Santa Clara Street, San Jose	3:00–5:00 p.m. 6:00–8:00 p.m.
12/1/05	San Francisco	San Francisco Civic Center Complex, Hiram Johnson Building, Auditorium, 455 Golden Gate Avenue, San Francisco	3:00–5:00 p.m. 6:00–8:00 p.m.
12/5/05	Livermore	Livermore Public Library, Community Room A + B, 1188 S. Livermore Avenue, Livermore	3:00–5:00 p.m. 6:00–8:00 p.m.
12/6/05	Modesto	Doubletree Hotel, Ballrooms 1, 2, and 3, 1150 Ninth Street, Modesto	3:00–5:00 p.m. 6:00–8:00 p.m.
12/8/05	Suisun City	Suisun City Hall, Council Chambers, 701 Civic Center Boulevard, Suisun City	3:00–5:00 p.m. 6:00–8:00 p.m.

Each meeting began with a 1-hour open house during which HST and regional rail staff were present to answer questions and discuss materials being handed out or displayed around the room. Following the open house, PowerPoint presentations were made regarding the overall regional rail plan (presented by regional rail staff) and the HST scoping process (presented by Authority staff). The public was then encouraged to ask for clarification regarding either of the presentations. The remainder of the meeting was dedicated to answering questions from the attendees. Written and verbal comments from these meetings, as well as scoping materials, are included and summarized in the *Bay Area-to-Central Valley Scoping Report* (Authority and FRA 2006).

In addition to the formal scoping meetings, other presentations, briefings, and meetings were held during the scoping process. Meetings were attended primarily by public agencies and other representative local organizations. Notification of the meetings was provided by telephone and/or email to local/regional agency and organization representatives. Chapter 11, "Organization, Agency, and Business Outreach before Draft Program EIR/EIS Release," includes a list of the additional meetings held as part of the Authority's outreach effort, both during and subsequent to scoping.

B. CALIFORNIA HIGH SPEED RAIL AUTHORITY BOARD MEETINGS

The Authority governing board typically holds monthly meetings. Board meetings usually are held in Sacramento but were also held in the Bay Area to help encourage greater participation from agencies and the general public in the Bay Area. The board meetings during the program environmental review process regularly included status reports on the preparation of the Program EIR/EIS and provided opportunities for public comment. Authority board meetings are announced by posting on the Authority's web site and by mailing to approximately 1,600 persons and organizations. Minutes from board meetings are also posted on the web site. The places and dates of the Authority's board meetings are listed below.

- Sacramento—November 1 and 2, 2005.
- San Jose—January 25, 2006.
- Oakland—March 22, 2006.

- Sacramento—August 9, 2006.
- Sacramento—September 27, 2006.
- Sacramento—October 25, 2006.
- Sacramento—November 8, 2006.
- Sacramento—December 13, 2006.
- Sacramento—January 29, 2007.
- Sacramento—March 2, 2007.
- Sacramento—April 18, 2007.
- Sacramento—May 23, 2007.
- San Carlos—June 27, 2007.
- Sacramento—September 26, 2007.
- Sacramento—November 14, 2007.
- Sacramento—December 19, 2007.
- Sacramento—February 6, 2008.
- Sacramento—April 2, 2008.
- Anaheim—May 14, 2008.

C. PRESENTATIONS, BRIEFINGS, AND OUTREACH

During the program environmental review process, presentations to conferences, forums, local and regional government agencies, interest groups and organizations, and agency meetings and other briefings have been given to provide general information concerning the proposed HST system and the program environmental review process. Interest groups included nongovernmental organizations (e.g., RailPac), community planning organizations (e.g., Transportation Land Use Coalition [TALC]), and public interest discussion/research groups (e.g., WTS Seminar). The state, regional, and local groups that participated in this aspect of the Authority and FRA outreach effort are listed in Chapter 11, "Organization, Agency, and Business Outreach before Draft Program EIR/EIS Release."

10.1.3 Notification of Scoping Meetings

A California state NOP was distributed to the State Clearinghouse; elected officials; local, regional, and state agencies; and interested members of the public on November 14, 2005. An NOI was published in the *Federal Register* on November 28, 2005. The NOP and NOI presented the purpose of the project, the project limits, a description of alternatives to be considered, the need for agency input, potential environmental impacts of the project, the contact name for additional information regarding the project, and the dates and locations of the scoping meetings.

The Authority held scoping meetings in conjunction with San Francisco Bay Area Regional Rail Plan public meetings. Various federal, state, and local agencies; elected officials; community, business, and environmental leaders and organizations; and other interested individuals received notification of the first phase of public workshops/scoping meetings. The notification activities included legal notices, direct mail, web postings, media advisories, email blasts, and flyers, as described below. Several methods were used to notify the public of the scoping process.

- Notification of the scoping meetings was published in nine local newspapers on November 15, 2005. These newspapers were the *Modesto Bee*, *Merced Sun Star*, *Fresno Bee*, *Stockton Record*, *Sacramento Bee*, *Daily Republic*, *Oakland Tribune*, *San Francisco Examiner*, and *San Jose Mercury News*.

- An announcement postcard was distributed to approximately 3,175 individuals, agencies, organizations, and businesses on a mailing list derived from prior work and current project outreach. More than 1,500 addresses of public agencies, organizations, and individuals were extracted from the MTC contact database. The postcard provided a brief description of the project and the purpose of scoping, times and locations of scoping meetings, contacts for additional information, and contacts for additional information in Spanish.
- MTC mailed workshop flyers to its Bay Area Partnership Technical Advisory Committee, which includes representatives from Caltrans, county congestion management agencies, and local transit operators, for discussion at its meeting on October 24, 2005.
- The San Joaquin Council of Governments (SJCOG) mailed workshop flyers to 89 addresses representing its standing committee members (Citizen's Advisory Committee, Social Services Transportation Advisory Committee, Technical Advisory Committee, Manager's and Finance Committee, and Transit Operator's Working Group) on November 16, 2005.
- Information about the workshops/scoping meetings was posted on MTC's web site: www.mtc.ca.gov; the Authority's web site: www.cahighspeedrail.ca.gov; the FRA's web site: www.fra.dot.gov; and the Regional Rail Plan public web site: www.bayarearailplan.info. Also, Caltrain's web site (www.caltrain.com) provided a link to the Regional Rail Plan public web site.
- Media advisories/press releases were issued by MTC, including a November 17, 2005, media advisory, a November 30, 2005, press release following the first workshop/scoping meeting in Oakland, and a December 1, 2005, press release prior to the Modesto workshop/scoping meeting. MTC also responded to all press calls on the Regional Rail Plan.
- MTC sent an email blast to the Regional Rail Steering Committee on October 25, 2005.
- MTC sent an email blast to 5,200 email addresses extracted from MTC's contact database of public agencies, organizations, and individuals on November 1, 2005.
- Altamont Commuter Express (ACE) distributed workshop flyers through a seat drop to more than 1,350 of its morning commuters on November 10, 2005.
- SJCOG sent an email blast to 4,617 email addresses compiled as part of its I-205 Campaign on November 21, 2005.
- Some 50,000 copies of a special BART Bulletin were distributed at all 34 BART station fare gates starting on November 29, 2005.
- Caltrain distributed 6,000 workshop flyers through a seat drop and issued a press release announcing the upcoming San Jose, San Francisco, and San Carlos workshops on November 30, 2005.
- Stanislaus Council of Governments (StanCOG) sent an email blast to email addresses representing its policy board and standing committees.

10.2 Agency Consultation before Draft Program EIR/EIS Release

10.2.1 Agency Scoping

In addition to the scoping meetings, informal roundtable/workshop meetings were conducted with many public agencies. Many of the agency contacts made during the scoping process led to subsequent one-on-one and small group agency consultation meetings during the preparation of the Program EIR/EIS.

10.2.2 Interagency Consultation

The Authority and the FRA convened staff representatives from 27 interested federal and state agencies to provide input on the environmental review process. The EPA and the USACE were designated cooperating agencies under NEPA for the preparation of the Program EIR/EIS, as reflected in an MOU among these agencies and the FRA. In addition to the scoping meetings, two agency consultation meetings were held on April 19, 2006. The federal cooperating agencies and the lead agencies had frequent communications throughout this program environmental process.

10.2.3 Other Agency Consultation

In addition to the scoping process and interagency staff meetings, agency consultation has taken place at the regional level. Chapter 11, "Organization, Agency, and Business Outreach before Draft Program EIR/EIS Release," lists these additional briefings. The Authority is a partner in the management of the SF Bay Area Regional Rail Plan, and Authority staff have participated as part of the Regional Rail Program Management Team (with MTC, Caltrain, and BART) throughout that planning effort—ensuring continuity between the Regional Rail Plan and the Bay Area to Central Valley HST Program EIR/EIS.

The FRA and the Authority also initiated consultation with the Native American Heritage Commission as part of the Statewide Program EIR/EIS. A search of their Sacred Lands file and lists of Native American contacts was conducted as part of the Statewide Program EIR/EIS. The Authority has contacted tribal representatives as part of this Program EIR/EIS.

10.3 Scoping Summary

The scoping process helped the lead agencies identify general environmental issues to be addressed in this Program EIR/EIS. The public and agency comments identified support for and interest in the proposed HST system in the study area and indicated the need for the proposed system to be connected to existing transportation systems. Much of the public comment focused on preferences for or against potential HST alignment alternatives. Providing potential freight service was also frequently mentioned. Concerns regarding environmental issues typically focused on potential noise and visual impacts, safety issues, potential impacts on air quality and sensitive habitats, and the potential for growth inducement. In the East Bay and Peninsula corridors, comments suggested the need to consider improving existing passenger rail services in existing corridors with compatible/consistent technologies versus adding new dedicated rights-of-way and services. Support was expressed for station locations at the proposed new Transbay Transit Center in San Francisco, at Diridon Station in downtown San Jose, in downtown Oakland, and in Livermore and Union City. The comments identified the need for the project to be sensitive to such environmental issues as noise, visual impacts, safety, impacts on wildlife refuges, and effects of induced growth. Concerns were raised regarding train speeds in urban areas.

Several overall themes related to HST arose at public meetings, as follows:

- Views on and preferences for Southern Alignments vs. Altamont Pass Alignments are divergent and strong.
- A Diablo Range "Direct" Alignment is not a viable option because it would present severe environmental impacts.
- Grasslands Ecological Area (GEA) is a critical environmental resource.
- The EIR/EIS should expand evaluation of biological impacts.
- HST should be used to upgrade commuter rail services.
- Interest, concerns, and requirements regarding new San Francisco Bay Crossing.

- HST system must be safe and secure.
- HST system connectivity and convenience are key.
- Should have TOD around stations.
- There is support for an HST system linking California's major metropolitan areas.
- Support for the Transbay Transit Center as the Downtown San Francisco HST terminus.
- Concerns relating to the potential for the HST Alignment Alternatives to induce growth.
- Questions about how the Program EIR/EIS address potential mitigation measures.

10.4 Notification and Circulation of the Draft Program EIR/EIS

Notice regarding the availability and the circulation of the Draft Program EIR/EIS were provided pursuant to CEQA and NEPA requirements. The Draft Program EIR/EIS was released for public review and comment on July 16, 2007, and noticed in the *Federal Register* on July 20, 2007. The initial public comment period was scheduled to end September 28, 2007, but due to public requests, it was extended to October 26, 2007. All comments submitted to the Authority during this review period have been addressed and responded to as part of this Final Program EIR/EIS.

Notification packets announcing the availability of the Draft Program EIR/EIS were mailed on July 13, 2007, to federal cooperating agencies, other affected agencies, and elected officials. The federal cooperating agencies and other selected agencies received an announcement letter from the Authority, a hard copy of the Draft Program EIR/EIS, and a CD copy of the document with appendices. Sixty-six other affected public agencies received an announcement letter from the Authority, an Executive Summary, and a CD copy of the document with appendices. Sixty Native American tribal representatives received an announcement letter from the Authority, an Executive Summary, and a CD copy of the document with appendices. Eighty-two elected officials received an announcement letter from the Authority and an Executive Summary. A distribution list for the Draft Program EIR/EIS was included in the Draft Program EIR/EIS.

The general public was informed of the Draft Program EIR/EIS release through distribution of an announcement of the document's availability to the project mailing list. The announcement also provided the details for submitting comments by mail or fax and announced dates, times, and locations of public hearings. The mailing list contains approximately 3,600 statewide contacts, including federal, state, and local elected officials; federal, state, and local agency representatives; chambers of commerce; environmental and transportation organizations; special interest groups; media; private entities; and members of the public. The mailing list was based on the database developed as part of the statewide Program EIR/EIS and the MTC contact database. The mailing list is on file with the Authority and is available for viewing.

The Program EIR/EIS was also made available for viewing and downloading at the Authority's web site, www.cahighspeedrail.ca.gov. Comments were accepted directly from the website as well. The website also provided the opportunity to request a CD ROM or printed copies of the document.

The announcement and web site listed the libraries with a hard copy of the document available for review. Participating libraries are located in the following cities: Fremont, Gilroy, Merced, Modesto, Mountain View, Oakland, Pleasanton, Palo Alto, Sacramento, San Francisco, San Jose, and Stockton.

The release of the Draft Program EIR/EIS was announced through display ads distributed in the following newspapers: *Sacramento Bee, Daily Republic*, *Oakland Tribune*, *San Francisco Examiner*, *San Jose Mercury News*, *Modesto Bee*, *Merced Sun Star*, *Fresno Bee,* and *Stockton Record*.

10.4.1 Public Hearings

The Authority held a total of eight public hearings to present the Draft Program EIR/EIS and to receive public comments. Originally, six public hearings were scheduled, but due to requests, two more public hearings were planned. A court reporter was present at each of the public hearings to record oral comments. At each public hearing, oral comments could be made during the "public testimony" portion of the meeting or during the open house portion of the meeting to the court reporter at the "public comments" table. Oral comments on the Draft EIR/EIS were only accepted during the eight public hearings.

Requests were made to extend the comment period, and the Authority Board, in consultation with the FRA, extended the comment period at the September 28, 2007, board meeting to October 26, 2007. A notice postcard regarding the comment period extension to October 26, 2007, was distributed to the project mailing list on October 3, 2007 (list is described in 10.1.1 above). In addition, the FRA published a notice of the extension in the *Federal Register*.

The public was notified of the first six public hearings through a notice postcard that provided the public hearing locations and schedule. The notice postcard was mailed on July 18, 2007, to the project mailing list (list is described in Section 10.1.1). The two additional public hearings were announced through notice announcements mailed on September 5, 2007, and September 18, 2007, to the project mailing list.

The public hearings were also announced through a display ad published in nine newspapers within the region. The display ad for the first six public hearings was published on Friday, July 20, 2007. The Stockton public hearing ad was published on Tuesday, September 4, 2007, and the ad for the Sacramento public hearing was published on Wednesday, September 19, 2007. The Stockton public hearing ad was published in the *Modesto Bee*, *Tracy Press*, and *Stockton Record*, and the Sacramento public hearing ad was published in the *Sacramento Bee*.

In addition to the public hearings held during the comment period, Authority staff and the FRA notified over 50 Native American tribal organizations and held a meeting on August 24, 2007, to discuss the Draft Program EIR/EIS and to solicit input.

A. INITIAL SIX PUBLIC HEARINGS

Each of the six initial public hearings started at 4:00 PM and ended at 6:00 PM. From 4:00 to 4:15 PM there was an informational open house with exhibit boards available for viewing and project staff present to answer questions and discuss issues. Formal public testimony began at 4:15 PM. Authority Board members facilitated the public testimony. Other Board Members, Authority staff, and an FRA Representative (at selected meetings only) were present to listen to comments. The open house resumed once all public testimony was received.

The public hearings were scheduled as follows:

- San Francisco—Thursday, August 23, 2007
- San Jose—Friday, August 24, 2007
- Livermore—Monday, August 27, 2007
- Oakland—Tuesday, August 28, 2007
- Gilroy—Wednesday, August 29, 2007
- Merced—Thursday, August 30, 2007

B. ADDITIONAL TWO PUBLIC HEARINGS

The two additional public hearings were held from 4:00 PM to 6:00 PM following the same format of the previous meetings and included an open house and public testimony with Board Members and Authority staff present to listen to comments.

The two additional public hearings were scheduled as follows:

- Stockton—Tuesday, September 18, 2007
- Sacramento—Wednesday, September 26, 2007

At each public hearing, speaker cards were available for public testimony. Individuals who wished to testify submitted a speaker card and were then called in turn by the facilitator. Individual comments were not time limited and allowed sufficient time for people to comment. A court reporter was present and recorded all the oral comments. Individuals were also able to make oral comments directly to the court reporter once the public testimony session had ended. Comment sheets were available for submitting written comments.

C. PUBLIC HEARING OVERVIEW

In all, over 354 members of the public attended the public hearings.

San Francisco—Thursday, August 23, 2007, 4:00–6:00 PM

- Location: San Francisco City Hall, Board Chambers, 1 Dr. Carlton B. Goodlett Place
- Individuals Signed In: 42

San Jose—Friday, August 24, 2007, 4:00–6:00 PM

- Location: San Jose City Hall, City Council Chambers, 200 East Santa Clara Street
- Individuals Signed In: 63

Livermore—Monday, August 27, 2007, 4:00–6:00 PM

- Location: Livermore City Council Chambers, 3575 Pacific Avenue
- Individuals Signed In: 23

Oakland—Tuesday, August 27, 2007, 4:00–6:00 PM

- Location: Oakland City Hall, City Council Chambers, 1 Frank Ogawa Plaza, 2nd Floor
- Individuals Signed In: 30

Gilroy—Wednesday, August 29, 2007, 4:00–6:00 PM

- Location: Gilroy City Hall, City Council Chambers, 7351 Rosanna Street
- Individuals Signed In: 28

Merced—Thursday, August 30, 2007, 4:00–6:00 PM

- Location: Merced County Administration Building, Board Chambers, 2222 M Street, 3rd Floor

- Individuals Signed In: 84

Stockton—Tuesday, September 18, 2007, 4:00–6:00 PM

- Location: San Joaquin Council of Governments Regional Center Board Room, 555 E. Weber Avenue
- Individuals Signed In: 53

Sacramento—Wednesday, September 26, 2007, 4:00–6:00 PM

- Location: State Capitol, Room 112, 10th Street and Capitol Mall
- Individuals Signed In: 61 (includes those attending regular Board Meeting)

10.4.2 Summary of Comments

In addition to comments received through the public hearings, written comments on the Draft Program EIR/EIS were sent to the Authority in the form of letters and faxes, and were also sent through the Authority's website. Table 10.4-1 lists the number of those providing comments during the public comment period including those from the public hearings. Some of the letters received listed multiple agencies. In addition, a number of individuals and organizations also orally commented at the public hearings and/or commented both in hardcopy and electronically (through the website). More than 400 people provided over 1,300 comments from July 20, 2007, to October 26, 2007, during the circulation period (either through written letters or oral comments).

Table 10.4-1
Comment Submittals on the Draft Program EIR/EIS

Method of Comment Submission	Federal		State		Local		Organization	Individual	Total
	Elected	Agency	Elected	Agency	Elected	Agency			
Public Hearings									
Oral Testimony	4	0	1	3	21	30	47	57	163
Written	2	0	1	2	3	6	1	12	27
Letters/Faxes	1	8	4	6	12	24	17	35	107
Web				1		5	15	83	104
Total	15		18		101		80	187	401

Through the public hearings, 163 people provided oral testimony and 27 provided written comments. There were 106 written letters and faxes received (1 from federal elected officials[1], 8 from federal agencies, 4 from state elected officials[2], 6 from state agencies, 11 from local elected officials, 21 from local agencies[3], 22 from organizations[4], and 34 from individuals), and 104 people provided comments on the Authority's website (1 from a state agency, 5 from local agencies, 15 from organizations, and 83 from individuals).

[1] 1 letter signed by 5 federal elected officials of the U.S. Congress.

[2] 1 letter signed by 4 state elected officials of the California Legislature.

[3] 1 letter signed by 3 local agencies.

[4] 1 letter representing comments of 10 organizations/agencies.

A. OVERVIEW OF COMMENTS RECEIVED

The brief summary below provides an overview of written letters, comments received through the Authority's website, and oral testimony received at the public hearings during the comment period. The responses to the comments received on the Draft Program EIR/EIS are included in Volume 3 of the Final Program EIR/EIS.

In general, the comments fell into two categories: HST program and environmental issues. Many of the comments supported the HST program; however, disapproval of certain alternative routes was also expressed. Most of the comments either favored one HST alternative (alignments and/or station locations) over another or favored combined alternatives. Concerns were raised about potential environmental impacts from the construction and operation of HST service. Many comments about environmental impacts dealt with alternative HST alignments, but some of the commenters also were concerned with the potential for the HST system to induce growth. Some comments were raised regarding the adequacy and detail of the Program EIR/EIS. A few requested for an extension to the comment period and for additional public meetings to be held (Note: the comment period was extended and two additional public hearings were provided). A few also indicated that it was essential for the bond measure to remain on the ballot in 2008. The following bullets summarize some of the comments received:

- Support for a HST system linking California's major metropolitan areas.
- Support and opposition for specific alignment options between the Bay Area and Central Valley.
- Opposition to HST alignment through the GEA.
- Opposition to HST alignments through the Don Edwards San Francisco Bay National Wildlife Refuge.
- Support for Castle Air Force Base as the HST station location and maintenance facility.
- Support for the Transbay Transit Center as the Downtown San Francisco HST terminus.
- Interest in station location, design, and potential for joint development.
- Concern that the project crossed Tribes Ancestral Territory.

As noted above, those providing input focused their comments on the two general categories of the HST program or environmental issues, as summarized below.

<u>High-Speed Train Program</u>

The vast majority of commenters strongly supported the HST program; many expressed urgency in getting the project built as soon as possible. Many considered the HST program to represent an opportunity for California to:

- Demonstrate leadership on a national level.
- Begin to address the global climate change issue.
- Provide desperately needed congestion relief.
- Provide much needed alternatives to travel by both the automobile and airplanes.
- Serve population centers and provide an alternative to air travel between the Bay Area and Los Angeles.
- Provide solutions for combating air quality issues.
- Provide an economic benefit to California generally and Silicon Valley and the Central Valley.

- Provide complementary transportation service to other existing transit systems, as well as agency regional transit system plans.

Some of those providing comments questioned the necessity for the project or whether it was an effective project, indicating that building additional lanes on the freeways, especially those that would allow for high speed automobile travel, was a better alternative. A commenter indicated that an alternative that would upgrade rail corridors to 125 miles per hour travel speed would be a sufficient and more effective means of providing congestion relief. It was also expressed that the HST system needs to serve the San Francisco International Airport and San Jose International Airport.

Many commenters indicated that if a high speed train system was going to be built, it needed to focus on what they perceived to be the overall objective: to provide a fast downtown to downtown alternative from San Francisco to Los Angeles.

Some expressed concern that the program would be partially built and then lose funding, and never be fully completed. A few commenters also addressed the need for the federal government to fund the rail program, with some indicating that they believed a national high-speed rail program was essential.

Route Preference

In general, a large portion of the comments received addressed which route should be selected, with some commenters discussing specific station locations, connections to BART and Caltrain, and preferred locations for the storage/maintenance facilities. Many commenters expressed a preference for either the Pacheco Pass or Altamont Pass routes with some wanting both routes to connect the Bay Area to the Central Valley and suggesting close coordination between this project and the MTC San Francisco Bay Regional Rail Plan.

The reasons given for supporting the Pacheco Pass route included that it:

- Provides quicker travel times between San Jose/Silicon Valley and Southern California.
- Provides more frequent/better service between Bay Area and southern California.
- Provides higher ridership potential.
- Results in fewer potential environmental impacts.
- Avoids impacts on wildlife and sensitive habitat through Don Edwards San Francisco Bay National Wildlife Refuge.
- Best serves the Caltrain Corridor (San Francisco to Gilroy).
- Provides good HST access for the three county Monterey Bay area with a south Santa Clara HST station.
- Can serve San Francisco, Oakland, and San Jose without a new crossing of the Bay.
- Provides service through San Jose and best serves south Bay.
- Is less costly for first phase of system between the Bay Area and Anaheim.

In addition, commenters indicated that if the Pacheco Pass route were selected, BART could be extended to serve communities along the Altamont Pass corridor and that the ACE trains already serve those areas; thus, the Altamont Pass route would be a redundant service. Some expressed concern about the redundancy of service along the Caltrain corridor and that the shared use would present conflicts with scheduling and use of stations.

The reasons given for supporting the Altamont Pass route included that it:

- Provides quicker travel times between Sacramento/Northern San Joaquin Valley and the Bay Area.
- Best serves the Central Valley.
- Serves more Northern San Joaquin markets on the Authority's adopted first phase of construction between the Bay Area and Anaheim.
- Provides higher ridership potential.
- Has less potential for environmental impacts.
- Avoids impacts on wildlife and sensitive habitat through Pacheco Pass and the GEA.
- Serves a greater population/more population along the alignment.
- Best serves ACE corridor and reduces traffic along I-580.
- Has better service between the Bay Area and Southern California (either reduced frequency is needed on shared Caltrain alignment or HST service can be split).
- Best serves San Jose since it would be a terminus station and with much faster travel times to commuter markets in the Northern San Joaquin Valley.
- Is less sprawl inducing.

A few commenters indicated that both routes should be built because both areas equally need the HST system. Some indicated that the Pacheco Pass route could operate as an express route and the Altamont route could operate as more of a regional route. It was also noted that with either alignment, design refinements would be important to reduce overall impacts.

Environmental Issues

The comment letters contained concerns about environmental issues. Some comments were specific: addressing the adequacy of the Draft Program EIR/EIS, the type of modeling for some aspects of the study, the depth of the analyses for some subjects, etc.; however, most were not addressing the Draft Program EIR/EIS but were speaking to overall environmental concerns. A number of comments were related to biology (Don Edwards San Francisco Bay National Wildlife Refuge, GEA, wildlife movement corridors, and sensitive habitats). Comments generally related to the following topics:

- Biology
- Floodplains
- Travel times
- Ridership
- Traffic and parking
- Air quality
- Noise and vibration
- Visual quality
- Farmland
- Geologic and soil constraints
- Land use
- Utilities
- Hydrology

- Growth inducement and cumulative impacts
- Operating and capital costs

The more specific concerns included:

- HST likely to adversely affect federally listed plants/animals.
- EIR/EIS makes no provisions for future of federally listed species and no assurances of total avoidance.
- Impacts to the GEA and Grasslands Important Bird Area.
- Growth inducing impacts of the HST system.
- Concern that the HST program does not equitably serve all populations and low- and moderate-income groups are under served.
- Encroachment onto Department of Water Resources land, which would trigger their involvement as a Responsible Party and need for permits.
- Need to allocate sufficient funding for mitigation measures.
- Impacts to wildlife movement.
- Concern that impacts to parks, trails, and historic/cultural resources were not fully evaluated.
- Noise and vibration impacts on wildlife.
- Impacts to San Francisco Bay and the Don Edwards San Francisco Bay National Wildlife Refuge.
- Concern about addition of two tracks that would impact adjacent planned development.
- Stand alone mitigation program needs to be developed and carried forward to ensure implementation.
- Concern about cumulative impacts.
- Concern about habitat fragmentation if both Pacheco Pass and Altamont Pass options were implemented.

Some commenters indicated that alternatives should be evaluated that avoided or minimized impacts. Some indicated that the Draft Program EIR/EIS deferred analysis and that mitigation measures provided are vague and unenforceable. Some also indicated that the growth of Silicon Valley was not adequately addressed.

10.4.3 Responses to Comments Received and the Final Program EIR/EIS

As part of this Final Program EIR/EIS, the Authority and FRA have responded to comments received, which are included in and have informed the preparation of this Final Program EIR/EIS. The members of the Authority Board will consider the comments and input received on the Draft Program EIR/EIS and the responses prior to certifying the Final Program EIR. Once the Authority Board has certified the Final Program EIR, it may approve the project and issue a CEQA Findings of Fact and a Statement of Overriding Considerations and file a Notice of Determination with the State Clearinghouse in the Governor's Office of Planning and Research.

The FRA is the agency responsible for authorizing federal involvement for the project and is the NEPA lead agency for the Final Program EIS. The EPA and the USACE are federal cooperating agencies under NEPA. FRA will consider all comments and responses in the preparation of the Final Program EIS and the issuance of a NEPA Record of Decision.

10.4.4 Additional Agency Consultation and Outreach Activities

The FRA and Authority staff have consulted with representatives of federal, state, and local agencies as well as various groups and organizations in preparation of this Final Program EIR/EIS.

11 ORGANIZATION, AGENCY, AND BUSINESS OUTREACH BEFORE DRAFT PROGRAM EIR/EIS RELEASE

Organization	Contact	Date	Topic
Alameda County	Supervisor Scott Haggerty Dawn Argula	March 9, 2006	Program update
Alameda County Congestion Management Agency	Dennis Faye	April 12, 2006	Program update
Altamont Commuter Rail Service	Stacey Mortensen	April 27, 2006	Program update
American Public Transportation Association	Rod Diridon	October 11, 2006	Presentation at Annual Conference in San Jose
Amtrak	Liz O'Donahue	Frequent communication	Program updates
ARUP	Michael Kaye John Eddy	Frequent communication	Program updates
BART (San Francisco Bay Area Rapid Transit District)	Marianne Payne	Frequent communication	Program updates, alignment options
	Marianne Payne	July 6, 2006	Presentation to BART Managers, program update
BayRail Alliance	Margaret Okuzumi	Frequent communication	Program updates, issues on alignment and station options
CA Department of Parks and Recreation	Heidi West	February 23, 2006 March 6, 2006 Frequent Communication	Program update, alignment options
CA Department of Parks and Recreation, Diablo Vista District	Don Monahan	April 4, 2006 Frequent Communication	Program update, alignment options
CA Department of Transportation (Caltrans)	Rick Deming	April 19, 2006	Program update
	Lea Simpson, Division of Rail	Frequent communication	Program updates, technical studies details
CA Public Utilities Commission	Ernie Von Ibseh	April 19, 2006	Agency coordination meeting
CA Transportation Commission	Robert Chung	Frequent communication	Program updates
Caltrain JPA	Art Lloyd	Frequent communication	Program updates, Caltrain corridor
Capitol Corridor Joint Powers Authority	David Kutrosky Eugene Skoropowski	Frequent communication	Program updates, East Bay station/alignment issues
	Jim Allison	June 30, 2006	Program update, conceptual engineering

Organization	Contact	Date	Topic
Defenders of Wildlife	Cynthia Wilkerson	October 3, 2005	Program update
		November 8, 2006	Program update
DE Consult	Gerd Morhenn Wolfgang Henn	Frequent communication	Technical standards, methodologies, and analysis
Dublin (City of)	Mayor Janet Lockhart Richard Ambrose	March 9, 2006	Program update
	Mayor Janet Lockhart Melissa Martin	June 30, 2006	Program update, conceptual engineering
Earthtech	Karl Schaarschimdt	Frequent communication	Program updates, alignments and station locations, engineering and operations assumptions
East Bay Regional Parks	Brad Olson	Frequent communication	Program updates
	Brad Olson	April 19, 2006	Agency coordination meeting
Fremont (City of)	Jim Pierson	June 20, 2006	Program update, conceptual engineering
Grasslands Water District/Grasslands Resource Con. Dist.	Tom Enslow	Frequent communication	Program updates
	Tom Enslow	November 16, 2005 February 23, 2006	Program updates
	Richard Wright	April 19, 2006	Agency coordination meeting
Great Valley Center	Carol Whiteside	Frequent communication	Program updates, outreach to Central Valley
Hatch Mott MacDonald	Lee Warnock	Frequent communication	Program updates
Japanese Delegation	Ikuo Fujita Representatives from Central Japan Railways, Hitachi, JARTS, JTRI, Mitsubishi, MLIT, Nippon, Sharyo, Japanese Consulate	September 7, 2006	Program update, technology issues
Korve Engineering	Brent Ogden	Frequent communication	Program updates, alignments and station locations
Livermore (the City of)	Debbie Bell Bob Vinn	Frequent communication	Program updates
	Cheri Sheets Bob Vinn Debbie Bell	March 9, 2006 March 15, 2006 June 30, 2006	Alternatives and issues, program updates, conceptual engineering
LTK	Tom Matoff	Frequent communication	Program updates, technical studies, methodologies
Luckhart, Charlie and Jeff O'Neil	Charlie Luckhart	November 17, 2005	Program update, alignments through Mt. Hamiliton range
Menlo Park (City of)	Chip Taylor	June 20, 2006	Program update, conceptual engineering

Organization	Contact	Date	Topic
Merced (City of)	James Marshall	April 28, 2006	Program update, station and alignment options
	James Marshall	June 30, 2006	Program update, conceptual engineering
Merced County Association of Governments	Jesse Brown	April 28, 2006 June 30, 2006	Program update, Merced station locations, alignment issues
Merced Economic Development Corporation	Elaine Trevino	Frequent communication	Station locations, UC Merced
Metropolitan Transportation Commission (MTC)	Doug Kimsey	Frequent communication	Program updates, alignment options
	Ashley Nguyen	Frequent communication	Program updates, alignment issues
	MTC Board	May 12, 2006	Presentations
Modesto (City of)	George Britton Miguel Galvez	April 28, 2006	Program update, alignment and station options
	Nicholas Pinhey Miguel Galvez	June 30, 2006	Program update, conceptual engineering
Native American Heritage Commission	Debbie Pilas-Treadway	Frequent communication	Program updates, alignment and station locations, Native American outreach efforts
The Nature Conservancy	Lloyd Wagstaff	February 27, 2006	Program updates, alignment options
	Lloyd Wagstaff	October 16, 2006	Alignment issues
Newark (City of)	Peggy Claassen	June 20, 2006	Program update, conceptual engineering
Oakland (City of)	Shanna O'Hare	November 16, 2005 February 10, 2006	Program update
	Shanna O'Hare	Frequent communication	Program updates, East Bay station/alignment issues
Planning and Conservation League	Gary Patton	November 3, 2005	Program update
Pleasanton (City of)	Jerry Iserson	June 20, 2006	Program update, conceptual engineering
Rail PAC	Richard Silver	Frequent communication	Program updates
	Paul Dyson	January 28, 2006 May 15, 2006	Program updates
	Annual Conference (Richard Silver contact)	January 28, 2006	Presentation
Regional Rail Steering Committee Meeting	Ashley Nguyen	May 10, 2006 December 13, 2006	Updates on Program EIR/EIS, alignments under investigation

Organization	Contact	Date	Topic
Regional Rail Program Management Team Meeting	Ashley Nguyen	January 11, 2006 February 1 & 15, 2006 March 1, 15, & 29, 2006 April 5, 19, & 26, 2006 May 24, 2006 June 7 & 21, 2006 July 12, 2006 August 2 & 16, 2006 September 6 & 20, 2006 October 4 & 18, 2006 November 15, 2006 January 10, 2007 January 31, 2007 February 14, 2007	Updates on Program EIR/EIS, alignments under investigation, ridership forecasts, travel times, cost estimates.
Sacramento COG	Olin Woods	Frequent communication	Program updates, alignment and station issues
SACOG Regional Planning Partnership	Olin Woods	January 26, 2006	Presentation, program update
Samtrans	Howard Goode Ian McAvoy Bob Dotey	Frequent communication	Program update, San Francisco Peninsula alignment, Caltrain right-of-way, design
	Ian McAvoy Bob Dotey	December 14, 2005	Program update
San Francisco (City and County of)	Michael Coen	November 4, 2005	Monthly meetings on Transbay Transit Center
	Michael Coen	Frequent communication	Program updates, station and alignment issues
San Joaquin COG	Danielle Kockman	April 28, 2006	Program updates, station and alignment options
San Jose (City of)	Ben Tripousis	November 30, 2005 January 20, 2006	Program updates
	Council Member Madison Nguyen	March 13, 2006	Program update
	Ben Tripousis	Frequent communication	Program updates, South Bay station and alignment issues
San Ramon (City of)	Lisa Bobadilla	March 10, 2006	Program update
San Francisco Planning and Urban Research (SPUR)	Gabriel Metcalf	Frequent communication	Program update, alignment issues
Siemens	Wayne Williams Frank Guzzo	Frequent communications	Program updates
Sierra Club California	Ken Ryan	January 28, 2006	Program update, alignment options

Organization	Contact	Date	Topic
	Ken Ryan Patrick Moore	February 28, 2006	Presentation
	Ken Ryan	Frequent communication	Program updates, alignment/station options
Silicon Valley Leadership Group	Laura Susinski	Frequent communication	Program updates, South Bay station and alignment issues
	Laura Susinski	November 30, 2006	Presentations
Stanislaus County	George Stillman	April 28, 2006	Program update, alignment and station issues
State Parks Foundation	Elizabeth Goldstein Traci Verdugo	March 6, 2006	Alignment issues, parklands
	Traci Verdugo	November 8, 2006	Alignment issues, update
TRAC (Train Riders Association of California)	Gerald Cauthen	Frequent communication	Alignment options and Altamont Pass, program updates
Tracy (City of)	Dan Hobbs	April 27, 2006	Program update
	Dan Hobbs Julie Yuan-Miu Kuldeep Sharma	June 30, 2006	Program update, conceptual engineering
Transbay Transit Center	Liz Wiecha Maria Ayerdi Heather Barber	Frequent communication	Program updates, station and alignment issues
	Maria Ayerdi	August 11, 2006	Alignment and station issues
Transmetrics	Jack Ybarra	Frequent communication	Program updates
Transportation and Land Use Coalition (TALC)	Stuart Cohen	Frequent communication	Program updates, potential stations, TOD
Tri-Valley Regional Rail Policy Working Group	Bob Vinn, City of Livermore	June 13, 2006 September 19, 2006	Program updates, potential stations and alignment alternatives
U.S. Army Corps of Engineers	Robert Smith	December 13, 2005	Alignment options, system alternatives, program update
	Robert Smith	March 1, 2006	Review of purpose and need, system alternatives, and environmental analysis methodologies
	Robert Smith	April 18, 2006 April 19, 2006	Review of purpose and need, system alternatives, and environmental analysis methodologies
	Robert Smith	Frequent communication	Program updates, environmental methods, alignments

Organization	Contact	Date	Topic
U.S. Environmental Protection Agency	Connell Dunning Erin Foresman	December 13, 2005	Alignment options, system alternatives, program update
	Connel Dunning	March 1, 2006	Review of purpose and need, system alternatives, and environmental analysis methodologies
	Connell Dunning	April 18, 2006	Review of purpose and need, system alternatives, and environmental analysis methodologies
	Connell Dunning	Frequent communication	Alignment options, environmental methodologies, program updates
U.S. Fish & Wildlife Service	Mark Littlefield	April 19, 2006	Agency coordination meeting
U.S. FTA	Ray Sukys	April 19, 2006	Agency coordination meeting
UC Berkeley	Professor Betty Deakin	June 1, 2006	Program update
Union City (City of)	Mark Leonard Mintze Cheng Joan Malloy	June 20, 2006	Program update, conceptual engineering
VTA	Michael Burns Kurt Evans	November 30, 2006	Program update
	Michael Burns Kurt Evans	March 13, 2006	Alignment issues, program update
	Kevin Connoly	May 3, 2006 June 20, 2006	Program update, potential alignments, conceptual engineering
	Kurt Evans	Frequent communication	Program updates, South Bay alignment issues
WTS Seminar	Ashley Nguyen	September 6, 2006	Presentation at MTC

12 LIST OF PREPARERS

12.1 California High-Speed Rail Authority

Dan Leavitt, Deputy Director

Carrie Pourvahidi, Deputy Director

12.2 Federal Railroad Administration

David Valenstein, Environmental Program Manager

William Fashouer, Assistant Chief Counsel for General Law (NEPA Review)

12.3 List of Consultants

Name	Title	Responsibility
Dave Mansen	Vice President, Parsons	Project Manager
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Soumya Ananthanarayanan	Environmental Planner, Parsons	Land Use Traffic and Transportation
Gui Shearing	Transportation Planning Manager, Parsons	Traffic and Transportation
Indu Sreedevi	Senior Transportation Systems Analyst, Parsons	Traffic and Transportation
Linda McGlochlin Wolff	Project Manager, California Professional Geologist, California Certified Hydrogeologist, Parsons	Hazardous Materials
Michael Kiesling	Principal, Architecture 21	Aesthetic and Visual Resources
Kip Field	Project Manager, PB Americas, Inc.	Discipline Co-Lead Capital Costs, Alternatives
Dominic Spaethling	Bay Area Regional Program Manager, PB Americas, Inc.	Discipline Co-Lead Capital Costs, Alternatives
Alice Lovegrove	Senior Environmental Engineer, PB Americas, Inc.	Co-Discipline Lead Air Quality
Eddie Tadross	Senior Environmental Engineer, PB Americas, Inc.	Co-Discipline Lead Air Quality
Neal Mace	Senior Engineering Geologist, Geotechnical Consultants, Inc.	Geology and Soils
Kenneth M. Bogdan	Environmental Counsel, Principal, Jones & Stokes	Environmental Counsel Cumulative Impacts

Name	Title	Responsibility
David Freytag	Principal, Jones & Stokes	Discipline Co-Lead, QA/QC Hydrology and Water Quality, Energy, Cultural Resources, Biological Resources and Wetlands, Agricultural Resources, Unavoidable Adverse Impacts
Jennifer Rogers	Environmental Planner II, Jones & Stokes	Cumulative Impacts
Donna McCormick	Associate Principal, Jones & Stokes	Discipline Lead Agricultural Resources
Steve Avery	Associate Principal, Jones & Stokes	Discipline Lead Biological Resources and Wetlands
William Kohn, Jr.	Environmental Planner III, Jones & Stokes	Discipline Co-Lead Biological Resources and Wetlands
Chariss Tweedy.	Environmental Planner, Jones & Stokes	Discipline Co-Lead Biological Resources and Wetlands
Brian Ramos	Senior Environmental Planner, Jones & Stokes	Discipline Lead Cultural Resources
Christiann Havelaar	Environmental Planner III, Jones & Stokes	Discipline Co-Lead Cultural Resources
Nate Martin	Environmental Planner III, Jones & Stokes	Discipline Co-Lead Hydrology and Water Quality
Nicole Breznock	Environmental Planner II, Jones & Stokes	Discipline Co-Lead Hydrology and Water Quality
Daniel Schiff	Environmental Planner, Jones & Stokes	GIS
Aaron Carter	Environmental Planner, Jones & Stokes	GIS
Garrick Jones	Environmental Planner, Jones & Stokes	Discipline Lead Energy
Asher Sheppard	Environmental Scientist, PB Americas, Inc.	Discipline Lead EMI/EMF
Steven Wolf	Senior Environmental Planner, PB Americas, Inc.	Discipline Co Lead Noise and Vibration
Kevin Keller	Senior Environmental Planner, PB Americas, Inc.	Discipline Co Lead Noise and Vibration
Robert Malone	Senior Planner, PB Americas, Inc.	Discipline Lead Public Utilities
Paul Mosier	Senior Rail Operations Engineer, PB Americas, Inc.	Discipline Lead Operations Planning Discipline Co-Lead Engineering Criteria
Melissa Rodriguez	Civil Engineer, PB Americas, Inc.	Discipline Co-Lead Capital Costs and Engineering Criteria
George Mazur	Senior Transportation Engineer, Cambridge Systematics, Inc.	Discipline Lead Economics/Growth

Name	Title	Responsibility
Ellen Unsworth	Managing Editor, Jones & Stokes	Editorial Lead
Mindy Higginson	Support Editor, Jones & Stokes	Technical Editor
Darle Tilly	Lead Editor, Jones & Stokes	Technical Editor
Corrine Ortega	Publications Specialist, Jones & Stokes	Word Processing
Jenelle Mountain	Publications Specialist, Jones & Stokes	Word Processing
Susan Davis	Web Services Leader, Jones & Stokes	Electronic Publishing
Senh Saelee	Graphics Specialist, Jones & Stokes	Graphics

13 FINAL PROGRAM EIR/EIS DISTRIBUTION

The statewide distribution of the Final Program EIR/EIS emphasizes the use of electronic media to ensure cost-effective, broad availability to the public and interested parties. The entire Final Program EIR/EIS, appendices, and supporting reports are available on the Internet at the Authority's website (www.cahighspeedrail.ca.gov). The Final Program EIR/EIS is also available at the repositories listed below. Electronic CD copies of the document are also available on request at the office of the Authority, 925 L Street, Suite 1425, Sacramento, CA 95814.

All persons, agencies, and organizations listed in this chapter have been informed of the availability of and locations to obtain the Final Program EIR/EIS. Repositories and cooperating federal agencies were sent both hard and electronic copies of the Final Program EIR/EIS and appendices. Other federal agencies, state agencies, and selected interested parties listed below have received summary chapters and electronic copies of the Final Program EIR/EIS. All commenters are at a minimum receiving an electronic copy of the Final Program EIR/EIS (see index for Volume III for a complete list commenters). Federal, state, and county elected officials, mayors of cities with possible stations, and potentially affected local agencies listed below were mailed informational material about how to get a copy of the Final Program EIR/EIS. Additional local elected officials and agency representatives, along with all others on the project mailing list (approximately 3,200 contacts), have been mailed a notification that includes information about how to access the Final Program EIR/EIS.

13.1 Repository Locations

Modesto: Stanislaus County Library, Government Documents Section, 1500 I Street, Modesto, CA 95354
Phone: (209) 558-7890
Contact: Charles Teval, Branch Manager

Oakland: Oakland Public Library, 125 14th Street, Oakland, CA 94612
Phone: (510) 238-3134
Contact: Pat Coffey, Government Documents Section

Sacramento: Sacramento Central Library, 828 I Street, Sacramento, CA 95814
Phone: (916) 264-2795 ex. 2
Contact: James Scott, Librarian

Sacramento: California State Library, Government Publications Section, PO Box 942837, Sacramento, CA 94237-0001
Phone: (916) 651-6813
Contact: Janet Cole, Government Publications Librarian

San Francisco: San Francisco Main Library, Government Information Center, 100 Larkin Street, Civic Center, San Francisco, CA 94102
Phone: (415) 557-4500
Contact: Therese Cason, California Documents Librarian

San Jose: Dr. Martin Luther King Jr. Library, Reference Department, 150 East San Fernando Street, San Jose, CA 95112
Phone: (408) 808-2094
Contact: David Kravitz, Reference Department

Palo Alto: Palo Alto Main Library, 250 Hamilton Avenue, Palo Alto, 94303

Phone: (650) 329-2641
Contact: Deborah Angel, Librarian

Mountain View: City of Mountain View General Public Library, 585 Franklin Street, Mountain View, 94040
Phone: 650-903-6337
Contact: Alice Chu, Library Assistant

Gilroy: Gilroy Library, 7387 Rosanna Street, Gilroy, CA 95020
Phone: (408) 842-8207
Contact: Sally Leete, Adult Program Librarian

Fremont: Fremont Main Library, Reference Department, 2400 Stevenson Boulevard, Fremont, CA 94538
Phone: (510) 745-1400
Contact: Jackie Beth, Reference Librarian

Stockton: Cesar Chavez Central Library, 605 North El Dorado Street, Stockton, CA 95202
Phone: (209) 937-8221
Contact: Gretchen Louden, Government Documents Librarian

Merced: Merced County Library, 2100 O Street, Merced, CA 95340
Phone: 209-385-7643
Contact: Victoria Mrozek, Librarian

Livermore: Livermore Public Library, 1188 S Livermore Ave., Livermore, CA 94550
Phone: (925) 373-5500
Contact: Rosemary Dukelow, Supervising Librarian

Pleasanton: Pleasanton Public Library, 400 Old Bernal Avenue, Pleasanton, CA 94566
Phone (925) 931 3400 ext. 21
Contact: Mary Corpora, Sr. Reference Librarian

Tracy: Tracy Branch Library, 20 E. Eaton Ave., Tracy, CA 95376-3100
Phone: (209) 937-8221
Contact: Kathleen Buffleben, Branch Librarian

Washington DC: Federal Railroad Administration, 1200 New Jersey Ave. SE, Washington, DC 20590
Phone: (202) 493-6368
Contact: David Valenstein, Environmental Program Manager

13.2 Federal Agencies

Advisory Council on Historic Preservation, Executive Director, Washington DC
Bureau of Indian Affairs, Regional Director, Sacramento, CA
Bureau of Land Management, State Director, Sacramento, CA
Federal Aviation Administration, Planning and Programming Branch, Supervisor, Capacity Section, Lawndale, CA
Federal Emergency Management Agency, Region 9, Regional Director, Oakland, CA
Federal Highway Administration, Environmental Program Coordinator, Sacramento, CA
Federal Transit Administration, Region 9, Office of Planning and Program Development, Director, San Francisco, CA

Federal Transit Administration, Washington DC
Governor's Office of Planning and Research-State Clearinghouse, Sacramento, CA
National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Assistant Regional Administrator for Habitat Conservation, Long Beach, CA
U.S. Army Corps of Engineers, Regulatory Branch, Sacramento District, Sacramento, CA
U.S. Army Corps of Engineers, Regulatory Branch, San Francisco District, San Francisco, CA
U.S. Coast Guard, District 11, Chief of Staff, Alameda, CA
U.S. Department of Agriculture – National Resource Conservation Service, State Resource Conservationist, Davis, CA
U.S. Department of Agriculture – Farm Service Agency, California State Executive Director, Davis, CA
U.S. Department of the Interior, Director, Washington DC
U.S. Department of Transportation – Federal Railroad Administration, Washington DC
U.S. Environmental Protection Agency, Office of Federal Activities, EIS Filing Section, Washington DC
U.S. Environmental Protection Agency, Region 9, San Francisco, CA & Washington DC
U.S. Fish and Wildlife Service, Fish & Wildlife Biologist, Sacramento, CA
U.S. Forest Service, Regional Forester Representative, Vallejo, CA
U.S. National Park Service, Regional Director Pacific West Region & Environmental Coordinator, Oakland, CA

13.3 State Agencies

California Air Resources Board, Chair, Sacramento
California Business, Transportation and Housing Agency, Agency Secretary, Sacramento
California Coastal Commission, Director, San Francisco
California Department of Boating and Waterways, Director, Sacramento
California Department of Conservation, Director, Sacramento
California Department of Fish and Game, Program Coordinator for Environmental Review and Permitting, Sacramento
California Department of Housing and Community Development, Director, Sacramento
California Department of Parks and Recreation, Resource Management Division, Chief of Natural Resources, Sacramento
California Department of Pesticide Regulation, Director, Sacramento
California Department of Transportation, Chief Deputy Director, Sacramento and District Directors from Districts 3, 4, 5, 6 and 10
California Department of Water Resources, Environmental Services Office, Regulatory Staff, Sacramento
California Energy Commission, Executive Director, Sacramento
California Environmental Protection Agency, Secretary for Environmental Protection, Sacramento
California Geologic Survey, Supervising Geologist, Sacramento
California Health and Human Services, Secretary, Sacramento
California Integrated Waste Management Board, Executive Director, Sacramento
California Native Plant Society, Executive Director, Sacramento
California Public Utilities Commission, Rail Safety & Crossing Branch, Staff, San Francisco
California State Lands Commission, Executive Officer, Sacramento
California State Resources Agency, Secretary, Sacramento
California Transportation Commission, Executive Director, Sacramento
Department of Toxic Substances Control, Director, Sacramento
Native American Heritage Commission, Environmental Specialist, Sacramento
Office of Environmental Health Hazard Assessment, Director, Sacramento
Office of Stateside Health Planning and Development, Director, Sacramento
Planning and Conservation League, Executive Director, Sacramento

State Coastal Conservancy, Executive Officer, Oakland
State Historic Preservation Officer, State Historian, Sacramento
State of California Governor's Office of Planning and Research, Sacramento
State Water Resources Control Board, Water Quality Division, Regulatory Staff, Sacramento

13.4 Elected Officials

13.4.1 Federal Elected Officials

A. U.S. SENATORS

The Honorable Barbara Boxer, U.S. Senate, California
The Honorable Dianne Feinstein, U.S. Senate, California

B. U.S. HOUSE OF REPRESENTATIVES

The Honorable Dennis A. Cardoza, 18th Congressional District
The Honorable Jim Costa, 20th Congressional District
The Honorable John Doolittle, 4th Congressional District
The Honorable Anna G. Eshoo, 14th Congressional District
The Honorable Michael Honda, 15th Congressional District
The Honorable Tom Lantos, 12th Congressional District
The Honorable Barbara Lee, 9th Congressional District
The Honorable Zoe Lofgren, 16th Congressional District
The Honorable Daniel Lungren, 3rd Congressional District
The Honorable Doris O. Matsui, 5th Congressional District
The Honorable George Miller, 7th Congressional District
The Honorable Nancy Pelosi, 8th Congressional District
The Honorable Jerry McNerney, 11th Congressional District
The Honorable George P. Radanovich, 19th Congressional District
The Honorable Fortney "Pete" Stark, 13th Congressional District
The Honorable Ellen Tauscher, 10th Congressional District

13.4.2 State Elected Officials

A. GOVERNOR

The Honorable Arnold Schwarzenegger, California Governor

B. STATE SENATE

The Honorable Elaine Alquist, 13th Senate District, San Jose
The Honorable Dave Cox, 1st Senate District, Roseville
The Honorable Ellen Corbett, 10th Senate District, Fremont
The Honorable Jeffrey Denham, 12th Senate District, Merced County
The Honorable Dean Florez, 16th Senate District, Fresno
The Honorable Michael Machado, 5th Senate District, Stockton
The Honorable Abel Maldonado, 15th Senate District, Santa Cruz
The Honorable Carole Migden, 3rd Senate District, San Rafael
The Honorable Darrell Steinberg, 6th Senate District, Sacramento
The Honorable Don Perata, 9th Senate District, Oakland
The Honorable Dave Cogdill, 14th Senate District, Fresno
The Honorable Joseph S. Simitian, 11th Senate District, Palo Alto
The Honorable Leland Yee, 8th Senate District, San Mateo
The Honorable Tom Torlakson, 7th Senate District, Concord

C. STATE ASSEMBLY

The Honorable Greg Aghazarian, 26th Assembly District, Stockton
The Honorable Juan Arambula, 31st Assembly District, Fresno
The Honorable Mark DeSaulnier, 11th Assembly District, Martinez
The Honorable Sandre R. Swanson, 16th Assembly District, Oakland
The Honorable Tom Berryhill, 25th Assembly District, Modesto
The Honorable Jim Beall Jr., 24th Assembly District, Campbell
The Honorable Joe Coto, 23rd Assembly District, San Jose
The Honorable Guy S. Houston, 15th Assembly District, Livermore/Walnut Creek/Brentwood
The Honorable Dave Jones, 9th Assembly District, Sacramento
The Honorable Mary Hayashi, 18th Assembly District, Hayward
The Honorable Sally J. Lieber, 22nd Assembly District, San Jose
The Honorable Mark Leno, 13th Assembly District, San Francisco
The Honorable Ted Gaines, 4th Assembly District, Roseville
The Honorable Cathleen Galgiani, 17th Assembly District, Stockton
The Honorable Gene Mullin, 19th Assembly District, San Mateo
The Honorable Roger Niello, 5th Assembly District, Sacramento
The Honorable Ira Ruskin, 21st Assembly District, Palo Alto
The Honorable Anna M. Caballero, 28th Assembly District, Salinas
The Honorable Alberto Torrico, 20th Assembly District, Fremont
The Honorable Michael N. Villines, 29th Assembly District, Fresno
The Honorable Lois Wolk, 8th Assembly District, Vacaville
The Honorable Fiona Ma, 12th Assembly District, San Francisco

D. STATEWIDE COUNTY BOARD OF SUPERVISORS CHAIRPERSON

Mr. Donald F. Gage, Santa Clara County
Mr. Scott Haggerty, Alameda County
Mr. Bob Waterson, Fresno County
Mr. Don Nottoli, Sacramento County
Mr. Frank Bigelow, Madera County
Ms. Rose Jacobs Gibson, San Mateo County
Mr. William O'Brien, Stanislaus County
Mr. Victor Mow, San Joaquin County
Mr. Mike J. Reagan, Solano County
Mr. Aaron Peskin, San Francisco County
Mr. John Pedrozo, Merced County
Ms. Mary N. Piepho, Contra Costa County

E. MAYORS OF CITIES WITH POTENTIAL STATIONS

The Honorable Mayor Jerry Brown, Oakland
The Honorable Mayor Jim Burch, Palo Alto
The Honorable Mayor Ron Gonzales, San Jose
The Honorable Mayor Mark Green, Union City
The Honorable Mayor Jeff Ira, Redwood City
The Honorable Mayor Dennis Kennedy, Morgan Hill
The Honorable Mayor Gavin Newsom, San Francisco
The Honorable Mayor Al Pinheiro, Gilroy
The Honorable Mayor Jim Ridenour, Modesto
The Honorable Mayor Hubert Walsh, Merced
The Honorable Mayor Marc Hershman, Millbrae
The Honorable Mayor Jennifer Hosterman, Pleasanton
The Honorable Mayor Marshall Kamena, Livermore

The Honorable Mayor Brent H. Ives, Tracy
The Honorable Mayor Joan Faul, Atwater
The Honorable Mayor Robert Wasserman, Fremont

Note: Other local elected officials not listed here have been notified regarding the availability of the Draft Program EIR/EIS.

13.5 Regional/Local Agencies

Alameda County Transportation Improvement Authority, Executive Director, Oakland
Bay Area Air Quality Management District, Executive Officer, San Francisco
Bay Area Council, President and CEO, San Francisco
Bay Area Rapid Transit District (BART), President of the BART Board, Oakland
Caltrain – Peninsula Corridor Joint Powers Board, Board Secretary, San Carlos
Capitol Corridor Joint Powers Authority, Chairperson, Oakland
Council of Fresno County Governments, Executive Director, Fresno
Merced County Association of Governments, Chairperson, Merced
Metropolitan Transportation Commission, Executive Director, Oakland
Sacramento Area Council of Governments, Board of Directors Chairperson, Sacramento
Sacramento Metropolitan Air Quality Management District, Chairperson, Sacramento
Sacramento Transportation Authority, Executive Director, Sacramento
San Francisco Bay Conservation and Development Commission, Executive Director, San Francisco
San Joaquin Council of Governments, Executive Director, Stockton
San Joaquin Regional Rail Commission, Chairperson, Stockton
San Joaquin Valley Air Pollution Control District, Governing Board Chairperson, Fresno
San Joaquin Valley Unified Air Pollution Control District, Vice Chair, Fresno
San Mateo County Transit District, Board of Directors Chairperson, San Carlos
San Mateo County Transportation Authority, Board of Directors Chairperson, San Carlos
Stanislaus Council of Governments, Executive Director, Modesto
Solano Transportation Authority, Executive Director, Solano

13.6 Organizations and Businesses

Amtrak, Mayors Advisory Council, Bakersfield
Amtrak, President & CEO Amtrak, Washington
Bay Area Council, President and CEO, San Francisco
Burlington Northern and Santa Fe Railway, Director of Public Affairs, Los Angeles
California Aviation Alliance, Executive Director, Vacaville
California Native Plant Society, Executive Director, Sacramento
California-Nevada Super Speed Train Commission
Great Valley Center, President, Modesto
Natural Resources Defense Council, Regional Director, San Francisco
Planning and Conservation League, Executive Director, Sacramento
Rail Passenger Association of California, Executive Director, San Francisco
San Francisco Planning and Urban Research Association, President, San Francisco
Sierra Club California, Executive Committee Chair, Sacramento
Silicon Valley Manufacturing Group, Associate Director, Transportation & Land Use, San Jose
The Nature Conservancy, Regional Director, San Francisco
Train Riders Association of California, Executive Director, Sacramento
Union Pacific Railroad, Special Representative, Sacramento

13.7 Native American Contacts

Doug Alger, Cultural Resources Coordinator
Salinan Nation Cultural Preservation Association
Lockwood, CA

Pamela Baumgartner, Tribal Administrator
Ione Band of Miwok Indians*
Ione, CA

Lawrence Bill. Interim Chairperson
Sierra Nevada Native American Coalition
Dunlap, CA

Christine Boston, Environmental Coordinator
Ione Band of Miwok Indians*
Ione, CA

Patricia Ann Murphy Brattland
Vice-Chair, Native American Advisory Council to CDF
El Cajon, CA
Tribal Affiliation: Dumna/Kechayi Yokuts

Anthony Brochini, Chairperson
Southern Sierra Miwuk Nation
Mariposa, CA

Jerry Brown
Chaushiha Tribe
Fresno, CA

Silvia Burley, Chairperson
California Valley Miwok Tribe*
(Formerly Sheep Ranch)
Stockton, CA

Rosemary Cambra, Chairperson
Muwekma Ohlone Indian Tribe of the SF Bay Area
Milpitas, CA

Mary Camp, Tribal Administrator
Tuolumne Band of Me-Wuk
Tuolumne, CA

Gregg Castro, Administrator
Salinan Nation Cultural Preservation Association
San Jose, CA

Stanley Robert Cox, Cultural Resources Department
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Tuolumne, CA
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Sacramento, CA 95828
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Tribal Affiliation: Me-wuk, Miwok

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Salinan Nation Cultural Preservation Association
Greenfield, CA

Dwight Dutschke Chairperson
Sierra Native American Council
Ione, CA

Billie Blue Elliston
Galt, CA
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Elaine Fink, Chairperson
North Fork Rancheria
North Fork, CA

Judy Fink, Chairperson
North Fork Rancheria
North Fork, CA
Tribal Affiliation: Mono

Mathew Franklin, Chairperson
Ione Band of Miwok Indians*
Ione, CA
Tribal Affiliation: Miwok

Jose Freeman, President
Salinan Nation Cultural Preservation Association
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Tribal Affiliation: Salinan

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Tuolumne Band of Me-Wuk Indians
Tuolumne, CA

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Fremont, CA
Tribal Affiliation: Ohlone, Bay Miwok, Plains Miwok, Patwin

Ramona Garibay, Representative
Trina Marine Ruano Family
Newark, CA
Tribal Affiliation: Ohlone - Costanoan, Bay Miwok, Plains Miwok, Patwin

Ron Goode
North Fork Mono Tribe
Clovis, CA

Durta Graham, Chairperson
Picayune Rancheria of Chuckchansi
Coarsegold, CA

Emmaline Hammond
Chukchansi Tribe
Oakhurst, CA

Donna Haro
Xolon Salinan Tribe
Bay Point, CA
Tribal Affiliation: Salinan

Ione Band of Miwok Indians
Heritage Cultural Committee
Ione, CA

Les James
Southern Sierra Miwuk Nation
Mariposa, CA

Jay Johnson, Spiritual Leader
Southern Sierra Miwuk Nation
Mariposa, CA

Jakki Kehl
Patterson, CA

Edward Ketchum
Amah Mutsun Tribal Band
Davis, CA

Karin Wilson Kirkendal, Chairperson
Dumna Tribal Government
Fresno, CA

Gaylen D. Lee
North Fork, CA
Tribal Affiliation: North Fork Mono Rancheria

Valentin Lopez, Chairperson
Sacramento, CA
Tribal Affiliation: Ohlone - Costanoan

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Salinan Tribe of Monterey and San Luis Obispo Counties
Nipomo, CA
Tribal Affiliation: Salinan

Mary Motola, Cultural Specialist
Picayune Rancheria of Chukchansi*
Samuel Elizondo, Environmental Director
Coarsegold, CA
Tribal Affiliation: Chukchansi

Frank Navarrette, Environmental Planner
Ione Band of Miwok Indians
Ione, CA
Tribal Affiliation: Miwok

Katherine Erolinda Perez
North Valley Yokuts Tribe
Linden, CA

Neal Peyron, Chairperson
Tule River Indian Tribe*
Porterville, CA

Bonnie Pierce
Los Osos, CA

Lorrie Planas
Choinumni Tribe
Clovis, CA

Jim Redmoon
Cultural Resources Representative
Dumna Tribal Government
Fresno, CA

Majorie Ann Reid
Redding, CA
Tribal Affiliation: Ohlone, Costanoan

Tina Reynolds, Executive Secretary
Ione Band of Miwok Indians
Ione, CA

Ann Marie Sayers, Chairperson
Indian Canyon Mutsun Band of
Costanoan
Hollister, CA
Tribal Affiliation: Ohlone - Costanoan

Mary Daniels-Tarango
Wilton Rancheria
Sacramento, CA
Tribal Affiliation: Miwok

Keith Turner, Tribal Contact
Dumna/Wo-Wah Tribal Government
Auberry, CA
Tribal Affiliation: Dumna/Foothill Yokuts,
Mono

Kenneth Woodrow
Salinas, CA

Xielolixii
Salinan Nation Cultural Preservation
Association
Bakersfield, CA

Randy Yonemura
Sacramento, CA
Tribal Affiliation: Miwok

Michelle Zimmer, Cultural Resource
Coordinator
Amah/Mutsun Tribal Band
Woodside, CA

Irene Zwierlein, Chairperson
Amah/Mutsun Tribal Band
Woodside, CA

14 SOURCES USED IN DOCUMENT PREPARATION

This chapter lists the sources used in the preparation of this document. The sources are listed by chapter, and by section in the case of Chapter 3. The sources include printed material, Web-based material, and personal communications.

14.1 Summary

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15 GLOSSARY

A

Abatement: Reduction; often used to describe mitigation of noise.

Accessibility: The ease with which a site or facility may be reached by passengers and others necessary to the facility's intended function. Also, the extent to which a facility is usable by persons with disabilities, including wheelchair users.

Action Alternative: An alternative that represents the proposed action or another alternative action, as contrasted to the No Action (No Project) Alternative.

Adverse: Negative or detrimental.

Affected Environment: The physical, biological, social, and economic setting potentially affected by one or more of the alternatives being considered.

Air Pollution: A general term that refers to one or more chemical substances that degrade the quality of the atmosphere.

Alignment: The horizontal and vertical general location for HST tracks within study corridors.

Alignment Alternatives: The general location for HST tracks, structures and systems for the HST system between logical points within study corridors.

Alluvium: Sedimentary materials deposited by running water.

Alquist-Priolo Earthquake Fault Zoning Act: California law passed in 1972 to prevent construction of buildings used for human occupancy on surface traces of active faults.

Americans with Disabilities Act (ADA): Federal regulation establishing legal requirements for accessibility.

Amplitude: The magnitude of a periodic wave; also describes the strength or intensity of a signal that travels in wave form, such as a radio signal.

Aquifer: Subsurface geologic unit (rock or sediment) that contains and transmits groundwater.

Arc, Arcing: Electrical discharge is said to arc when it jumps across the space between two contacts.

At Grade: At ground surface level; a term used to describe roadways, river crossings, and track alignments.

Attainment: An air basin is considered to be in *attainment* for a particular pollutant if it meets the federal or state standards set for that pollutant. *See also* Maintenance, Nonattainment.

A-Weighted Sound Level: A measure of sound intensity that is weighted to approximate the response of the human ear, so it describes the way sound will affect people in the vicinity of a noise source.

B

Baseline: Foundation or basis to use for comparison purposes.

Beneficial Visual Impact: Impact resulting if a project alternative eliminates a dominant feature that currently detracts from scenic qualities or blocks vistas in the landscape.

BNSF: BNSF Railway Company.

BTU: British Thermal Unit, equal to the amount of heat required to raise 1 pound of water 1 degree Fahrenheit at 1 atmosphere of pressure.

Buttressing: An action or structure that provides support or stability.

C

California Environmental Quality Act (CEQA): "Legislation enacted in 1970 to protect the quality of the environment for the people of California by requiring public agencies and decision-makers to document and consider the environmental consequences of their actions. CEQA is the state equivalent of the National Environmental Policy Act (NEPA)."

Capital Cost: The total cost of acquiring an asset or constructing a project.

Capitol Corridor: An existing intercity rail alignment approximating the I-80 corridor; carries freight traffic, long distance Amtrak service, and intrastate "Capitol" service.

Carbon Dioxide (CO_2): A colorless, odorless gas that occurs naturally in the earth's atmosphere; significant quantities are also emitted into the air by fossil fuel combustion.

Carbon Monoxide (CO): A colorless, odorless gas that is generated in the urban environment, primarily by the incomplete combustion of fossil fuels in motor vehicles.

Catenary Wire: A suspended (overhead) wire system that supplies power from a central power source to an electric vehicle such as a train.

Class I Trail: A trail in a separate right-of-way designated for exclusive use by bicycles and pedestrians, with cross traffic by motorists minimized.

Class II Trail: A trail in a restricted right-of-way designated for semiexclusive use by bicycles, with traffic by motor vehicles or pedestrians at crossings.

Class III Trail: A trail located in a right-of-way designated by signs or permanent markings and shared with pedestrians and motorists.

Cofferdam: Watertight enclosure from which water is pumped to expose the bottom of a body of water and permit construction.

Community Cohesion: The degree to which residents have a sense of belonging to their neighborhood, a commitment to the community, or a strong attachment to neighbors, groups, and institutions, usually as a result of continued association over time.

Community Noise Equivalent Level: A 24-hour L_{eq} that has been adjusted to add a "penalty" of 5 dBA for evening noise (between 7:00 p.m. and 10:00 p.m.) and 10 dBA for nighttime noise (between 10:00 p.m. and 7:00 a.m.).

Congestion Management Plan: A planning document that addresses strategies for reducing traffic congestion.

Connectivity: Describes the degree of "connectedness" of a transportation system, such as a transit network, and the ease with which passengers can move from one point to another within the network or points outside the network.

Conservation Easement: An easement created by transferring development rights over a property from a farmer to another entity, such as the local jurisdiction or an agricultural protection organization; the land remains in private ownership and may be farmed, but may not be developed with urban uses. *See also* Easement.

Cooperating agency: Under NEPA, any agency other than the lead agency that has legal jurisdiction over, or technical expertise regarding, environmental impacts associated with a proposed action and has agreed to participate.

Construction: Any activity related to building projects, including highways or HST infrastructure (e.g., track, stations, tunnels, bridges) that directly alters the environment.

Corridor: A geographic belt or band that follows the general route of a transportation facility (highway, railroad, etc). *See also* Study corridors.

Criteria Pollutants: Refers to pollutants for which federal and state air quality standards have been established: carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x), ozone (O_3), particulate matter with a diameter of 10 microns or less (PM10), particulate matter with a diameter of 2.5 microns or less (PM2.5), and lead (Pb).

Cultural Resources: Resources related to the tangible and intangible aspects of cultural systems, living and dead, that are valued by a given culture or contain information about the culture. These include (i.e., are not limited to) sites, structures, buildings, districts, and objects associated with or representative of people, cultures, and human activities and events.

Cumulative Impact: (1) As defined by CEQA, the result of two or more individual impacts which, when considered together, are considerable or which compound or increase other environmental impacts. (2) As defined by NEPA, and impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.

Cut and Cover: Construction technique in which a trench is excavated, infrastructure is installed, and the trench is closed.

Cut and Fill: Construction technique involving excavation or grading followed by placement and compaction of fill material.

Cut Slope: A slope that is shaped by excavation or grading. *See also* Fill slope.

D

Decibel (dB): A logarithmic measurement of noise intensity.

Densification: The process of making an element more compact by reducing air space.

Dewatering: The process of removing water from an area or substance, such as fill material.

Disturbance: A discrete event, either natural or human induced, that causes a change in the condition of an ecological system.

E

Easement: An interest in land owned by another individual or organization that entitles its holder to a specific limited use.

Ecosystem: A system formed by the interaction of living organisms, including people, with their environment.

Electromagnetic Field (EMF): The force field that extends outward from any moving electrical current, consisting of both a magnetic field and an electric field.

Electromagnetic Interference (EMI): An electrical emission or disturbance that causes degradation in performance or results in malfunctions of electrical or electronic equipment, devices, or systems.

Emergent: (1) Arising naturally or (2) of vegetation, rooted in periodically or continuously inundated substrate, but with a portion of the plant extending above the water.

Eminent Domain: A jurisdiction or agency's legal right to take private property for public use in exchange for fair compensation.

Emission and Dispersion Modeling System (EDMS): Modeling system used by the Federal Aviation Administration (FAA) to estimate airplane emissions generated from a specified number of landing and take-off (LTO) cycles.

Endangered Species: Species listed under the federal Endangered Species Act as being in danger of or threatened with extinction throughout all or most of its range.

Enplanement: The act of boarding an airplane.

Environmental Impact Report (EIR): A detailed informational document that analyzes a project's potential significant effects and identifies mitigation measures and reasonable alternatives to avoid the significant effects. This document is part of the CEQA environmental review process.

Environmental Impact Statement (EIS): A detailed informational document that analyzes a project's potential significant effects and identifies mitigation measures and reasonable alternatives to avoid the significant effects. This document is part of the NEPA environmental review process.

Environmental Justice: Identifying and addressing the potential for disproportionately high and adverse effects of programs, policies, and activities on minority populations and low-income populations.

Erosion: Process by which earth materials are worn down by the action of flowing water, ice, or wind.

Ethnicity: A grouping or category of people based on shared cultural traits, such as ancestral origin, language, custom, or social attitude.

F

Farmland of Local Importance: Farmlands that are important to the local agricultural community, as determined by each county's board of supervisors and local advisory committee. *See also* Farmland of Statewide Importance, Prime Farmland.

Farmland of Statewide Importance: Farmlands similar to prime farmlands but that have been evaluated as less valuable because they have steeper slopes, less ability to retain moisture in the soil, or other characteristics that limit their use. To qualify as farmland of statewide importance, a property must have been used for production of irrigated crops at some time during the previous 4 years.

Farmland Severance: Because agricultural land usually consists of large parcels, the acquisition of part of a property results in the severance (disconnection) of land retained under agricultural use and in impacts associated with construction and with occupation or use of developed areas.

Fault: A fracture in the earth's lithosphere (brittle rocky shell) along which movement has occurred.

Feasible: Capable of being implemented.

Fill Slope: A slope shaped by the placement and compaction of loose "fill" materials, which may be reused from elsewhere on the construction site, or imported.

Fiscally or Financially Constrained Plans: Plans that are limited by the foreseen availability of project funding in a region.

Flyover: A bridge that carries one road or rail alignment aerially over another.

Footprint: Area of the ground surface covered by a facility or affected by construction activities.

Freeway Deficiency Plans: Freeway Deficiency Plans contain the following components: an analysis of the causes of the deficiency; a list of improvements that would have to be made to remedy the deficiency, including cost estimates; a list of proposed improvements; and an implementation plan including a schedule.

Frequency: The number of times a field, such as an electromagnetic field, changes direction in space each second. Also, the number of trains, flights, or other transportation service occurring in a given time period.

G

G Force: A force whose magnitude is equal to the gravitational force acting on a body at sea level, expressed as 1.0g.

Gauss: Unit of measure describing the strength of a magnetic field. Near the surface of the earth, the earth's magnetic field measures approximately 0.5 gauss (0.1 Telsa). *See also* Tesla.

General Plan: A planning document, usually at the city or county level, that encapsulates policies for land use and development over a specified period of time. A general plan may be supplemented by specific plans that address land use and development policies for specific portions of a planning jurisdiction, such as historic districts or areas slated for redevelopment.

Geographic Information System (GIS): An information management system designed to store and analyze data referenced by spatial or geographic coordinates.

Giga: Prefix meaning 1 billion.

Grade Crossing: The intersection of a railroad and a highway at the same elevation (grade); an intersection of two or more highways; an intersection of two railroads.

Grade-Separated: At different elevations; on separate levels.

Greenhouse Gases: A class of air pollutants believed to contribute to the "greenhouse" global warming effect, including nitrogen oxides (NO_x), hydrocarbons (HC), and carbon dioxide (CO_2).

Grid: A system of interconnected power generators and power transmission lines that is managed to meet the requirements of energy users connected to the grid at various points.

Groundwater: Water contained and transmitted through open spaces in rock and sediment below the ground surface.

Growth Inducement: Contribution to the rate or extent of development in an area.

H

Habitat: An environment where plants or animals naturally occur; an ecological setting used by animals for a particular purpose, such as roosting or breeding.

Headway: The time between buses, trains, or other transit vehicles at a given point. For example, a 15-minute headway means that one bus arrives every 15 minutes.

Herbaceous: Describes plants that have little or no woody tissue. Herbaceous plants typically survive for only a single growing season.

Heritage Resources: An alternate term for cultural resources used in some planning documents. *See* Cultural Resources.

Hertz: A unit of measure describing frequency; equal to cycles (number of reversals) per second.

High-Speed Steel-Wheel-on-Steel-Rail Train: An improvement of traditional railroad passenger technology that has been designed to operate at speeds of 100–150 mph (160–240 kph) on existing rail infrastructure.

High-Speed Train (HST): A train designed to operate safely and reliably at speeds near 200 mph (350 kph).

High Visual Impact: Impact sustained if features of a project alternative are very obvious, such that they begin to dominate the landscape and detract from the existing landscape characteristics or scenic qualities.

HST Alignment Alternatives: General location for HST tracks, structures and systems for the HST system between logical points within study corridors; they are generally configured along or adjacent to existing rail transportation facilities. These HST Alignment alternatives are described in Chapter 2, analyzed in Chapter 3, compared and used to create HST Networks in Chapter 7.

HST Network Alternatives: Represent different ways to implement the HST system in the study region with combinations of HST Alignment Alternatives and station location options. These HST Network alternatives are identified in Chapter 2 and compared in Chapter 7.

HST Alignment Segment: A portion of alignment (often defined to distinguish sub-alternatives) that can be combined with other segments to form an alignment.

Hydrocarbons: A wide variety of organic compounds, including methane (CH_4), emitted principally from the storage, handling, and combustion of fossil fuels.

I

Impact: A change in the condition or function or an environmental resource or environmental value as a result of human activity. Also called *effect*.

In Lieu Of: Instead of or in place of.

Indigenous Species: A native species; any plant or animal species that occurs naturally in a wilderness area and was not introduced, deliberately or accidentally, by humans.

Infrastructure: The facilities required for a societal function or service (e.g., *transportation infrastructure*, *utilities infrastructure*).

Initial Study: An environmental study carried out in compliance with CEQA, with the goal of evaluating whether a proposed project has the potential to result in significant impacts on the environment.

Insertion Loss: The actual noise-level reduction at a specific receiver due to construction of a noise barrier or some other intervention between the noise source (e.g., traffic) and the receiver.

In-Situ: In the original or natural position.

Intermodal: Describes transportation that involves more than one means (e.g., walk, bike, auto, transit, taxi, train, bus, air) during a single journey.

Investment-Grade Ridership Forecast: Ridership forecast that is sufficiently detailed and reliable to permit responsible decision-making about capital expenditures.

J

K

Kilo: Prefix meaning 1 thousand.

L

Landslide: Movement of earth or rock materials downslope under the influence of gravity.

Land Use Compatibility Assessment: An assessment of the compatibility of a proposed project or land use with existing and projected land uses in nearby areas, based on the sensitivity of various land uses to change related to the alternatives and the impact of these changes on the land use.

Lead (Pb): A stable element that persists and accumulates both in the environment and in humans and animals and can have toxic effects.

Lead Agency: The public agency that has the principal responsibility for carrying out or approving a project or action and is thus responsible for preparing environmental review documents in compliance with CEQA and/or NEPA.

L_{eq}: A measure of the average noise level during a specified period of time.

L_{eq}(h), dBA: Equivalent or average noise level for the noisiest hour, expressed in A-weighted decibels. See also A-Weighted Sound Level.

Less Than Significant: In CEQA usage, describes an impact that is not sufficiently adverse, intense, or prolonged to require mitigation.

Level of Service (LOS): A rating using qualitative measures that characterizes operational conditions within a traffic stream and the perception by motorists and passengers of these conditions.

Liquefaction: A type of ground failure in which soils or sediments lose their internal cohesion, cease to behave as a solid, and flow like a liquid.

Logarithmic Scale: A measurement in which the ratio of successive intervals is not equal to 1 (which is typical for linear scales) but is some common factor larger than the previous interval (a typical ratio is 10, so that the marks on the scale read 1, 10, 100, 1000, 10000, etc.). Logarithmic scales are useful for graphing values that have a very large range.

Low Visual Impact: Impact sustained if features of a project alternative are consistent with the existing line, form, texture, and color of other elements in the landscape and do not stand out.

M

Mainline: A principal highway or railroad, exclusive of connectors, ramps, spurs, etc.

Maintenance: An air basin is considered to be in *maintenance* for a given pollutant if it was formerly in nonattainment but is now meeting the established standards for that pollutant. See also Attainment, Nonattainment.

Major Investment Study (MIS): A study that evaluates project alternatives for their ability to solve an area's transportation problems.

Master Plan: A comprehensive planning document intended to guide the long-range growth and development of a community or region, or the long-term management and use of a parkland.

Measure M: Approved by Orange County voters in November 1990, Measure M instituted a sales tax of 0.5 cent for countywide transportation improvements.

Mean High-Water Mark: The elevation reached by the water surface at the mean (average) high water level (average high-tide elevation or average flood elevation), often indicated by physical characteristics, such as erosion, lines of vegetation, or changes in type of vegetation.

Medium Visual Impact: Impacts sustained if features of a project alternative are readily discernable but do not dominate the landscape or detract from existing dominant features.

Microscale: Description of local air quality analysis.

Midden: Refuse accumulation associated with prehistoric use of a site or area.

Mitigation: Action or measure undertaken to minimize, reduce, eliminate, or rectify the adverse impacts of a project, practice, action, or activity.

Monitoring: The collection of information to determine the effects of resource management and to identify changing resource conditions or needs.

Monoculture: The cultivation of a single product to the exclusion of other uses of land.

N

National Ambient Air Quality Standards (NAAQS): Federal standards stipulating the allowable ambient concentrations of specific criteria pollutants.

National Environmental Policy Act (NEPA): "Federal legislation requiring federal agencies to consider the environmental impacts of major federal projects or decisions, to share information with the public, to identify and assess reasonable alternatives, and to coordinate efforts with other planning and environmental reviews taking place."

Nitrogen Oxides (NO_x): A class of pollutant compounds that include nitrogen dioxide (NO_2) and nitric oxide (NO), both of which are emitted by motor vehicles. *See* Criteria Pollutants.

No Action: Under NEPA, refers to an alternative under which no action would be taken (no infrastructure would be built and no new management or operational practices would be instituted). See No Project.

No Project: Under CEQA, refers to an alternative under which no action would be taken (no infrastructure would be built and no new management or operational practices would be instituted). See No Action.

No Project Alternative: Represents the region's (and state's) transportation system (highway, air, and conventional rail) as it is today and with implementation of programs or projects that are in regional transportation plans and have identified funds for implementation by 2030.

Nonattainment: An air basin is considered to be in *nonattainment* for a particular pollutant if it is exceeding federal or state standards for that pollutant. See also Attainment, Maintenance.

Non-Electrified Steel-Wheel-on-Steel-Rail Train: Conventional intercity diesel locomotive train equipment (e.g., Amtrak California Corridor trains).

Nonpoint Source Pollution: Pollution that cannot be traced to a single source but collects from a wide area. Examples include pesticides or fertilizers that wash into rivers or percolate through the soil into groundwater.

Non-Water-Contact Recreation: Recreational activities where contact with the water is not likely, such as photography and wildlife viewing.

Notice of Intent (NOI): Formal notice stating that an environmental impact statement will be prepared for a proposed project; published in the Federal Register by the federal lead agency.

Notice of Preparation (NOP): Formal notice stating that an environmental impact report will be prepared for a proposed project, issued by the state lead agency.

Noxious Weed: A plant that has been defined as a pest by law or regulation. Both the State of California and the federal government maintain lists of plants that are considered threats to the well-being of the state or the country.

NPL/Superfund List: Federal list of sites that have been identified as posing an immediate public health hazard and where an immediate response is necessary.

O

Ordinary High-Water Mark: The line on the shore of a body of water established by the fluctuation of water.

Ozone (O_3): A photochemical oxidant that is a major cause of lung and eye irritation in urban environments.

P

Paleontological: Related to the study of life in past geologic time.

Pantograph: A device on the roof of the HST for collecting current from an overhead wire, consisting of a hinged vertical arm operated by springs and hydraulic mechanism with a wide, horizontal contact surface that slides along the wire.

Particulate Matter: Liquid and solid particles of a wide range of sizes and compositions; of particular concern for air quality are particles smaller than or equal to 10 microns and 2.5 microns (PM10 and PM2.5 respectively).

Point Source Pollution: Pollution that can be traced to a single source. An example is a smokestack at a factory.

Poverty Level: A federally established income guideline used to define persons who are economically disadvantaged.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Preferred Alternative: The alternative identified as preferred by the lead agencies.

Program-Level: Refers to a CEQA or NEPA environmental review that covers the broad spectrum of a large, complex, regionally extensive effort comprised of a number of smaller, regionally focused projects or phases.

Project-Level: Refers to more detailed site-specific environmental analysis focusing on a single project that is part of a larger program.

Prime Farmland: Rural land that has the best combination of physical and soil chemistry characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses.

Public Transportation: Includes bus, trolley bus, streetcar or trolley car, subway or elevated, railroad, ferryboat, and taxicab service.

Purpose and Need: The reason(s) why a project or action is undertaken, and the need(s) it is intended to meet or fulfill.

Q

R

Radio Frequency: The frequency range of the electromagnetic spectrum that is used for radio communication.

Reactive Organic Gases (ROG): Reactive hydrocarbon pollutants.

Regional Transportation Improvement Plan (RTIP): A listing of all transportation projects proposed over a six-year period for a given region. The RTIP is prepared to implement projects and programs listed in the Regional Transportation Plan and is developed in compliance with state and federal requirements.

Regional Transportation Plan (RTP): A long-range (20+ year) transportation plan. The regional transportation plan (RTP) identifies major challenges as well as potential opportunities associated with growth, transportation finances, the future of airports in the region, and impending transportation system deficiencies that could result from growth anticipated in the region. There are typically two components of the RTP: a financially constrained and financially unconstrained version. The financially constrained version of the RTP includes projects and programs that fit within existing and planned funding sources.

Representative Demand: For this Program EIR/EIS, the higher ridership forecast of 117 million intercity trips (based on the sensitivity analysis described in Chapter 1), which includes the 31 million commute trips figure. Provides a reasonable representation of total capacity and serves as a representative worst-case scenario for analyzing the potential environmental impacts from construction and operation of the HST system through 2030. This higher forecast is generally used as a basis for defining the HST alternatives.

Richter Scale: A logarithmic scale measuring the severity of earthquakes, based on the magnitude of ground motion.

Ridership: The number of people who ride a transportation system.

Right-of-Way: A legal right of passage over a defined area of real property. In transit usage, right-of-way refers to the corridor along a roadway or track alignment that is controlled by a transit or transportation agency/authority.

Riparian: Relating to, living, or located on the bank of a natural watercourse, lake, or tidewater.

Riprap: Armoring consisting of randomly placed rock or concrete; used to strengthen an embankment or protect it from erosion.

Ruderal: Weedy vegetation, commonly including or dominated by introduced species, characteristic of areas where native vegetation has been disturbed or removed.

S

Scenic Corridor: A corridor with landscapes and vistas of high scenic quality.

Scoping: A process used under both CEQA and NEPA to determine the scope of issues to be addressed and to identify the significant issues related to the proposed action or project to be addressed in an environmental impact report or environmental impact statement.

Screenline: An imaginary line across parallel roadways that defines a zone of analysis.

Section 4(f): Provisions originally enacted as Section 4(f) of the U.S. Department of Transportation Act of 1966 (23 C.F.R. 771.135) and subsequently codified in 49 U.S.C., Subtitle I, Section 303(c). The Section 4(f) provisions address the potential for conflicts between transportation needs and the protection of lands for recreational use and resource conservation by regulating the use of publicly owned parkland, recreation areas, and historic sites. Specifically, they prohibit the Secretary of Transportation from approving any program or project that would require the use of any publicly owned land from a public park, recreation area, wildlife or waterfowl refuge, or land of an historic site of national significance as determined by the officials having jurisdiction over these lands, unless there are no feasible and prudent alternatives to the use of these lands. In addition, a proposed program or project must include all possible planning to minimize harm resulting from the proposed use.

Section 6(f): Section 6(f) of Land and Water Conservation Fund Act of 1964, which prohibits the conversion to a non-recreational purpose of property acquired or developed with funds granted through the Act without the approval of the National Park Service. Section 6(f) directs the Department of the Interior to ensure that replacement lands of equal value (monetary), location, and usefulness are provided as conditions to such conversions. Consequently, where such conversions of Section 6(f) lands are proposed for transportation projects, replacement lands must be provided.

Sedimentary Rock: Rock resulting from the consolidation of sediment.

Seiche: Oscillation or “sloshing” of water in a lake, bay, or other enclosed body as a result of landsliding or seismic groundshaking.

Senate Bill 45: Bill that instituted consolidation of various funding programs into the State Transportation Improvement Program and increased accountability for programming and delivery of STIP projects to the regions around the state and the various Caltrans districts.

Sensitivity Analysis: An analysis that assesses how sensitive the outcomes predicted by modeling are to changes in different model inputs (assumptions or variables).

Shadow impact: Shadow impact is the introduction of shadows to a land sensitive to aesthetic conditions from a new structure.

Significant: In CEQA usage, describes an impact that is sufficiently adverse, intense, or prolonged to require mitigation. For NEPA usage see 40 CFR 1508.27.

South Coast Air Quality Management District: The regional regulatory agency with the primary responsibility for improving air quality in the South Coast Air Basin.

State Implementation Plan (SIP): Statewide plan for complying with the federal Clean Air Act. The SIP consists of narrative, rules, and agreements that California will use to cleanup polluted areas.

State Transportation Improvement Program (STIP): A multi-year capital improvement program of transportation projects on and off the state highway system, funded with revenues from the State Highway Account and other funding sources. STIP programming generally occurs every two years.

Station Location Options: general locations that represent the most likely HST stations based on current knowledge, consistent with the objective to serve the state's major population centers.

Strike-Slip Fault: A fault along which the dominant direction of movement is parallel to the fault trace (the expression of the fault on the ground surface).

Stub End: A track that terminates at one end.

Study Corridors: Six linear geographic belts or bands being considered for the HST system that connect different parts of the study region. They are distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections) and generally follow the route of a transportation facility.

Study Region: Bay Area to Central Valley region encompassing all six study corridors.

Subsidence: Sinking or lowering of the ground surface.

Sulfur Oxides (SO_x): Sulfur-oxygen compounds that include the important criteria pollutants sulfur dioxide (SO_2) and sulfur trioxide (SO_3).

T

Take: As defined in Section 3 of the federal Endangered Species Act, "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

Tesla: Unit of measure describing the strength of a magnetic field. *See also* Gauss.

Tiering: Refers to the practice of addressing general issues in broader environmental impact reports or statements such as program-level documents and providing more detailed site-specific analyses in subsequent (typically project-level) documents that incorporate the initial broad analysis by reference.

Total Organic Gases (TOG): A pollutant classification that includes all hydrocarbons, both reactive and nonreactive.

Trainset: A complete unit of rolling stock that makes up a single train.

Transit-Dependent Population: The population over the age of 16 (workers) who use public transportation as a means of traveling to and from work.

Transit Node: A connection, station, or terminal on a transit network.

Transportation Demand Management: The operation and coordination of various transportation system policies and programs to manage travel demand to make the most efficient and effective use of existing transportation services and facilities.

Transportation System Management: Actions that improve the operation and coordination transportation services and facilities to realize the most efficient use of the existing transportation system.

Travel Time: The time spent on the road, in the air, or on a train from a place of origin to a place of destination. *Total travel time* includes the time required to reach a station or an airport, time spent waiting for the next scheduled train or flight, time spent getting to the boarding area, time spent checking and retrieving luggage, time spent getting a rental car or taxi, as well as time spent to reach the final destination.

Tributary Watercourse: A stream feeding a larger stream or a lake.

Tsunamis: Waves that travel in the open ocean and are caused by an undersea earthquake, landslide, or volcanic activity.

U

Unavoidable: In CEQA and NEPA usage, describes an impact that cannot be entirely avoided, reduced, or compensated for.

Unique Farmland: Farmland with soils of lower quality than either prime farmland or farmland of statewide importance, but still used for the production of crops. Unique farmlands are usually irrigated but may include nonirrigated orchards or vineyards in some of California's climate zones. To quality as unique farmland, a property must have been used for crops at some time during the previous 4 years.

Units of Measure:

Table of Metric Equivalents	
Length	
Unit	Approximate U.S. Equivalent
1 kilometer	0.62 mile
1 meter	39.37 inches
1 centimeter	0.39 inch
Area	
Unit	Approximate U.S. Equivalent

Table of Metric Equivalents	
1 square kilometer	0.3861 square miles
1 hectare	2.47 acres
Capacity	
Unit	Approximate U.S. Equivalent
1 liter	1.057 quarts
Mass and Weight	
Unit	Approximate U.S. Equivalent
1 metric ton	1.102 short tons (2,204.6 pounds)
1 kilogram	2.2046 pounds
1 gram	0.035 ounce
Speed	
Unit	Approximate U.S. Equivalent
1 kilometer per hour	0.621 mile per hour

Uplift: The action of a portion of the earth's surface as it rises above adjacent areas. An area of higher elevation than surrounding areas; an area that has been uplifted.

UPRR: Union Pacific Railroad Company.

V

Volume to Capacity Ratio (V/C Ratio): The relationship between the amount of traffic a roadway was designed to carry and the amount of traffic it actually carries. Related to the level of service (LOS) the roadway can provide.

Very High Speed Steel-Wheel-on-Steel-Rail Train: A train capable of maximum operating speeds near 220 mph (350 kph) utilizing steel-wheel-on-steel-rail technology.

Viaduct: A bridge that conveys a road or a railroad over a valley; often constructed of a series of arches supported by piers.

Viewshed: Total visible area from a single observer position, or the total visible area from multiple observer positions. Viewsheds are accumulated seen-areas from highways, trails, campgrounds, towns, cities, or other viewer locations. Examples include corridor, feature, or basin viewsheds.

Visual Intactness: The aesthetic integrity of the visual environment and its freedom from encroaching elements.

Visual Resources: The natural and artificial features of a landscape that characterize its form, line, texture, and color.

Visual Unity: The visual coherence and compositional harmony of a landscape when considered as a whole.

Visual Vividness: The visual power or memorability of landscape components as they combine in patterns experienced by the viewer.

Volt: Standard unit of measure for electrical potential.

W

Watershed: The area that contributes water to a drainage system or stream.

Watt: Standard unit of measure for electrical power.

Wayside Power: Electrical power provided from the utility grid to the electrified railroad right-of-way at convenient locations from the side of the rail tracks or corridor.

Weir: A small dam that restricts flow in a stream in order to raise water level, or that diverts flow into a desired course.

Wetland: An area that is regularly saturated by surface water or groundwater and is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions.

Wildlife Corridor: A belt of habitat that is essentially free of physical barriers such as fences, walls, and development, and connects two or more larger areas of habitat, allowing wildlife to move between physically separate areas.

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17 ACRONYMS AND ABBREVIATIONS

µT	microtesla
AB	Assembly Bill
ac	acre
AC	Alameda County
ACE	Altamont Commuter Express
ACGIH	American Conference of Governmental Industrial Hygienists, Inc.
ACM	Asbestos Containing Materials
ADL	aerially deposited lead
AFB	Air Force Base
ANSI/IEEE	American National Standards Institute/Institute of Electrical and Electronic Engineers
APE	area of potential effects
ASTM	American Society for Testing and Materials
Authority	California High-Speed Rail Authority
AWP	Annual Work Plan
BA	biological assessment
BART	Bay Area Rapid Transit
BCDC	Bay Conservation and Development Commission
Bcf	billion cubic feet
Bcm	million cubic meters
BMP	best management practices
BO	biological opinion
BRMP	Biological Resources Management Plans
Btu	British thermal unit
C.C.R.	California Code of Regulations
CAA	Clean Air Act
CAFÉ	Corporate Average Fuel Economy
CalEPA	California Environmental Protection Agency
Cal-ISO	California Independent State Operator
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CAT	Ceres Area Transit
CCA	chromated copper arsenate
CCAA	California Clean Air Act
CCC	California Coastal Commission
CCJPA	Capitol Corridor Joint Powers Authority
CDF	California Department of Forestry and Fire Protection
CDFG	California Department of Fish and Game

CDWR	California Department of Water Resources
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CH4	methane
CHRIS	California Historical Resources Information System
CIDH	Cast-in-drilled-hole
cm	centimeters
CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
Commission	California Intercity High Speed Rail Commission
CPAU	City of Palo Alto Utilities
CPUC	California Public Utilities Commission
CRHR	California Register of Historical Resources
CSC	California species of special concern
CUPA	Certified Unified Program Agencies
CURBA	California Urbanization and Biodiversity Analysis
CVP	Central Valley Project
CWA	Clean Water Act
CWR	continuously welded rail
CZMA	Coastal Zone Management Act
CZMP	coastal zone management program
DOI	U.S. Department of the Interior
DOT	Department of Transportation
DTSC	California Department of Toxic Substances Control
EDMS	Emission and Dispersion Modeling System
EF	electric field
EFH	Essential Fish Habitat
EIR/EIS	environmental impact report/ environmental impact statement
ELF	extremely low frequency
EMF	electromagnetic field

EMI	electromagnetic interference
EMUs	electric multiple units
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Protection Indicators for California
ESA	federal Endangered Species Act
ESAs	Environmentally Sensitive Areas
FAA	Federal Aviation Administration
FARS	Fatality Analysis Reporting System
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRE	finance, insurance, and real estate
FIRM	Flood Insurance Rate Maps
FMMP	Farmland Mapping and Monitoring Program
FPPA	Farmland Protection Policy Act
FR	Federal Register
FRA	Federal Railroad Administration
ft	feet
FTA	Federal Transit Administration
GEA	Grassland Ecological Area
General Construction Permit	General Permit for Construction Activities
general WDRs	general waste discharge requirements
GIS	geographic information systems
GPI	greatest potential impacts per region
GSP	gross state product
GWh	gigawatt-hours
ha	hectare
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HASP	Health and Safety Plan
HC	hydrocarbons
HCP	Habitat Conservation Plan
HOVs	high-occupancy vehicles
HST	high-speed train
Hz	hertz
I-5	Interstate 5
ICE	InterCity Express
ICES	International Committee on Electromagnetic Safety
ICNIRP	International Commission on Non-Ionizing Radiation protection
in	inch
IOU	investor-owned utility
ISAC	Invasive Species Advisory Committee
ISTEA	Intermodal Surface Transportation Efficiency Act

ITP	incidental take permit
ITS	intelligent transportation system
JPB	Joint Powers Board
km per hour	kph
km	kilometers
kpl	kilometers per liter
kV	kilovolt
LAUS	Los Angeles Union Station
LAVTA	Livermore Amador Valley Transit Authority
LBP	lead-based paint
LCMMP	Land Cover Mapping and Monitoring Program
LCP	local coastal program
Ldn	Day-Night Sound Level
LEDPA	least environmentally damaging practicable alternative
Leq	Equivalent Sound Level
LESA	Land Evaluation and Site Assessment
LEV	low emission vehicle
LF	low frequency
Lmax	Maximum Sound Level
LOS	level of service
LPI	least potential impacts region
LTO	landing and take-off
LUFT	Leaking Underground Fuel Tank
LUST	Leaking Underground Storage Tank
m	meters
MCAG	Merced County Association of Governments
MCE	Merced Municipal/Macready Field
MF	magnetic field
mG	milligauss
mi	mile
MMBTUs	million British thermal units
MOD	Modesto City-County-Harry Sham Field
MOU	memorandum of understanding
mpg	miles per gallon
mph	miles per hour
MPOs	Metropolitan Planning Organizations
MST	Monterey-Salinas Transit
MTC	Metropolitan Transportation Commission
Muni	Municipal Railway
MW	megawatts
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NCCP	natural community conservation plan
NCP	National Contingency Plan
NCRP	National Council on Radiation

	Protection
NCRS	Natural Resources Conservation Service
NEC	Northeast Corridor
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NHRP	National Register of Historic Places
NISC	National Invasive Species Council
No Project	No Project/No Action
NO	nitric oxide
NO2	nitrogen dioxide
NOA	naturally occurring asbestos
NOAA	National Oceanic and Atmospheric Administration
NOI	notice of intent
NOP	notice of preparation
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NWPs	nationwide permits
O&M	operating and maintenance
O3	ozone
OAG	Official Airline Guide
OAK	Oakland International Airport
OEHHA	Office of Environmental Health Hazard Assessment
OSHA/CalOSHA	federal and state Occupational Safety & Health Administration
P.L.	Public Law
PA	programmatic agreement
Pb	lead
PCBs	polychlorinated biphenyls
PCP	pentachlorophenol
PKT	passenger kilometers traveled
Plan	San Francisco Bay Area Regional Rail Plan
PM10	particulate matter 10 microns in diameter or less
PM2.5	particulate matter 2.5 microns in diameter or less
PMT	passenger miles traveled
PRBO	Point Reyes Bird Observatory
Program EIR/EIS	Bay Area to Central Valley HST Program EIR/EIS
RCRA	Resource Conservation and Recovery Act
RF	radiofrequency
RM2	Regional Measure 2
ROG	reactive organic gases
ROTA	Riverbank-Oakdale Transit Authority
ROWD	report of waste discharge
RPS	Renewable Portfolio Standard
RTIP	regional transportation improvement plans
RTP	regional transportation plan
RWQCBs	California Regional Water Quality Control Boards
S&I	service and inspection
SACOG	Sacramento Area Council of Governments
SamTrans	San Mateo County Transit District
SANDAG	San Diego Association of Governments
SARA	Superfund Amendments and Reauthorization Act
SCADA	System Control And Data Acquisition
SCAG	Southern California Association of Governments
SCVTA	Santa Clara Valley Transportation Authority
SEAs	significant ecological areas
SEL	Sound Exposure Level
SFEI	San Francisco Estuary Institute
SFHA	special flood hazard area
SFPUC	San Francisco Public Utility Commission
SHPO	State Historic Preservation Office
SIC	standard industrial classification
SIP	state implementation plan
SJC	Norman Y. Mineta San Jose International Airport
SJCOG	San Joaquin Council of Governments
SJRTD	San Joaquin Regional Transit District
SLIC	Spill, Leak, Investigations, and Cleanup
SO2	sulfur dioxide
SO3	sulfur trioxide
SO_x	sulfur oxides
SPL	State Priority List
sq km	square kilometers
sq mi	square miles
SR	State Route
StanCOG	Stanislaus Council of Governments
StaRT	Stanislaus Regional Transit
STIP	State Transportation Improvement Project
SWLF	solid waste landfill
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
TA	time audible
TALC	Transportation Land Use Coalition
Tcf	trillion cubic feet
Tcm	trillion cubic meters
TDRs	time domain reflectometers

TDS	total dissolved solids
TGV	Train à Grande Vitesse
TMDLs	total maximum daily loads
TOD	transit-oriented design
TOG	total organic gases
TSM	Transportation System Management
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U. S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
V/C	volume-to-capacity
V/m	volts per meter
VHS	very high-speed
VKT	vehicle kilometers of travel
VLF	very low frequency
VMT	vehicle miles of travel
VOCs	volatile organic compounds
WHEELS	Livermore Amador Valley Transit Authority